1 INTRODUCTION

1.1 INTRODUCTION

This Chapter of the Environmental Impact Assessment Report (EIAR) introduces the proposed Inchamore Wind Farm (the Development) and provides details of the Environmental Impact Assessment (EIA), Project Team and the structure of the report. It sets out the broad context and defines the key terms of reference used in the environmental assessment of the Development. The Development is subject to an EIA, under the EIA Directive 2011/92/EU (EIA Directive) as amended by Directive 2014/52/EU.

The EIAR has been prepared by Jennings O'Donovan & Partners Limited, on behalf of Inchamore Wind DAC, to accompany a planning application for the Development. This EIAR takes into account the Project as a whole, including all integral elements that are not part of the Development, and all direct and indirect effects, and cumulative impacts and interactions.

In addition to the identification, description and assessment of the Development, this EIAR identifies, describes and assesses the overall Project (**Table 1.1**). Existing, permitted and known proposed developments and projects are cumulatively assessed in the EIAR. This includes projects and developments that are pending a decision from the planning authority and other known projects which are in the advanced stages of being prepared to be submitted for planning and have the potential for in combination effects, namely the Cummeennabuddoge Wind Farm[1]. Cummeennabuddoge Wind Farm is at the pre-planning/concept stage and is being prepared by the same client as Inchamore Wind Farm.

This EIAR includes the conclusions of the competent and qualified experts as to the significance of any environmental effects, to assist the competent authority to comply with Article 8a of the EIA Directive as amended.

Article 8a of the Directive specifies various requirements in relation to the making of the decision. These mainly relate to reasoned conclusion, conditions, mitigation measures and monitoring. The planning application is also accompanied by a Natura Impact Statement (NIS) as required under Article 6(3) of the EU Habitats Directive (92/43/EEC). This is an assessment of the likely or possible significant effects of the Development on sites designated as Natura 2000 conservation areas, also defined in Irish legislation as "European sites".

[1] https://cummeennabuddogewindfarm.ie/

This chapter is supported by Figures and the following Appendices in Volume IV:

- **Appendix 1.1:** Consultation Responses
- **Appendix 1.2:** Glossary of Common Acronyms
- **Appendix 1.3:** Community Consultation Report

1.2 KEY DEFINED TERMS

To provide clarity in the EIAR, the following defined terms will be used throughout.

Table 1.1: Defined Terms used throughout the EIAR

Term	Definition
Site	Refers to all land that falls within the Proposed Inchamore Wind Farm Redline Boundary as shown on **Figure 1.1**.
Redline Boundary	Refers to the proposed development redline planning boundary. It is the boundary line of all works to be completed as part of the Development and is shown on the planning drawings accompanying this EIAR.
Baseline	Refers to the existing lands and their characteristics.
Development	Refers to all elements of works described in the planning application form and public notices for Inchamore Wind Farm, the details of which are set out within **Chapter 2: Project Description**. These elements include the wind turbines, all site infrastructure and all works required on nodes of the Turbine Delivery Route that are within the Redline Boundary. They do not include the Grid Connection Route from the onsite substation to Ballyvouskill 220 kV substation.
Project	Refers to the Development and all associated infrastructure required for the wind farm to be functional, such as the Turbine Delivery Route and the Grid Connection Route.
Survey Areas	Refers to areas within which surveys are undertaken. These are specifically defined within each technical section/chapter of this EIAR.
Study Areas	Refers to areas which are considered as part of the assessment process. These are specific and defined within each technical section/ chapter of this EIAR.
The Council	Refers to Cork County Council.
Developer	Inchamore Wind Designated Activity Company (DAC)

Term	Definition
EIA Regulations	The European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018) transpose the requirements of the 2014 EIA Directive into the Planning and Development Regulations 2001 (As Amended).
EIA Directive	Refers to the EIA Directive 2011/92/EU.
The 2014 EIA Directive	Refers to EIA Directive 2014/52/EU which amends the EIA Directive.
Scoping	This is the process to identify key environmental issues, and to determine which elements of the Project are likely to cause significant environmental impacts and to identify elements that can be removed from the assessment.
The Onsite Substation and Control Building	Refers to the onsite substation comprising the control building and other associated electrical infrastructure, including the compound in which it is located.
Met Mast	Refers to the proposed Meteorological Mast to be located on site.
Replant Lands	Refers to offsite forestry replanting lands.
Construction Haul Routes	Refers to the proposed routes from local quarries and suppliers to the Site for construction materials.
Turbine Delivery Route	Refers to the proposed turbine delivery route from Ringaskiddy Port to the site entrance on the N22.
Grid Connection Route	Refers to the proposed route of connecting to the national grid.
Wind Farm Internal Cabling	Refers to the electrical cables connecting the turbines to the on-site substation.
Temporary Construction Compound	Refers to the compound to be developed and used by the appointed contractor(s) for the purposes of constructing the wind farm.
Turbine Hardstand	Refers to the hardstand next to the turbine location used by cranes for erection of turbine hub, nacelles and rotor blades.
Turbine Foundation	Refers to turbine concrete base located under ground level and used to support the turbine.
Decommissioning	Refers to the end of the operational life of the wind farm when turbines are dismantled and taken off site for recycling. The turbine

Term	Definition
	foundations, hardstands and the site roads will be left *in-situ* and allowed to revegetate through natural succession. The underground cabling will be removed while the ducting will remain *in-situ*. The substation building will be left *in-situ*.
Reinstatement	Reinstatement means restoring the habitat in the areas of the Site where infrastructure was developed.
Turbine Range	Refers to the range of turbine parameters assessed in this EIAR as per section 1.9.4.

1.3 THE APPLICANT

The Applicant seeking planning permission is Inchamore Wind DAC, a joint venture between FuturEnergy Ireland and SSE Renewables.

FuturEnergy Ireland (FEI) is the recently launched joint venture company owned on a 50:50 basis by Coillte and ESB. This new business combines the State's strongest assets and expertise in onshore renewable energy development on behalf of the people of Ireland. We are one of the largest dedicated developers of onshore wind in Ireland and our mission is to maximise the potential of our national resources and accelerate Ireland's transformation to a low carbon energy economy.

The aim of FEI is to help Ireland deliver on its green energy targets, achieving net zero emissions by 2050, as set out in the Government's Climate Action Plan and legislated for under the Climate Action and Low Carbon Development (Amendment) Act 2021. In this regard, FEI is looking to actively drive Ireland's transition to a low carbon economy by developing 1 GW of wind energy projects by 2030.

FEI is dedicated to developing best-in-class, commercially successful wind farms while maximising the support from local communities. Its wind farm projects have the potential to play a fundamental role in a green economy by creating jobs in rural areas and growing a green industrial sector, while also funding local development for host communities through its community benefit funds.

SSE Renewables is a leading developer, owner and operator of renewable energy in Ireland with a vision to make renewable energy the foundation of a zero-carbon world. The renewable electricity generated at wind farms operated by SSE Renewables across Ireland powers SSE Airtricity, Ireland's largest provider of 100% green energy. The company's onshore portfolio in Ireland comprises 29 windfarms producing nearly 700 MW of renewable generation, including Ireland's largest wind farm the 174 MW Galway Wind Park.

1.4 THE SITE

The Site, as defined in **Table 1**, comprises an area of 167 hectares, of which a significant area is commercial forest owned by Coillte and the remaining third-party land is agricultural land of varied productivity and open mountain heath. The Site is located 5.9 km west of Ballyvourney, Co. Cork and shares the county boundary between Cork and Kerry. It is 54 km west of Cork City, and 23 km north-east of Kenmare, Co. Kerry.

The Site elevations range from 460 m AOD in the north-western side of the Site to 350 m AOD towards the eastern side of the Site. A Site Location Map showing the Redline Boundary is appended as **Figure 1.1** and a map which comprises all elements of the Project is outlined as **Figure 1.2.**

The Site is located in a rural setting and housing density in the area is low. There are 39 dwellings within a 2 km radius of the proposed turbines, comprising one off houses and farm holdings (**Figure 1.3**). The nearest settlements are Inchamore which is situated 750 m to the south of the Site Boundary, and the townland of Milleeny is located 1 km to the south-east of the Site Boundary.

The Development is located within the townlands of Inchamore, Mileeny Derryreag and Derreenaling.

A full description of the Development is provided in **Chapter 2: Project Description**.

1.5 SUMMARY OF PROJECT DESCRIPTION

Permission is being sought by the Developer for the construction of 5 No. Wind Turbines, a meteorological mast, an on-site substation, Turbine Delivery Route and all ancillary works.

The development will consist of

- A wind farm with an operational lifespan of 35 years (from the date of commissioning of the development).
- The construction of five turbines with an overall ground to blade tip height ranging from 177 m to 185 m inclusive; a rotor diameter ranging from 149 m to 155 m inclusive; and a hub height ranging from 102.5 m to 110.5 m inclusive.

- Construction of permanent turbine hardstands and turbine foundations.
- Construction of one temporary construction compound with associated temporary site offices, parking areas and security fencing.
- Installation of a (35-year life cycle) meteorological mast with a height of 110 m and a 4 m lightning pole on top, such that the overall structure height will be 114 m.
- Development of one on-site borrow pit.
- Construction of new permanent internal site access roads and upgrade of existing internal site access roads to include passing bays and all associated drainage infrastructure.
- Development of a permanent internal site drainage network and sediment control systems.
- Construction of a permanent 38 kV electrical substation including a control building with welfare facilities, all associated electrical plant and equipment, parking, security fencing and gates, all associated underground cabling, wastewater holding tank, and all ancillary structures and works.
- All associated underground electrical and communications cabling connecting the wind turbines to the on-site wind farm substation.
- Ancillary forestry felling to facilitate construction of the Development.
- All associated site development works including berms, landscaping, and soil excavation.
- Upgrade of existing forest access roads to include passing bays and all associated drainage infrastructure.
- Upgrade works on the Turbine Delivery Route to include the following:
    - Works at an entrance to an existing forest road accessed off the N22 to include localised widening of the forest road and creation of a splayed entrance, removal of existing vegetation for visibility splays and removal of street furniture to facilitate construction traffic including the delivery of abnormal loads and turbine component deliveries.

A 10-year planning permission and 35-year operational life for the wind turbines and met mast, from the date of commissioning of the entire wind farm is being sought. This reflects the lifespan of modern-day turbines.

A permanent planning permission is being sought for the substation and all associated electrical plant, equipment cabling security fencing and gates, wastewater holding tank, and all ancillary structures and works as these will become an asset of the national grid under the management of ESB & EirGrid and will remain in place upon decommissioning of the wind farm.

The Grid Connection consists of one 38 kV substation (to include one control building with welfare facilities, all associated electrical plant and equipment, security fencing and gates, all associated underground cabling, wastewater holding tank, and all ancillary structures and works) and a 38 kV cable to connect to Ballyvouskill 220 kV Substation.

A temporary access road off the N22 in the townland of Cummeenavrick will facilitate the safe turning of vehicles leaving the Site.

Permission is not being sought for a Grid Connection Route or the turning area in Cummeenavrick, however the below is assessed as part of the Project in the EIAR:

- All works associated with the permanent connection of the wind farm to the national electricity grid comprising a 38 kV underground cable in permanent cable ducts from the proposed, permanent, on-site substation, in the townland of Inchamore and onto the townlands of Inchamore, Derreenaling, Derryreag, Cummeenavrick, Glashacormick, Clydaghroe and Cummeennabuddoge to the existing Ballyvouskill 220 kV Substation in the townland of Caherdowney.
- The construction of a temporary access road off the N22 in the townland of Cummeenavrick to facilitate a 180 degrees turning manoeuvre by construction vehicles and reinstatement at the end of the construction period.

1.6 ENVIRONMENTAL IMPACT ASSESSMENT

1.6.1 Environmental Impact Assessment Requirement and National Legislation

European Union Directive 2011/92/EU ("the EIA Directive") requires that, before consent is given for certain public and private projects, an assessment of the effects on the environment is undertaken by the relevant competent authority. The EIA Directive has been transposed into Irish legislation, for the purposes of this EIA Development, by the Planning and Development Act 2000, as amended ("the Planning Acts") and the Planning and Development Regulations 2001, as amended ("the Planning Regulations").

Section 171A of the Planning and Development Act 2000 (as amended) defines an Environmental Impact Assessment (EIA) as '*a process—*

(a) consisting of—

(i) the preparation of an environmental impact assessment report by the applicant in accordance with this Act and regulations made thereunder,

(ii) the carrying out of consultations in accordance with this Act and regulations made thereunder,

(iii) the examination by the planning authority or the Board, as the case may be, of—

(I) the information contained in the environmental impact assessment report,

(II) any supplementary information provided, where necessary, by the applicant in accordance with section 172(1D) and (1E), and

(III) any relevant information received through the consultations carried out pursuant to subparagraph (ii),

(iv) the reasoned conclusion by the planning authority or the Board, as the case may be, on the significant effects on the environment of the proposed development, taking into account the results of the examination carried out pursuant to subparagraph (iii) and, where appropriate, its own supplementary examination, and

(v) the integration of the reasoned conclusion of the planning authority or the Board, as the case may be, into the decision on the proposed development, and

(b) which includes—

(i) an examination, analysis and evaluation, carried out by the planning authority or the Board, as the case may be, in accordance with this Part and regulations made thereunder, that identifies, describes and assesses, in an appropriate manner, in the light of each individual case, the direct and indirect significant effects of the proposed development on the following: (I) population and human health; (II) biodiversity, with particular attention to species and habitats protected under the Habitats Directive and the Birds Directive; (III) land, soil, water, air and climate; (IV) material assets, cultural heritage and the landscape; (V) the interaction between the factors mentioned in clauses (I) to (IV), and

(ii) as regards the factors mentioned in subparagraph (i)(I) to (V), such examination, analysis and evaluation of the expected direct and indirect significant effects on the environment derived from the vulnerability of the proposed development to risks of major accidents or disasters, or both major accidents and disasters, that are relevant to that development.

Section 172(1)(a)(ii)(I) requires projects of a class specified in Part 2 of Schedule 5 of the Planning Regulations to be subject to an EIA where:

"(I) *such development would exceed any relevant quantity, area or other limit specified in that Part,*".

Part 2 of Schedule 5 of the Planning Regulations includes the following classes of EIA Development:

Class 3(i) *"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."*

The Development comes within the scope of Class 3(i).

1.6.2 Directive 2014/52/EU

The EIA Directive (2011/92/EU) was amended by the 2014 EIA Directive (2014/52/EU).

On 1st September 2018, the Minister for Housing, Planning and Local Government published updated guidelines for planning authorities and An Bord Pleanála on carrying out Environmental Impact Assessments. The publication of the Guidelines coincides with the coming into operation on 1st September 2018 of the provisions of the European Union (Planning and Development) (EIA) Regulations 2018 (S.I. No. 296 of 2018), which were signed by the Minister on 26th July 2018. These Regulations transpose the requirements of Directive 2014/52/EU, amending previous Directive 2011/52/EU, on the assessment of the effects of certain public and private projects on the environment (the EIA Directive) into planning law.

Accordingly, this EIAR complies with the European Union (Planning and Development) (EIA) Regulations 2018 (S.I. No. 296 of 2018). To the extent relevant and necessary, regard has been given to the existing provisions of the Planning and Development Act 2000 (as amended) and the Planning and Development Regulations 2001, (as amended) insofar as they transpose the EIA Directive. Article 5 of the EIA Directive as amended provides where an EIA is required, the developer shall prepare and submit an Environmental Impact Assessment Report (EIAR). The information to be provided by the developer shall include at least:

(a) *a description of the Development comprising information on the site, design, size and other relevant features of the Development*

(b) *a description of the likely significant effects of the Development on the environment*

(c) *a description of the features of the Development and/or measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment*

(d) *a description of the reasonable alternatives studied by the developer, which are relevant to the Development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the Development on the environment*

(e) *a non-technical summary of the information referred to in points (a) to (d) and*

(f) *any additional information specified in Annex IV relevant to the specific characteristics of a particular Development or type of Development and to the environmental features likely to be affected.*

The EIAR provides information on the receiving environment and assesses the likely significant effects of the Development and proposes mitigation measures to avoid or reduce these effects. The function of the EIAR is to provide information to allow the competent authority to reach a reasoned conclusion on the effects of a development and inform subsequent decisions, such as planning. All elements of the Project (including the grid connection and turbine delivery route) have been assessed as part of this EIAR.

1.6.2.1 EIA Definition

Article 1(2)(g) of the EIA Directive as amended defines EIA as a process consisting of:

"(i) the preparation of an environmental impact assessment report by the developer, as referred to in Article 5(1) and (2);

(ii) the carrying out of consultations as referred to in Article 6 and, where relevant, Article 7;

(iii) the examination by the competent authority of the information presented in the environmental impact assessment report and any supplementary information provided, where necessary, by the developer in accordance with Article 5(3), and any relevant information received through the consultations under Articles 6 and 7;

(iv) the reasoned conclusion by the competent authority on the significant effects of the project on the environment, taking into account the results of the examination referred to in point (iii) and, where appropriate, its own supplementary examination; and

(v) the integration of the competent authority's reasoned conclusion into any of the decisions referred to in Article 8a".

1.6.2.2 Factors of the Environment

The EIA Directive as amended requires the EIA to identify, describe and assess, in an appropriate manner and in light of each individual case, the direct and indirect significant effects of a project on the following factors:

(a) population and human health;

(b) biodiversity, with particular attention to species and habitats protected under the Habitats and Birds Directives;

(c) land, soil, water, air and climate;

(d) material assets, cultural heritage and the landscape, and

(e) the interaction between the factors referred to in points (a) to (d).

The effects referred to above shall include the expected effects deriving from the vulnerability of the project to risks of major accidents and/or disasters that are relevant to the project concerned.

The implementations of the EIA Directive as amended in the EIAR can be seen in **Table 1.2**.

Table 1.2: Outline of respective chapters relating to the requirements of the EIA Directive as amended

The EIA Directive	Chapter	Title
(a) population and human health	4	Population and Human Health
(b) biodiversity, with particular attention to species and habitats protected under the Habitats and Birds Directives	5 6 7	Terrestrial Ecology Aquatic Ecology Ornithology
(c) land, soil, water, air and climate	2 5 6 7 8 9 10 13	Project Description (land) Terrestrial Ecology (land) Aquatic Ecology (land) Ornithology (land) Soils and Geology (land) Hydrology and Hydrogeology Air and Climate Material Assets & Other Issues (land)
(d) material assets, cultural heritage and the landscape	13 14 12	Material Assets & Other Issues Cultural Heritage Landscape and Visual Amenity
(e) the interaction between the factors referred to in points (a) to (d)	16	Major Accidents and Natural Disasters

The EIA Directive	Chapter	Title
	17	Interactions of the Foregoing

1.6.2.3 Major Accidents and Disasters

The EIA Directive as amended requires the EIAR to consider the expected effects deriving from the vulnerability of the project to risks of major accidents and/or disasters that are relevant to the project concerned. This is discussed in further detail in **Chapter 16: Major Accidents and Natural Disasters**.

A wind farm is not a recognised source of chemical pollution. Should a major accident or natural disaster occur, the potential sources of pollution onsite during both the construction and operational phases are limited. Sources of chemical pollution with the potential to cause significant environmental pollution and associated negative effects on health include bulk storage of hydrocarbons or chemicals and storage of wastes. Spills and leaks can occur if they are not mitigated against which may cause negative effects to human health, if contamination of food or water occurs. The occurrence of such spills and leaks is unlikely as bunding and safe storage practices will be complied with. The Site is not regulated under the Control of Major Accident Hazards Involving Dangerous Substances Regulations i.e., SEVESO sites and so there is no potential effect from this source. All SEVESO sites are located approximately 50 km or more from the Development.

There is limited potential for natural disasters to occur at the Site. Ireland is a geologically stable country with a mild temperate climate. The potential natural disasters that may occur are therefore limited to peat-slide, flooding and fire.

- The Peat Stability Assessment Risk Ranking ranged from 'Very Low to Low with the exception of Moderate or High-risk point locations associated with deeper peat and/or steeper inclines and/or close proximity to sensitive receptors'. The risk of peat-slide is further addressed in **Chapter 8: Soils and Geology**.
- There are no recorded localised flood events within the vicinity of the Site. The risk of flooding is addressed in **Appendix 9.1: Flood Risk Assessment**.
- A 2020 article in Wind Power Engineering Magazine estimated that 1 in 2,000 wind turbines catch fire each year. Overall, the data shows that wind turbine fires are relatively rare. It is therefore considered that the risk of significant fire occurring, affecting the wind farm and causing the wind farm to have significant environmental effects is limited. This is discussed in **Chapter 16: Major Accidents and Natural Disasters**.

- As described earlier, there are no significant sources of pollution in the wind farm with the potential to cause environmental or health effects. Also, the spacing of the turbines and distance of turbines from any properties limits the potential for impacts on human health. This is further discussed in **Chapter 16: Major Accidents and Natural Disasters**.

Article 5(1)(d) of the EIA Directive as amended requires that the EIAR include a description of the reasonable alternatives studied by the developer, which are relevant to the Development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the Development on the environment.

In addition, Annex IV, paragraph 2 provides that the EIAR 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.*".
This is addressed in **Chapter 3: Alternatives Considered** of this EIAR.

1.6.2.4 National Guidance

The following documents have been referred to in the preparation of this EIAR:

- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, EPA, May 2022;
- Department of Housing, Planning and Local Government 'Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment' (August 2018).

In addition to the applicable EIA legislation and guidance, all EU Directives and national legislation relating to the specialist areas have also been considered as part of the process and are addressed in the relevant assessment chapters. Subject-specific best practice guidance used for each appraisal presented in the EIAR is detailed in the relevant assessment chapter of this EIAR.

1.6.2.5 European Guidance

- Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report, European Commission, 2017
- Environmental Assessments of Plans, Programmes and Projects – Rulings of the Court of Justice of the European Union (European Union 2017a)

- Environmental Impact Assessment of Projects – Guidance on Scoping (Directive 2011/92/EU as amended by 2014/52/EU) (European Union 2017b)
- Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions (European Commission 1999)

1.6.2.6 Competent Experts and Quality of the EIAR

Article 5(3) of the 2014 EIA Directive states that, in order to ensure the completeness and quality of the EIAR, the Applicant shall ensure (a) the EIAR is prepared by competent experts; (b) the competent authority shall ensure that it has, or has access to, sufficient expertise to examine the EIAR, and (c) where necessary, the competent authority shall seek from the Applicant any supplementary information, in accordance with Annex IV (the information to be contained in the EIAR), which is directly relevant to reaching the reasoned conclusion on the significant effects of the Development on the environment.

Article 94(e) of the Planning and Development Regulations 2001 (as amended) requires the following information to be provided in an EIAR:

“(e) a list of the experts who contributed to the preparation of the report, identifying for each such expert—

(i) the part or parts of the report which he or she is responsible for or to which he or she contributed,

(ii) his or her competence and experience, including relevant qualifications, if any, in relation to such parts, and

(iii) such additional information in relation to his or her expertise that the person or persons preparing the EIAR consider demonstrates the expert’s competence in the preparation of the report and ensures its completeness and quality.”

The experts involved in the preparation of this EIAR are competent, having regard to the task he or she performed, taking account of the scope of the study for which he or she undertook the work, the person/s possess sufficient training, experience and knowledge appropriate to the nature of the work.

This EIAR has been prepared by Jennings O’Donovan & Partners Limited (JOD), Consulting Engineers, Finisklin Business Park, Sligo, F91 2HH9, on behalf of the Developer. JOD are one of the longest established and most reputable multi-disciplinary engineering consultancies in Ireland. Established in 1950, it has grown to be the largest engineering consultancy in the north-west of Ireland. JOD have been an established presence in the Renewable Energy Wind Farm Sector since 1998. To date, the company has been working on a portfolio of projects extending to over 2,040 MW of power in Ireland

and Northern Ireland and is a recognised market leader in the area of Wind Energy development. This portfolio will equate, when completed, to an investment of €3 billion in the Wind Energy Sector. Additionally, JOD has attained certificates in line with industry standards as follows:

- ISO 9001:2015 – Quality Management System
- ISO 14001:2015 – Environmental Management System
- ISO 45001:2018 – Occupational Health and Safety Management System

Possession of these certificates is, in itself, evidence that JOD, have developed, maintained and implemented systems in quality, safety and environmental related matters and are therefore competent experts.

This project has been completed in line with JOD's Integrated Management System which is based on the current versions of ISO 9001 (Quality Management System), ISO 14001 (Environment Management System) and ISO 45001 (Safety Management System). JOD are fully certified and accredited to ISO 9001:2015, ISO 14001:2015 and ISO 45001:2018 for the provision of project management, environmental, civil and structural consulting engineering services.

JOD have developed a Quality Policy Statement, an Environmental Policy Statement and a Safety Health and Welfare Policy Statement. It is a stated objective in our Quality Policy Statement that:

"…Jennings O'Donovan and Partners Limited is committed to complying with the requirements of the quality management system and to continually improve its effectiveness…".

JOD staff are degree qualified in their respective specialist fields and have developed their competence through both experience on the job and through training. Each team member has developed the following:

- Sufficient knowledge of the specific tasks to be undertaken and the risks which may arise, and
- Sufficient experience and ability to carry out their duties in relation to the project and to take appropriate actions required under the EIA Directive

Specialist consultancies have been employed to complete some of the EIAR Chapters. Each Chapter of the EIAR includes a Statement of Authority regarding the section of the

EIAR for which the author is responsible, the competency of the author and relevant qualifications. Please see section 1.9 for more information.

1.6.2.7 Information to be Included in a Decision to Grant

Article 8a (1) of the EIA Directive as amended states:

"The decision to grant development consent shall incorporate at least the following information:

(a) the reasoned conclusion referred to in Article 1(2)(g)(iv);

(b) any environmental conditions attached to the decision, a description of any features of the project and/or measures envisaged to avoid, prevent or reduce and, if possible, offset significant adverse effects on the environment as well as, where appropriate, monitoring measures".

To assist the Council with this requirement, the EIAR includes a summary at the end of each chapter of all proposed mitigation and monitoring measures outlined within the technical assessments. A summary document has also been appended to **Chapter 17: Interactions of the Foregoing (Appendix 17.1: Schedule of Mitigation Measures)**.

1.7 NEED FOR THE DEVELOPMENT

The proposed Inchamore Wind Farm will contribute renewable energy in order to assist in the transition of Ireland's energy sector to a low carbon economy. The Project has an estimated Maximum Export Capacity (MEC) of between 28 MW and 33 MW. The exact MEC will be dependent on the output power of the models available at procurement stage. The Project will play a significant role in providing renewable electricity in the Ireland, accounting for approximately 0.75% of the current installed wind energy capacity (Wind Energy Ireland, 2021). At a strategic level, the need for the Project is supported by International, European, and National environmental and energy commitments and policies.

Under the 2009 Renewable Energy Directive, Ireland committed to produce at least 16% of all energy consumed by 2020 from renewable sources. This was to consist of 40% from renewable electricity, 12% from renewable heat and 10% from the renewable transport sector.

The Irish Government published the Climate Action Plan in June 2019 (DoCCAE, 2019) which sets out actions to ensure Ireland's 2030 renewable energy targets can be achieved. This is in the context of substantial and continuing failure by Ireland in meeting climate targets to date. These targets have recently been updated in the Climate Action Plan 2023 which has increased the target of renewable energy from 70% as included in the 2019 CAP to 80% by 2030. This target is to be achieved partly by the delivery of 8 GW of onshore wind energy.

REPower EU Energy Plan 2022

The European Commission presented the REPowerEU plan on 18 May 2022[2]. The plan is a key pillar in the EU's response to the disruption which has been caused to energy markets and aims to tackle the climate crisis by transforming Europe's energy system. The plan also forms part of the EU's wider response to Russia's invasion of Ukraine, including several sanctions packages.

Within the overarching goals of strengthening Europe's climate ambitions, security and economic growth, the REPowerEU plan responds to the current energy situation in four ways:

- energy savings;
- the diversification of energy imports;
- the acceleration of Europe's clean energy transition, and
- smart investment.

The European Commission has laid down a framework to accelerate the deployment of renewable energy (Council Regulation (EU) 2022/2577 of 22 December 2022). Member States should establish "go-to" areas for renewable energy development. These areas would have lower environmental risks and therefore allow shortened and simplified permitting processes.

This renewable energy Project will aid in the diversification of energy production in Ireland and together with other renewable energy projects and developments, will decrease our reliance on imported fossil fuels by becoming energy self-efficient.

[2] REPowerEU: A plan to rapidly reduce dependence on Russian fossil fuels and fast forward the green transition; European Commission – Press Release. Available online: https://ec.europa.eu/commission/presscorner/detail/en/IP_22_3131 [Accessed 22/07/2022]

The Climate Action Plan 2023

The Climate Action Plan 2023 aims to evaluate in detail the changes that are required in order "*to halve our emissions by 2030 and reach net zero no later than 2050, as we committed to in the Programme for Government*".

In relation to electricity generation there is a commitment to increase the reliance on renewables to 80%, which includes increasing the target of offshore wind energy by up to 7 GW[3]. The target for onshore wind energy is 9 GW, by 2030.

The European Commission announcement[4] in March 2022 addresses energy security issues emerging from Russia's invasion of Ukraine. The EU intends on significantly accelerating its transition to clean energy and thereby increasing Europe's energy independence.

"*Phasing out our dependence on fossil fuels from Russia can be done well before 2030. To do so, the Commission proposes a REPowerEU plan that will increase the resilience of the EU-wide energy system based on….*

…Reducing faster our dependence on fossil fuels at the level of homes, buildings and the industry, and at the level of the power system by boosting energy efficiency gains, increasing the share of renewable and addressing infrastructure bottlenecks"

The contribution of the Development to the de-carbonisation of the Irish electricity network will contribute positively to an issue of strategic social importance. This is illustrated by the text of the Irish government's Climate Action Plan 2023 which sets an ambitious 80% target for electricity production from renewable sources by 2030 and highlights the need to remove barriers to the development of renewables, including onshore wind, such as streamlining regulation and encouraging reinforcement of the grid to facilitate greater renewables penetration. The significance of the Climate Action Plan is underlined by the Irish government's declaration of a climate emergency in 2019.

Ireland is facing significant challenges in efforts to meet these targets, alongside its commitment to transition to a low carbon economy by 2050. Ireland did not meet its 2020

[3] SSE RENEWABLES HAILS IRELAND'S INCREASED 7GW OFFSHORE WIND AMBITION BY 2030, 29 Jul 2022 [Accessed Online 08/02/2023] https://www.sserenewables.com/news-and-views/2022/07/sse-renewables-hails-ireland-s-increased-7gw-offshore-wind-ambition-by-2030/

[4] Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions [08/03/2022]. REPowerEU: Joint European Action for more affordable, secure and sustainable energy

target for renewable energy and is falling behind in the longer-term movement away from fossil fuels.

The Renewable Energy Directive (recast) 2018/2001/EU

The Renewable Energy Directive (recast) 2018/2001/EU entered into force in December 2018. It entered into force, as part of the Clean energy for all Europeans package, aimed at keeping the EU a global leader in renewables and, more broadly, helping the EU to meet its emissions reduction commitments under the Paris Agreement. It was transposed into Irish law in September 2020 by the Renewable Energy Regulations 2020. The regulations set the parameters for the establishment of future renewable electricity support schemes, and build on the existing regime, which was created by the European Union (Renewable Energy) Regulations 2014 (as amended) (the "2014 Regulations"). The ambition of increased electricity from renewable sources will be significantly ramped up. The recast directive moves the legal framework to 2030 and sets a new binding renewable energy target for the EU for 2030 of at least 32%, with a clause for a possible upwards revision by 2023, and comprises measures for the different sectors to make it happen. Failure to meet renewable energy targets is subject to fines from the EU.

Wind Energy Ireland (WEI), Ireland's largest renewable energy organisation, in its annual report for 2020 noted that Ireland's wind energy share of electricity demand in 2020 rose to 36.3% compared to 32.5% in 2019. Wind Energy Ireland in its February 2022 Wind Energy report showed that wind energy provided 53 per cent of Ireland's electricity that month. This is the highest share of demand ever achieved by wind in Ireland.
The total installed capacity of the Republic of Ireland's wind farms is now 4,255 MW (the latest publication of the Annual Report, 2020)[5]; this is approximately enough to power 2.2 million Irish homes annually.

The Project is critical to helping Ireland address these challenges as well as addressing the country's over-dependence on unsustainable imported fossil fuels. The need for the Development is driven by the following factors:

- A requirement to diversify Ireland's energy sources, to achieve national renewable energy targets;
- Reduce Ireland's dependency on fossil fuels resulting in lower carbon dioxide (CO_2) emissions;
- Avoid significant fines from the EU (the EU Renewables Directive);

[5] https://windenergyireland.com/latest-news/5364-annual-report-confirms-wind-energy-leads-fight-against-climate-change [Accessed on the 07/12/2021]

- A legal commitment under the Kyoto protocol from Ireland to limit greenhouse gas emissions;
- Aid in the acceleration of actions towards the goals of the Paris Agreement and the UN Framework Convention on Climate Change (COP26 and COP27);
- A requirement to increase Ireland's national energy security as set out in the Energy White Paper (Ireland's Transition to a Low Carbon Energy Future, 2015-2030[6]);
- Provision of cost-effective power production for Ireland which would deliver local benefits, and
- Increase energy price stability in Ireland by reducing an over-reliance on imported gas and exposure to international market price and supply fluctuations.

The Development will also offer opportunities such as:

- The provision of clean energy whilst minimising environmental impacts, and
- Contributing to renewable energy targets which will continue to drive down the overall cost of energy with benefits to the Irish consumer.

The Development will create additional jobs and will encourage continued investment in the renewable industry in Ireland.

1.7.1 Public Consultation

The project at an early stage appointed a local Community Liaison Officer (CLO) in July 2020. The role of a CLO is to introduce and communication key project information, timelines, updates, activities, benefits and proposals through direct and indirect community engagement, meetings, and events with the projects near neighbours and the wider community throughout the project lifecycle.

Initially the CLO's direct engagement focused on calling to houses within 2 km of the project area. These visits were used to provide Project updates as follows:

- Newsletter 1 in July/August 2020;
- Newsletter 2 in March 2021;
- Newsletter 3 in September 2021;
- Project update letter in November 2021;
- An Introduction letter to FuturEnergy Ireland from the CEO in December 2021;
- A further project update letter in March/April 2022, and

[6] Ireland's Transition to a Low Carbon Energy Future, 2015-2030, Department of the Environment. Climate and Communications, 2020. https://www.gov.ie/en/publication/550df-the-white-paper-irelands-transition-to-a-low-carbon-energy-future-2015-2030/

- A project update letter in November 2022.

During May 2022 FuturEnergy Ireland sponsored and arranged an Educational Program around "Climate Change" for 5 local National schools around the Project area which was well received.

In March 2023 a Media release was sent to local and regional journalists in the Southern Star, The Corkman, Irish Examiner, Radio Na Gealtachta and 96Fm launching the Inse Mhór Wind Farm's detailed project brochure and Virtual Tour Exhibition.

The detailed 36-page project brochure and invite letter to the projects virtual tour exhibition was also distributed at this time to the Project's near neighbours and wider community out to 5 km, and also to local interest groups and elected representatives.

In April 2023, advertisements were placed in the Southern Star, the Corkman, and the Kerryman newspapers displaying the details of the location, dates, and times of the two-day local on-site community engagement clinic to be held by the Project in Coolea village on 20th and 21st April.

Early in the engagement process, the CLO contacted and kept local interest groups from the wider community and local elected representatives up to date and informed of Project progress. This engagement commitment has continued throughout the whole engagement process and will continue to do so into the future.

The CLO was on hand to discuss any queries, comments or concerns that residents may have had during the project's engagement lifecycle and as required were replied to by the project team. Some requests for information were logged so that when the information become available it would be provided.

The CLOs work also included Saturdays and some midweek evenings in an effort to reach out to all.

At all stages of the Project's engagement cycle from 2020 to 2023, the Project communications material included contact numbers, project email addresses, postal addresses, and details of the dedicated Project website www.inchamorewindfarm.ie (when launched in early 2021). From this time onward all project updates and newsletters were continuously uploaded to the dedicated project website.

To acknowledge the region's Gaeltacht culture and heritage, the majority of our communications were provided in both Irish and English.

1.7.1.1 Public Information Days (PIDs)

The public information days were held on April 20th and 21st 2023 at Arus Éamon Mac Suibhne, Cúil Aodh, Co Chorcaí. P12 HY57 (a venue close to the site and easily accessible to local residents). Which took place between the hours of 12:00 and 20:00 on the Thursday and between 12:00 and 18:00 on the Friday, to give as many of the community members as possible the chance to attend, to view the proposals and ask questions of the Project team.

A Pre-Application Community Consultation (PACC) Report has been submitted to Cork County Council and Kerry County Council as a standalone document as part of this planning application. The PACC Report summarises the engagement and consultation that has taken place with the local community over the project lifecycle to date. Starting from the introduction of the project through to the Project's submission into planning, the PACC report includes reports of the public information day, how we intend to continually engage with the local community into the future and how comments received have been addressed and incorporated by the Project.

1.8 EIAR STRUCTURE

This EIAR uses the grouped structure method to describe the existing environment, the potential impacts of the Development thereon and the proposed mitigation measures. Background information relating to the Development, scoping and consultation undertaken and a description of the Development are presented in separate sections of this EIAR. Please note that the Irish Transverse Mercator coordinate system is used in the EIAR document.

The layout of this EIAR is arranged in four volumes, I-IV.

Volume I: This volume includes the opening **Non-Technical Summary (NTS).** It is a condensed and easily comprehensible version of the EIAR document. The NTS is presented in a similar format to the main EIAR document and comprises descriptions of the Development, the receiving environment, impacts, mitigation measures and interactions presented in a grouped format. It is a standalone document.

Volume II: This volume contains the **Environmental Impact Assessment Report (EIAR).** The EIAR is presented using the grouped structure method and describes the existing environment, the potential impacts of the Development thereon and the proposed mitigation measures. Background information relating to the Development, scoping and consultation undertaken and a description of the Development are presented in separate Chapters. The grouped format chapters describe the impacts of the Development in terms of human beings, biodiversity, soils and geology, hydrology and hydrogeology, air and climate, noise, landscape and visual, cultural heritage and material assets such as traffic and transportation together with the interaction of the foregoing.

The chapters in this **Volume II: EIAR** are as follows:

- Chapter 1: Introduction
- Chapter 2: Project Description
- Chapter 3: Alternatives Considered
- Chapter 4: Population and Human Health
- Chapter 5: Terrestrial Ecology
- Chapter 6: Aquatic Ecology
- Chapter 7: Ornithology
- Chapter 8: Soils and Geology
- Chapter 9: Hydrology and Hydrogeology
- Chapter 10: Air and Climate
- Chapter 11: Noise
- Chapter 12: Landscape and Visual Amenity
- Chapter 13: Material Assets and Other Issues
- Chapter 14: Cultural Heritage
- Chapter 15: Traffic and Transportation
- Chapter 16: Major Accidents and Natural Disasters
- Chapter 17: Interactions of the Foregoing

Volume III: EIAR Figures

The Figures referred to in each chapter of the EIAR are compiled separately in Volume III. Figures are numbered sequentially for each chapter in which they are principally referred.

Volume IV: Appendices

The Appendices referred to in each chapter of the EIAR are compiled separately in Volume IV. They are also numbered sequentially for each chapter in which they are principally referred.

1.9 EIAR PREPARATION

1.9.1 Project Team

JOD had overall responsibility for the coordination of the EIAR with input from other independent specialist consultants where necessary. The competency of JOD has been outlined in **Section 1.6.2.6**. **Table 1.3** provides details of the contributors of each aspect of the EIAR. Further details on the qualifications of each lead author can be found in **Section 1.9.2** and in the Statement of Authority in each individual technical assessment chapter.

Table 1.3: EIAR Preparation Details

Consultants	Principal Staff Involved in the Project	EIAR Input
Jennings O'Donovan & Partners Limited	David Kiely (DK) Sean Molloy (SM) Sarah Moore (SME) Breena Coyle (BC) Anthony McCoubrey (AMcC) John Doogan (JD) Shirley Bradley (SB)	Project Management, Scoping and Consultation, EIAR Sections • 1: Introduction (SME & SB) • 2: Project Description (SME, SB & SM) • 3: Alternatives Considered (SME & SB) • 4: Population & Human Health (SME & SB) • 10: Air & Climate (SME & SB) • 13: Material Assets (SME & SB) • 15: Traffic & Transportation (DK, JD & AMcC) • 16 Major Accidents and Natural Disasters (SME & SB)

Consultants	Principal Staff Involved in the Project	EIAR Input
		• 17 Interactions of the Foregoing (SME & SB)
Biosphere Environmental Services	Brian Madden With expert contributions from John Conaghan (Habitat surveys) Tina Aughney (Bat surveys) and Patrick Crushell (Kerry Slug Surveys) Karen Banks, Jonathon Dunn & Sinead Clifford (Fehily Timoney - Bird & Bat surveys)	Scoping responses and Consultation, EIAR Chapters 5: Terrestrial Ecology & Chapter 7: Ornithology
EirEco Environmental Consultants	Paul Murphy	Scoping responses and Consultation, EIAR Sections 6: Aquatic Ecology
Minerex	Cecil Shine (Chapter Review) Sven Klinkenbergh (Chapter preparation) Chris Fennel (Chapter preparation) Lissa Colleen McClung (Chapter preparation)	Scoping responses and Consultation, EIAR Sections 8: Soils & Geology 9: Hydrology & Hydrogeology
Brendan O'Reilly, Noise & Vibration Consultants Limited	Brendan O'Reilly	Scoping responses and Consultation, EIAR Sections 11: Noise (Assessment)
Irwin Carr Consulting	Shane Carr	Scoping responses and Consultation, EIAR Sections 11: Noise (Modelling)
Macro Works	Richard Barker	Scoping responses and Consultation, EIAR Chapter 12: LVIA
John Cronin & Associates	Tony Cummins (Cultural Heritage Assessment) David Murphy (Field surveys)	Scoping responses and Consultation, EIAR Chapter14: Cultural Heritage

Consultants	Principal Staff Involved in the Project	EIAR Input
AI Bridges	David McGrath (Telecommunications Report preparation) Kevin Hayes (Report review) Patrick Tinney (Modelling) Karla Chagas (Modelling)	Scoping responses and Consultation, EIAR Appendix 13.1 Inchamore Wind Farm Telecommunications Impact Study

1.9.2 Project Team Experience

David Kiely B.E., M.Sc., Eur.Ing., C.Eng., FIEI, MICE, F.RConsEI

David Kiely is a Director of JOD who holds a BE in Civil Engineering from University College Dublin and MSc in Environmental Protection from IT Sligo. He is a Fellow of Engineers Ireland, a Chartered Member of the Institution of Civil Engineers (UK) and has over 40 years' experience. He has extensive experience in the preparation of EIARs and EISs for environmental projects including Wind Farms, Solar Farms, Wastewater Projects, and various commercial developments. David has also been involved in the construction of over 60 wind farms since 1997.

Sean Molloy B.Eng., M.Sc., C.Eng., MIEI, Dip.PM

Sean is a Senior Associate and Senior Project Manager in the JOD Renewable Energy Department with over 15-years' experience. He is a Chartered Engineer with an Honours Master's Degree in Environmental Systems from Galway Mayo Institute of Technology (GMIT) and an Honours Degree in Civil & Transportation Engineering from Edinburgh Napier University. He has also received a Certified Project Management Diploma from the Institute of Project Management Ireland. Sean's professional experience includes managing Environmental Impact Assessments, Civil and Environmental Design, preparation of Planning Documentation and Technical Reports and Stakeholder Consultation.

Sarah Moore MSc, BSc Env.

Sarah is an Environmental Scientist in JOD with over 18 years of environmental consultancy experience. She has obtained a MSc in Environmental Engineering from Queens University, Belfast, and a BSc in Environmental Science from University of Limerick. Since joining JOD, Sarah has been involved as a Project Environmental Scientist on a range of renewable energy, wastewater, structures and commercial projects. She has experience in the preparation of Appropriate Assessments, Ecological Impact Assessments, Environmental Impact Assessments and Geographic Information Systems.

Breena Coyle BA, MSc MRTPI HD Planning and Environmental Planning Law

Breena has over 14 years' experience in the private sector and has a thorough knowledge of the planning system. Breena holds a MSc in Environmental Planning from Queens University Belfast and a Bachelor of Arts in History & Geography from NUI Galway. She is a Member of the Irish Planning Institute and a Member of the Royal Town Planning Institute. Since joining JOD, she has developed experience in a range of sectors through various projects and planning issues with a current focus within the environmental and renewable energy sector.

Anthony McCoubrey Cert.Civil.Eng

Anthony is a Senior Technician in JOD with over 35 years' experience. He has been involved in the preparation of planning through to as constructed drawings, land surveying and land transaction mapping for numerous renewables, commercial, water and wastewater projects. Anthony has received a National Certificate in Civil Engineering from the Institute of Technology, Sligo.

John Doogan Dip.Civil.Eng.

John Doogan is a Senior Designer at JOD. He has a National Diploma in Civil Engineering from Bolton Street College of Technology, Dublin and has over 32 years of road design experience. John has worked on over 30 wind farms in Ireland and Sweden.

Shirley Bradley B.Sc. (Hons)

Shirley is a Graduate Environmental Scientist with a First-Class Honours Degree (BSc. Hons) in Environmental Science from the Institute of Technology, Sligo. She was also awarded with the Governing Body award for a BSc in Environmental Protection. Shirley has two years' experience in consultancy and her key capabilities include preparation of Environmental Impact Assessment Reports, writing management plans, running software such as WindPRO 3.6 and ArcGIS Pro and assisting with project management.

Dr Brian Madden BA (Mod.), PhD, MCIEEM (botanist and ornithologist)

Brian Madden graduated in Natural Sciences from the University of Dublin in 1984 and earned a Ph.D. degree in 1990 from the National University of Ireland for his research on ecosystem processes in Mongan Bog, a raised bog in Co. Offaly (research work sponsored by Bord na Móna and Royal Irish Academy). Since then, he has carried out botanical surveys and habitat assessments for most terrestrial habitats which occur on the island of Ireland.

Brian is an experienced ornithologist, with particular interests in birds of prey and wetland birds. He has published a range of research papers, including papers on the birds of Mongan Bog, the impacts of wind farms on Hen Harriers, and the status of the Peregrine Falcon in Ireland. Brian is the principal ecologist with BioSphere Environmental Services.

Joe Adamson

Joe Adamson B.Sc., M.Sc., MCIEEM is a consultant senior ornithologist with BioSphere Environmental Services. He is highly experienced, having worked in the field of ornithology and ecology since 1988 and has extensive knowledge of Irish birds and their habitats. Joe has been involved in baseline bird surveys on the Bord na Móna cutaway bogs since 2014 and carries out winter and summer bird surveys. Joe carried out baseline ornithological surveys for the project.

Aidan Duggan

Aidan Duggan has more than 30 years of bird surveying experience in Ireland and abroad and is an active member of the Cork branch of Birdwatch Ireland. Aidan has worked on a variety of projects throughout Ireland and is proficient in Vantage Point surveys, Transect Surveys, Hinterland surveys, merlin surveys and red grouse surveys. Clients include Fehily Timoney & Co. Consultants, BioSphere Environmental Services, and Kelleher Ecology Services. Aidan carried out baseline ornithological surveys for the project.

Dr John Conaghan BSc., PhD, MCIEEM – habitats, vegetation & flora

John Conaghan is an experienced plant ecologist who has worked as a consultant ecologist in Ireland since 1994. He is a specialist in the survey and assessment of wetland vegetation and habitats with bogs and fens his main area of expertise. These surveys and assessments have contributed towards Environmental Impact Assessment Reports of a range of wind farm, power line, road, and gas pipeline developments.

John Curtin BSc.- bat surveys

John Curtin holds a BSc in Environmental Science from NUI Galway and has been working as a consultant ecologist since 2010. John is an experienced ecologist with a high skillset over several disciplines. A skilled field worker; with experience in botanical & habitat identification, ornithological surveys & monitoring, mammal surveys. John has also acted as lead bat ecologist for several large scale wind farm projects. John carried out bat surveys at Inchamore Wind Farm in 2021.

Tina Aughney B.Sc., Ph.D

Tina is an experienced bat ecologist with a B.Sc. in Environmental Science from University of Galway, 1996 and a Ph.D in Environmental Science from National University Ireland, Galway, 2000. Tina co-ordinates the All Ireland Daubenton's Bat Waterways Survey and the Brown Long-eared Bat Roost Monitoring Scheme. In addition, Tina undertakes numerous bat walks and talks, administration and training of volunteers. Tina undertook the 2022 bat surveys for the proposed Inchamore Wind Farm.

Dr Patrick Crushell BSc MSc PhD MCIEEM CEcol

Patrick holds an honours degree in Applied Ecology from University College Cork, 1997, a Masters degree in Environmental Resource Management from University College Dublin, 2000 and a PhD on peatland ecology from Wageningen University, the Netherlands, 2008. Patrick's skills include project management, ecological field surveying, GIS mapping and report preparation.

Karen Banks (Fehily Timoney Consultants) – bat activity and roost surveys.

Karen is an ecologist with 13 years' experience in the field of ecological assessment. She holds a BSc in Environment and Development from Durham University and is a full member of the Chartered Institute of Ecology and Environmental Management. Karen is an experienced and skilled bat surveyor, first gaining a scientific licence to disturb bats from Natural England, UK in 2008.

Dr Jonathon Dunn (Fehily Timoney Consultants) – bat static detector surveys in **2019/20**.

Jonathon is an ecologist with over seven years' experience in the environmental sector with specialism in spatial analyses and bird ecology/conservation. Jonathon holds a BA (Hons) in Natural Sciences (Zoology) from the University of Cambridge, an MSc in Ecology, Evolution and Conservation from Imperial College London and a PhD in Avian Ecology from Newcastle University. Jonathon is an ecologist currently located in Ireland.

Sinéad Clifford (Fehily Timoney Consultants)

Sinéad Clifford is a Graduate Ecologist working as part of the Energy and Environment Team at Fehily Timoney and Company (FT). She is a Graduate member of Chartered Institute of Ecology and Environmental Management (CIEEM) Sinéad Clifford holds a BA (Hons) from Institute of Technology, Tralee and a Certificate in Ecological Consultancy from Acorn Ecology and is fully trained in sound analysis of bat calls. Sinéad has conducted habitat surveys, including Appropriate Assessment (AA), ornithological surveys, and ecological appraisals. She has also carried out bat surveys, including preliminary surveys, activity surveys and sound analysis.

Paul Murphy *MSc Dip Aq Biol CEnv MCIEEM MIFM*

Paul Murphy is the Director of EirEco Environmental Consultants. He is an approved surveyor by the National Parks and Wildlife Service for various aquatic Annex-listed species and has held numerous licenses for the survey of freshwater pearl mussel (Stage 1 and Stage 2), white-clawed crayfish and lamprey. He regularly undertakes electro-fishing surveys and has held numerous Section 14 Authorizations from Inland Fisheries Ireland. Paul has been involved in river habitat survey for many decades covering riparian and instream habitats and their associated biota and is also experienced in the River Hydromorphology Assessment Technique (RHAT). He regularly carries out biological water quality assessment using the standardized EPA Q-Value methodology in addition to sampling for physic-chemical parameters. He is a qualified HSE Part III Commercial Diver (surface demand) and PADI Divemaster and regularly undertakes surveys in freshwater and marine environments. Paul has garnered a wealth of practical experience in the construction of infrastructure in the aquatic environment and was the principle author of the National Roads Authority Guidelines for the Crossing of Watercourses on National Road Schemes (2005).

Paul has been operating in the environmental field for over two and a half decades covering a broad range of projects in a variety of countries. He has expert knowledge of the various EU Environmental Directives (Habitats Directive, Birds Directive, Water Framework Directive, Environmental Liability Directive, etc.) and the Natura 2000 network and has been involved in the preparation of management plans for designated areas and Natura 2000 sites. He has extensive experience in Environmental Impact Assessment and ecological mitigation design for numerous major infrastructural schemes (roads, bridges, power plants, wind farms, etc.) and is fully conversant with the Appropriate Assessment process having undertaken numerous Screening Reports and Natura Impact Statements for a wide variety of developments. He has extensive experience at defending EIA's at Oral Hearings over a period of more than two decades.

Cecil Shine BSc MSc PGeo EurGeol

Cecil is Managing Director and a Senior Hydrogeologist in Minerex Environmental with a M.Sc. (Masters) in Hydrogeology & Contaminated Land from University of Birmingham, UK, and a B.Sc. (Hons) in Geology from University College Dublin (UCD). He has over 20 years' experience in hydrogeology both in Ireland and Africa and has employed over 200 staff during that time.

From a background in geology, mineral exploration and hydrogeology, Cecil set up Minerex Environmental in 1994 as a hydrogeological and environmental consultancy focusing on soil and water and is the managing director and chief technical assessor. His extensive managerial and technical experience ranges from groundwater resource exploration and development, catchment management studies, surface and groundwater hydrochemical and hydrometric interactions, groundwater source protection zone (SPZ) delineation, groundwater dependent terrestrial ecosystems (GWDTE) conceptualisation and risk assessment (RA) studies, geohydrological investigation of peatland & wetland environments, well design, yield testing, waste materials sampling and categorisation prior to disposal, environmental impact assessments, hydrogeological investigation and especially site dewatering in the current economic and business climate.

In the field of dewatering and soil classification, Cecil has developed a sought-after reputation around soil and groundwater issues on sites, designing suitable investigation and assessment programmes, implementing same, monitoring (remote, continuous, telemetric) and reporting in a manner that builds confidence and trust amongst arrange of clients and business sectors, including public and private and industry.

Cecil has acted as an expert witness in legal disputes and planning cases. Cecil's particular strengths are in managing staff performance, technical assessment & direction, project scoping and getting results.

Sven Klinkenbergh BSc PG Dip. M.CIWEM

Sven is a Project Manager/Environmental Consultant with over eight years' experience. He has obtained a Post Graduate Diploma in Environmental Protection from IT Sligo (2020) and a Bachelor of Science in Environmental Science from IT Sligo (2013).

Sven is a specialist in undertaking Hydrology, Hydrogeology, Land, Soils and Geology chapters of Environmental Impact Assessment Reporting and associated field investigations. Sven has multiple years' worth of experience in Environmental Monitoring with a focus on surface water and groundwater in addition to soil classification as waste / biproduct. With a background in project management, Sven has carried out multiple Flood Risk Assessments (Stage 1) as well as Peat and Slope Stability Risk Assessments.

Jayne Stephens BSc PhD

Jayne is an Environmental consultant with c. 5 years' experience working in microbiology, water, and environmental disciplines. She graduated with a BSc in Environmental Science from National University of Ireland Galway in 2014, majoring in mammal ecology. Following this, Jayne was the successful Irish applicant to the Tropical Biological Association in Cambridge to complete a field course in tropical biodiversity and conservation in Tanzania. She holds a PhD in environmental microbiology, graduating in 2023. Jayne has worked on a large number of bathing water and surface water monitoring investigations, on project Acclimatize, an EU funded project which aimed to bridge the knowledge gap in relation to at-risk urban and rural bathing waters in Ireland and Wales. During this project, Jayne was team lead for site investigations and has a number of years' experience on microbial contamination and public involvement projects for better water quality.

Dr Chris Fennel BA (mod), PG Cert., Ph.D.

Chris is a Project Hydrogeologist with over five years' experience. He has received a B.A (mod) in Environmental Science (First class) from Trinity College Dublin, a Post Graduate Certificate in Statistics from Trinity College Dublin and a Ph.D. in Civil, Structural and Environmental Engineering from Trinity College Dublin.

He is currently working on projects throughout Ireland pertaining to groundwater sampling, gas monitoring, critical analysis of results and subsequent reporting, site dewatering infrastructural setup and maintenance.

Lissa Colleen McClung BSc MSc

Colleen has recently joined Minerex Environmental Limited (RSK Ireland) as a Graduate Project Scientist under the Hydrology & Hydrogeology and Land, Soils & Geology Team. After attaining an MSc in Environmental Science, with 1.1 First Class Honours, from Trinity College Dublin in 2021 she began the new year with RSK Ireland drafting Environmental Impact Assessments. Colleen has undertaken technical report writing such as Environmental Impact Assessment Reports (Ireland) Environmental Statements (NI) and Flood Risk Assessments (Stage 1 & Stage 2). She has experience in report mapping in GIS and has worked on a number of projects which have involved field work associated with baseline surveying of sites, i.e., initial site walkovers, photographing and GPS logging of data, surface water grab sampling and hydrochemistry analysis.

Mairéad Duffy BSc MSc

Mairead has experience in technical report writing and field work surveying of hydrological and geological elements of the environment with associated proposed green energy projects around the country.

Brendan O'Reilly MPhil ISEE SFA EAA

Brendan has obtained a Master of Philosophy (MPhil) science degree in noise & vibration from the University of Liverpool, (2000). He was a Member of the International Society of Explosives Engineers (ISEE) for over 20 years, a Member of IMQS and Committee member for over 20 years and a member of French Society of Acoustic (FSA) for a number of years.

Brendan has compiled numerous Environmental Noise Impact Statements (EIS) since 1985 for projects ranging from wind farms/sewage treatment plants to mines/quarries and retail development. He successfully completed noise EIS's for over 100 wind farms throughout Ireland ranging in size from 0.65 MW to over 100 MW and has provided expert evidence in An Bord Pleanála oral hearings on large wind farm proposals (Straboy Energy in Co. Donegal and Doonbeg Wind Farm in Co. Clare).

Large wind farm projects, in which Brendan was the noise consultant, with a successful conclusion included Yellow River in Co. Offaly and Sliabh Bawn in Co. Roscommon. Brendan has also completed compliance monitoring on over 20 wind farms including Sliabh Bawn and acted as expert noise witness provided for Drehid Landfill, Fountain Cross Quarry and extension of the Boliden Tara Mines Tailing Storage Facility (2017) and on behalf of residents in EirGrid North/South overhead line.

Brendan has experience in many projects including Europe's largest Zn/Pb mine dealing with a variety of noise and vibration issues over a 35-year period. Other projects in which Brendan has been involved with include the development of the first continuous noise and vibration monitoring system in Europe for an industrial enterprise including the change from an analogue system to a digital integrated noise and wind monitoring system.

Brendan has experience in the investigation of complaints and specification for ameliorative noise and vibration control measures for numerous companies North and South, Consultancies and Local Authorities.

Brendan has been an expert witness as a vibration specialist in the High Court for Meath County Council relating to road construction (vibratory rollers to rock breaking). As well as this, Brendan has been an expert witness as vibration specialist in Belfast High Court regarding blasting vibration. He is an acknowledged contributor to the Irish EPA Integrated Pollution Control Licensing, 'Guidance Note for Noise in Relation to Scheduled Activities', 1995.

Brendan is also a co-author and project partner (as a senior noise consultant) in 'Environmental Quality Objectives Noise in Quiet Areas administered by the Environmental Protection Agency on behalf of the Dept. of Environment., Heritage and local Government.

Shane Carr BSc (Hons), MIA, CIEH

Shane is a Director in Irwin Carr Consulting, primarily responsible for environmental noise and noise modelling. He has over 22 years' experience working in both the public and private sectors having previously obtained a BSc (Hons) Degree in Environmental Health and a Post-Graduate Diploma in Acoustics. He is a Member of the Institute of Acoustics and a Chartered Member of the Chartered Institute of Environmental Health.

Shane has carried noise assessments for various wind farm development schemes throughout Ireland in line with the ETSU standard, been responsible for designing the assessment schemes to assess the noise impact for major wind farm redevelopments within Ireland as well as assessing the suitability of proposed sites for residential or commercial/industrial development.

He has a broad range of experience in all aspects of noise including environmental noise assessment and control. He has presented expert evidence on a number of occasions for a range of planning issues and environmental noise assessments.

Shane has contributed to numerous EIA in relation to significant developments in both Northern Ireland and the Republic of Ireland and where the Air Quality or Noise element of assessment is deemed key. He has been responsible for co-ordinating and preparation of the assessment for submission to the appropriate authority. This has included significant renewable energy schemes.

Richard Barker MLA. BA Env. PG Dip for. MILI. – Principal Landscape Architect

Richard formerly worked as a Town Planner in New Zealand, London and Dublin before moving into the field of Landscape Architecture. He has spent the last 16 years working as a Landscape Architect in Ireland and has considerable experience in the fields of both Landscape and Visual Impact Assessment (LVIA) and landscape design, covering all stages from project feasibility through to construction. This cross-over of expertise is invaluable in determining and designing the most appropriate and effective form of landscape and visual mitigation for infrastructural development projects.

Richard manages the LVIA department in Macro Works undertaking assessment work on a broad spectrum of projects from wind and solar energy, to roads and large-scale industrial and infrastructural development. Richard has personally completed the landscape and visual assessment of over 90 wind farms and 80 solar farms including nine SID projects. Consequently, he has considerable oral hearing expert witness experience. This extends to more than 15 oral hearings over the past 12 years with four of these being for large SID wind farm projects.

Richard has presented a number of conference papers relating to sustainable landscape design and LVIA as well as delivering the inaugural workshop on the landscape and visual effects of wind energy developments on behalf of the Irish Wind Energy Association. He has presented a paper to members of the Irish Landscape Institute on the application of the Guidelines for Landscape and Visual Impact Assessment (2013) using a wind energy case study. Richard has also delivered guest lectures to the University College Dublin professional course in EIA Management in relation to LVIA.

Tony Cummins BA MA – Senior Archaeologist & EIA Consultant

Tony Cummins has been a Senior Archaeologist with John Cronin & Associates since 2009. He holds B.A. and M.A. degrees in archaeology (University College Cork (UCC) 1992/1994) and has accumulated twenty-seven years industry experience. Tony has been a licence-eligible archaeologist since 1998 and has directed numerous excavations in Ireland. He also has a number of years' experience as an archaeological project manager responsible for assessing and supervising large-scale infrastructure projects, including the Limerick Southern Ring Road, the Waterford City Bypass, Killaloe Bypass, County Clare and the Clashavoon-Dunmanway 110 kV transmission, County Cork. He has extensive experience in preparing cultural heritage impact assessments for wind farm projects and his inputs to these have included liaising with project design teams and LVA specialists, as well as consulting with relevant local and national authority specialists. Examples of some of these wind farm projects include: Derrybrien rEIAR (Co. Galway), Coom, Glentane and Knockeenboy (Co. Cork), Shragh (Co. Clare) and Croaghaun Hill (Co. Carlow). Tony carried out desktop research and field inspections for the Inchamore project and was the principal author of the EIAR chapter.

David Murphy BA – Senior Project Archaeologist

David Murphy joined John Cronin & Associates in 2014 as a licence-eligible archaeologist. He holds a B.A. degree in archaeology (UCC 2003) and has accumulated eighteen years industry experience. Since becoming a licence-eligible archaeologist in 2012, David has overseen the completion of a large number of field surveys, monitoring, testing and excavation projects, while also authoring numerous archaeological impact assessments and screening reports for a variety of large infrastructure schemes, including wind farm developments. Between 2016 and 2021, David fulfilled the role of Project Archaeologist at a large-scale ESB wind farm development at Grousemount, Kilgarvan, Co. Kerry. During the course of the Grousemount project, David developed a comprehensive programme of mitigation measures for a range of previously unrecorded archaeological and cultural heritage sites which were identified within lands in the environs of construction areas. David contributed to the desktop research, field inspections and drone surveys carried out as part of the assessment of the Inchamore project.

David McGrath B.Sc. Computing

David is a Radio Planning Engineer in Ai Bridges Ltd. with over 10 years' experience working on radio frequency related projects, in excess of 7 years' experience working with wind farm wireless signal interference and remediation services, and over 5 years' experience of wireless network installations and commissioning.

He has received a B.Eng in Electronic Engineering and is experienced in analysing and troubleshooting RF issues, research and development in varying wireless network projects, and supervision of Dublin Institute of Technology Master's degree students.

Similar projects worked on include: Hunters Hill and Crockagarron Wind Farm, Slieve Kirk Wind Farm, Clydagh Wind Farm, Glenora Wind Farm, Woodhouse Wind Farm, Grouselodge Wind Farm, Bruckana Wind Farm, Mount Lucas Wind Farm, Athea Wind Farm, Dromada Wind Farm, Knockastanna Wind Farm, Rathcathill Wind Farm, Clydaroghe Wind Farm and Tievnameeta Wind Farm.

Patrick Tinney, B.Eng. Electronics, Occupational First Aid

Patrick is a Communications Engineer in Ai Bridges Ltd. with 3 years' experience as a company first aider and representative on Health and Safety committee. He has received a B.Eng. in Computer and IT Systems, with other training including ISRT Advanced Climber and ISRT Rescue Climber. Patrick has experience in conducting site surveys and RF planning using CE4 software prediction tools for UMTS mobile and fixed wireless networks.

He provides on-site support for Chorus roll-out of fixed wireless access in Ireland and RF planning/software modelling using Pathloss and CelPlan software prediction tools.

Previous wind farm projects worked on include: Developed Assessment Survey Methodologies Woodhouse Wind Farm Wireless Signal Interference Field Surveys; Co-ordinated and assisted on Grouselodge Wind Farm Wireless Signal Interference Field Surveys Project; Calibration Modelling on Bruckana Wind Farm Wireless Signal Interference Field Surveys Project, Managed “self-help” re-transmitter installation for Athea Wind Farm Wireless Signal Interference Field Surveys Project, and completion of Carrickateane, Eglish, Crockdun Wind Farm Residential Broadband Desk-top software prediction modelling services and completion of TV, GSM and Broadband Interference Reports.

Karla Chagas, B.Eng., M.Sc. Electrical Engineering

Karla is a Software Engineer in Ai Bridges Ltd. with over 14 years' experience working in radar, telecommunications and radio related interference and telecommunications modelling projects, and over 4 years' experience working with aviation, telecommunications and EMI interference and remediation projects. She has received a M.Sc. in Electrical Engineering and is currently undertaking a Ph.D. in Computer Engineering.

Karla has participated in numerous cellular network planning projects for vendors/operators. Prominent telecommunications include Radar and IS2000 network designs. She worked as a research scholar at Virginia Tech's Alexandria Research Institute, where her research included optimisation of Wide-Area IEEE 802.11 Systems for Community Networks.

Relevant experience includes development of the 3D paging system prediction model for Aviation, 3G Broadband and EMI Interference Projects, development of a proprietary 3D model for TV Interference for analogue and digital terrestrial broadcast based on the ITUT standards, and development of the software prediction modelling on contract for UK, NI and Scotland Aviation and MET Radar Interference Analysis on FITS Wind Farm Project.

1.9.3 Chapter Structure

Each technical assessment included in the EIAR has followed the same general format:

- Assessment Methodology and Significance Criteria: A description of the methods used in baseline surveys and in the assessment of the significance of effects

- Baseline Description: A description of the Site's existing baseline, based on the results of surveys, desk information and consultations, and a summary of any information required for the assessment, that could not be obtained, if applicable
- Assessment of Potential Environmental Effects: A description of how the baseline environment could potentially be affected for the Development including a summary of the measures taken during the design of the Development to minimise effects
- Mitigation Measures and Residual Effects - A description of measures recommended that will be implemented to reduce and/or off-set potential negative effects and a summary of the assessed level significance of the effects of the Development and/or the Development after mitigation measures have been implemented
- Cumulative Effects: A description identifying the potential for effects of the Development to combine with those from other existing, pending and/or permitted developments to affect resources
- Statement of Significance of effects

The significance of effects resulting from the Development will be determined through consideration of a combination of the sensitivity of the receiving environment and the predicted level of change from the baseline state. Environmental sensitivity can be categorised by several aspects including factors such as; the transformation of natural landscapes, the protection afforded to, and presence of, European sites, rare or endangered species, land use and fisheries.

Sensitivity of classification of the receiving environment can vary between the different technical areas of assessment e.g., ecology, hydrology, population and human health and visual. In general, this EIAR largely follows the principles and terminology of the 2022, EPA 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' in relation to the identification of significant effects. Where a technical assessment has adopted an alternative to this process, such as following technical guidance bespoke to that topic, such assessment criteria are made clear in that chapter. **Table 1.4** highlights the general framework for the assessment of significance of effects.

Table 1.4: Impact Classification Terminology (EPA Guidelines, 2022)

Impact Characteristic	Term	Description
Quality	Positive	A change which improves the quality of the environment
	Neutral	No effects or effects that are imperceptible within normal bounds of variation or within the margin of forecasting error

Impact Characteristic	Term	Description
	Negative	A change which reduces the quality of the environment
Significance	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 consistent with existing and emerging baseline 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
Extent & Context	Extent	Describe the size of the area, number of sites and the proportion of a population affected by an effect
	Context	Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions
Probability	Likely	Effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented
	Unlikely	Effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented
Duration and Frequency	Momentary	Effects lasting from seconds to minutes
	Brief	Effects lasting less than a day
	Temporary	Effects lasting less than a year
	Short-term	Effects lasting one to seven years
	Medium-term	Effects lasting seven to fifteen years
	Long-term	Effects lasting fifteen to sixty years
	Permanent	Effect lasting over sixty years
	Reversible	Effects that can be undone, for example through remediation or restoration
	Frequency	Describe how often the effect will occur, (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually)

Impact Characteristic	Term	Description
Type	Indirect	Impacts 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	The addition of many minor or significant effects, including effects of other projects, to create larger, more significant effects.
	'Do Nothing'	The environment as it would be in the future should the subject project not be carried out
	'Worst Case'	The effects arising from a project in the case where mitigation measures substantially fail
	Indeterminable	When the full consequences of a change in the environment cannot be described
	Irreversible	When the character, distinctiveness, diversity, or reproductive capacity of an environment is permanently lost
	Residual	Degree of environmental change that will occur after the proposed mitigation measures have taken effect
	Synergistic	Where the resultant effect is of greater significance than the sum of its constituents

1.9.4 Turbine Parameters used for EIAR Assessments

The proposed range of turbine parameters are assessed within the impact assessment chapters of this EIAR (Chapters 4-17) and are presented on **Figure 1.4**. In this regard the European Commission "Guidance document on wind energy developments and EU nature legislation, (November 2020)[7] notes that:

"The key issue for a competent national authority to authorise a wind energy development project based on an envelope rather than a specific design relates to environmental impact. From an environmental impact perspective, the applicant must ensure that the EIA and the Appropriate Assessment undertaken has considered the worst-case design possible within the different options available in the design envelope."

Table 1.5 describes for each of the EIAR topics how the turbine range, which is set out in the below bullet points, has been assessed. It should be noted that the Natura Impact Statement (NIS) submitted has similarly assessed the proposed range of turbine parameters. The proposed range of turbine parameters is limited to a variation of 8 m in tip height and 6 m in rotor diameter.

[7] https://ec.europa.eu/environment/nature/natura2000/management/docs/wind_farms_en.pdf, accessed 17/09/2021

- Turbine Tip Height – Maximum height 185 metres, Minimum height 177 metres.
- Hub Height – Maximum height 110.5 metres, Minimum height 102.5 metres.
- Rotor Diameter - Maximum diameter 155 metres, Minimum diameter 149 metres.
- Turbine Foundations – Maximum diameter 25.5 metres, Minimum diameter 22 metres.

Table 1.5: EIAR Topics and Turbine Ranges Assessed

Chapter	Turbines Considered
Chapter 3 Alternatives Considered	This chapter provides a description of the reasonable alternatives studied by the Developer, and the main reasons for choosing the proposed project (which includes the Turbine Range), taking into account the effects of the proposed project on the environment.
Chapter 4 Population & Human Health	This chapter comprehensively assesses the potential effects of the Project on Population and Human Health (which includes the turbine range). The relevant Irish guidance for shadow flicker is derived from the 'Wind Energy Development Guidelines for Planning Authorities' (Department of the Environment, Heritage and Local Government (DoEHLG), 2006) and the 'Best Practice Guidelines for the Irish Wind Energy Industry' (Irish Wind Energy Association, 2012). The DoEHLG Guidelines state that at distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low. Taking the above into consideration, JOD examined maps to identify receptors (dwellings) in the local area within a study area, a distance ten times the maximum proposed rotor diameter of the proposed turbines (10 x 155 m = 1,550 m). The maximum rotor diameter of 155 m was used to calculate this distance which was then rounded up to 2 km to ensure a conservative assessment. This dimension will give the most significant number of receptors and the largest study area. A specimen turbine was selected to model a base case scenario using the maximum possible rotor diameter and tip height. To ensure the full extent of the moving shadow which would be

Chapter	Turbines Considered
	created by the Turbine Range was assessed the following scenarios were modelled. These scenarios are appropriate to this assessment as they represent the full turbine range. • Specimen Turbine – 107.5 m hub, 155 m rotor diameter, 185 m tip height • Alternative Scenario 1 – 102.5 m hub, 155 m rotor diameter, 180 m tip height (lowest hub height and largest rotor diameter) • Alternative Scenario 2 – 110.5 m hub, 149 m rotor diameter, 185 m tip height (highest hub height and lowest rotor diameter) • Alternative Scenario 3 – 102.5 m hub (lowest hub), 149 m rotor diameter (shortest rotor), 177 m tip height
Chapter 5 Terrestrial Ecology	This chapter comprehensively assesses all scenarios and potential effects within the Turbine Range on terrestrial ecology. The potential impacts that could arise from the Project during the construction, operational and decommissioning phases were assessed, and it was found that there will be no change to the potential impacts or predicted effects irrespective of which turbine is selected within the Turbine Range. Habitat loss due to the extent of excavations required (30.75 ha) for the Project will differ depending on which turbine is chosen. However, the difference in effects is not seen as significant.
Chapter 6 Aquatic Ecology	This chapter comprehensively assesses all scenarios within the Turbine Range on Aquatic Ecology. The potential impacts that could arise from the Project during the construction, operational and decommissioning phases relate to the potential for increased suspended sediment concentrations associated with site preparation activities and excavations (77,262 m^3) for the infrastructure elements including the turbine foundations, cable trenches and watercourse crossings. There will be no change to the potential impacts or predicted effects irrespective of which turbine is selected within the Turbine Range because of the design phase mitigation measures which will be implemented prior to construction. All works will be outside of the 65 m buffer from watercourses and 20 m buffer from drains. Additionally, all temporary stockpiles will be at no less than

Chapter	Turbines Considered
	25 m from watercourses. This will be implemented regardless of the volume of excavated materials created as a result of the Turbine Range.
Chapter 7 Ornithology - Bird Collision Risk	This chapter comprehensively assesses all scenarios within the Turbine Range on Ornithology. The potential impacts that could arise from the Development during the construction, operational and decommissioning phases relate to the potential for increased collision risk for the Turbine Range. The Collision Risk Model has accounted for all scenarios within the Turbine Range.
Chapter 8 Soils & Geology	This chapter comprehensively assesses all scenarios within the Turbine Range on Soils and Geology. The potential impacts that could arise from the Project during the construction, operational and decommissioning phases relate to the potential for increased stability issues and suspended sediment concentrations associated with site preparation activities and excavations for the infrastructure elements including the turbine foundations and cable trenches (77,262 m^3) as detailed in **Appendix 2.1: Construction Environmental Management Plan**. The peat stability assessment has been completed on the basis of two scenarios: 1. Scenario A – Peat Stability in terms of the receiving environment as is, that is using the depth of peat observed and recorded during site surveys. 2. Scenario B – Peat stability in terms of the *in situ* peat with 1 m fill (presumed peat) placed on top, that is using the depth of peat observed and recorded during site surveys plus 1 m fill (depth + 1.0 m). This is the assessment worst case scenario and this will be used to assess stability at proposed infrastructure locations. There will be no change to the potential impacts or predicted effects irrespective of which turbine is selected within the Turbine Range as there is only a 3.5 m range in diameter of the wind Turbine Foundations to cater for all turbines within the Turbine Range. The

Chapter	Turbines Considered
	difference will be negligible in the assessment of potential effects of the Development on the environment. • Turbine Tip Height – Maximum height 185 metres, Minimum height 177 metres. • Hub Height – Maximum height 110.5 metres, Minimum height 102.5 metres. • Rotor Diameter - Maximum diameter 155 metres, Minimum diameter 149 metres. • Turbine Foundations – Maximum diameter 25.5 metres, Minimum diameter 22 metres.
Chapter 9 Hydrology and Hydrogeology	This chapter comprehensively assesses all scenarios within the Turbine Range on hydrology and hydrogeology. The potential impacts that could arise from the Project during the construction, operational and decommissioning phases relate to the potential for increased suspended sediment concentrations associated with site preparation activities and excavations for the infrastructure elements including the turbine foundations, cable trenches and watercourse crossings (77,262 m^3). There will be no change to the potential impacts or predicted effects irrespective of which turbine is selected within the Turbine Range because of the design phase mitigation measures which will be implemented prior to construction. All works will be outside of the 65 m buffer from watercourses and 20 m buffer from drains, where possible. Where this is not possible, additional mitigation measures such as increased use of Sustainable Drainage Systems (SuDS), will be implemented. Additionally, all temporary stockpiles will be at no less than 25 m from watercourses. This will be implemented regardless of the volume of excavated materials created as a result of the Turbine Range.
Chapter 10 Air & Climate	The assessment in this chapter considers an overall power output from the Project (which includes the Turbine Range) of between 28 MW to 33 MW. The Carbon Calculator, which is assessed for both the lower range (5.6 MW) and the higher range (6.6 MW), accounts for improvement works such as the habitat enhancement area and the years taken for the Site to return to its original characteristics.

Chapter	Turbines Considered
	Carbon Losses and Savings were calculated based on the lower and higher ranges of output to ensure all scenarios within the proposed range are assessed.
Chapter 11 Noise	This chapter comprehensively assesses all scenarios within the Turbine Range as well as all associated works. The 2006 Guidelines, ETSU-R-97 and the IOA Good Practice Guide recommend the measurement and use of wind speed data, against which background noise measurements are correlated. The IOA Good Practice Guide Supplementary Guidance Note 4[8] (Appendix 11.2) gives the methodology to account for wind shear, calculation to hub height and to standardise 10 m height wind speed. For this reason, the hub height was used to assess the potential effects of noise. A variation in hub height will not change the maximum sound power level of a turbine. However, a hub height wind speed of 110.5 m for the N149 when calculated to a 10 m height wind speed will give marginally different noise levels at the low wind speeds of 3 m/s and 4 m/s (10 m height) than if calculated from a hub height wind speed of 102.5 m. The marginal variation for the N149 is in the order giving lower levels of 0.8 dB at 3 m/s and 0.7 dB at 4 m/s for the hub height of 102.5 m. At 5 m/s (10 m height) and above the maximum sound power level does not change. A difference in sound power levels less than 1 dB are negligible to the human ear.
Chapter 12 Landscape & Visual Amenity	This chapter comprehensively assesses all scenarios within the Turbine Range as well as all associated works on the landscape and visual amenity. A specimen turbine and two alternative scenarios were included in the assessment in order to fully assess the range of turbine parameters.

[8] IOA, A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise- Supplementary Guidance Note 4: Wind Shear

Chapter	Turbines Considered
	A specimen turbine was selected to model a base case scenario using the maximum possible rotor diameter and tip height. To ensure the full extent of the visual effects of the Development on the landscape, which would be created by the Turbine Range, the following scenarios were modelled. • Specimen Turbine – 107.5 m hub, 155 m rotor diameter, 185 m tip height (as used for the visual impact assessment herein) • Alternative Scenario 1 – 102.5 m hub, 155 m rotor diameter, 180 m tip height (lowest hub height, longest rotor diameter) • Alternative Scenario 2 – 110.5 m hub, 149 m rotor diameter, 185 m tip height (highest hub height, shortest rotor diameter) As the lower, middle and higher ranges that would have the most visual impact on the landscape have been assessed, all scenarios within the Turbine Range are assessed.
Chapter 13 Material Assets and Other Issues	This chapter comprehensively assesses the Project (which includes the Turbine Range) on material assets and other issues. For aviation, the tallest tip height (185 m) represents the largest obstacle of any turbine within the Turbine Range to air traffic (irrespective of the turbine selected and constructed within the Turbine Range, a turbine with an equal or lesser tip height will still be within that space). Similarly, for the telecoms assessment, the largest possible dimensions of a turbine selected and constructed within the Turbine Range (which is a 185 m tip and a 155 m rotor diameter) were assessed as this provided the largest obstacle to communication links (any other turbine selected and constructed will be within that space). In terms of utilities, there will be no change to the potential impacts or predicted effects irrespective of which turbine is selected within the Turbine Range.
Chapter 14 Cultural Heritage	This chapter comprehensively assesses all scenarios within the Turbine Range on Cultural Heritage. The potential impacts that could arise from the Project during the construction, operational and

Chapter	Turbines Considered
	decommissioning phases relate to the potential for increased ground disturbance associated with site preparation activities and excavations for the infrastructure elements including the Turbine Foundations. Turbine Foundations will range from 22 m in diameter to 25.5 m in diameter. With larger excavations for larger Turbine Foundations, the chances of finding unrecorded, subsurface archaeological features are higher. However, such features may also be found where a smaller Turbine Foundation is used. Therefore, there will be no change to the potential impacts or predicted effects irrespective of which turbine is selected within the Turbine Range. The setting impacts described in Chapter 14 will result from the presence of turbines within the wider environs of extant cultural heritage sites. The difference in dimensions within the Turbine Range will not result in a likely increased magnitude of impact on setting that would result in changes to predicted effects.
Chapter 15 Traffic and Transportation	This chapter comprehensively assesses the proposed project (which includes the Turbine Range). There is one element of this assessment for which the turbine dimensions are directly relevant (i.e., The maximum blade length of 76.8 m). The transport assessment considered the worst-case scenario in terms of works required to the turbine delivery route based on a maximum 76.8 m blade length. Regardless of which turbine is selected and constructed within the Turbine Range the scale and extent of accommodation works required on the public road will remain the same as the same turbine delivery truck and methodology will be applied across the range of rotor diameters and therefore the associated impacts remain the same.

Chapter	Turbines Considered
	It should also be noted there are no additional traffic movements arising irrespective of which turbine is selected and constructed within the Turbine Range.
Chapter 16 Major Accidents and Natural Disasters	There will be no change to the likelihood of major accidents or natural disasters irrespective of which turbine is selected within the Turbine Range.
Chapter 17 Interactions of the Foregoing	There will be no change to the potential impacts or predicted effects irrespective of which turbine is selected within the Turbine Range.

1.9.5 Significance Criteria

The significance of the potential effects of the Development have been classified by taking into account the sensitivity of receptors and the magnitude of the potential effect on them, combined with the likelihood of an impact occurring as defined in **Table 1.6**

Table 1.6: Rating of Significant Environmental Impacts (EPA Guidelines, 2022)

Description of Impact Character/Magnitude/Duration/Likelihood/Consequences					
Magnitude of Significance /Sensitivity		Negligible	Low	Medium	High
	Extremely High	Not Significant	Profound/ Very Significant	Profound	Profound
	Very High	Not Significant	Moderate	Significant	Profound/ Very Significant
	High	Not Significant	Slight	Significant/ Moderate	Very Significant
	Medium	Not Significant/ Imperceptible	Slight	Moderate	Significant/ Moderate
	Low	Imperceptible	Slight/ Not Significant	Slight	Slight/ Moderate
	Negligible	Imperceptible	Imperceptible	Imperceptible	Imperceptible

1.9.5.1 Mitigation Measures and Residual Effects

There are three established strategies for impact mitigation - avoidance, reduction and remedy. The efficacy of each is directly dependent on the stage in the design process at which environmental considerations are taken into account, (i.e., impact avoidance can only be considered at the earliest stage, while remedy may be the only option available for projects where avoidance and reduction were not possible).

The EIA co-ordinator has engaged with stakeholders, which has provided the benefit of developing and refining mitigation through an iterative process rather than 'adding on' such measures at the end of the Project. Mitigation measures have been prioritised and embedded into the design phase of the Development to avoid, reduce and offset any significant adverse effects. These are referred to within this EIAR as 'embedded mitigation'.

Relevant mitigation measures are discussed within each technical Chapter of this EIAR. **Chapter 17: Interactions of the Foregoing** provides a summary of mitigation measures for all technical assessments in **Appendix 17.1: Schedule of Mitigation Measures**.

1.9.5.2 Cumulative Effects

The potential cumulative impact of the Project has been assessed in line with Annex IV of the EIA Directive as amended which provides that the EIAR must contain a description of the likely significant effects of the project on the environment resulting from the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources.

The assessment of the Project in combination with other projects considers the range and nature of existing projects within the cumulative impact study area of the Project, as far as practically possible. For the purposes of this EIAR, a radius of 3 km from the Redline Boundary, 50 m either side of the Turbine Delivery Route and a radius of 20 km for larger scaled projects for landscape and visual impacts.

Projects with the potential for cumulative or in combination effects were identified and those which will neither directly or indirectly contribute to cumulative or in combination impacts (outside of 3 km from the Development) were screened out.

A summary of the relevant projects with potential to create cumulative impacts has been included in **Appendix 2.4** and detailed cumulative impact assessments are included in each relevant section of the EIAR.

The geographic extent of the cumulative assessment is considered on a case-by-case basis, in line with the following:

- Guidelines on the information to be contained in Environmental Impact Assessment Reports (EPA, 2022).

- Guidance on the Preparation of the Environmental Impact Assessment Report (European Union 2017) (Directive 2011/92/EU as amended by 2014/52/EU); and
- Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions (European Commission 1999).

Assessment material for this cumulative impact appraisal was compiled based on relevant developments within 3 km of the Development, and 50 m either side of the length of the Grid Connection Route and Turbine Delivery Route lands.

For the purpose of Cumulative Assessment of Landscape and Visual, all existing and approved wind farms and wind farms pending a decision from the planning authority within 20 km from the outermost turbines of the Project were identified for Cumulative Visual Assessment. This study area is derived from the Wind Energy Development Guidelines (2006).

All existing and approved large-scale projects and large-scale projects pending a decision from a planning authority within 20 km of the Development were considered for potential Cumulative Assessment in all other chapters of this EIAR. This measurement was taken from the outermost turbines of the Development. A 20 km distance was considered appropriate due to the size and extent of the proposed wind farm and the nature of the potential effects as detailed throughout the EIAR.

All existing and approved projects and projects pending a decision from a planning authority within 50 m of the Grid Connection Route and Turbine Delivery Route lands were considered for potential Cumulative Assessment in all other chapters of this EIAR. A 50 m distance was considered appropriate due to the brief to temporary nature of the works involved and due to the limited extent of the works required.

The material for the cumulative assessment was gathered through a search of relevant County Councils' Online Planning Registers, the An Bord Pleanála website and the EIA Portal. Relevant EIA documents, planning application details and planning drawings were reviewed, which served to identify the locations of existing and approved projects and projects pending a decision from a planning authority, their activities and their environmental impacts.

The relevance of the projects was considered on a case-by-case basis in each chapter as necessary depending on the interaction and likelihood of in combination impacts. A full list of projects identified for cumulative assessment is set out in **Appendix 2.4**.

1.9.5.3 Statement of Significance of Effects

The statement of significance outlines the conclusion of each technical assessment in order to provide a final overall conclusion as to the significance of the Development under the terms of the EIA Directive 2011/92/EU (EIA Directive) and the 2014 EIA Directive 2014/52/EU (2014 EIA Directive).

1.10 SCOPING AND CONSULTATION

The scoping and consultation process was carried out in accordance with the EIA Directive and in accordance with the Guidelines on the information to be contained in Environmental Impact Assessment Reports (EPA, May 2022).

The 2014 EIA Directive Circular (PL 05/2018)[9] notes that:
"It is a requirement of the EIA process to consult with statutory consultees and to take into account any submissions made by these consultees. Such submissions may contain expert specialist opinions on topics to be assessed in the EIA process…".

A consultation and scoping exercise were carried out in November 2020 and again in September 2022. **Table 1.7** documents individuals and organisations that have been consulted as part of the EIA process. The purpose of this consultation process was to provide a focus for the EIA by identifying the key issues of relevance. As such, the consultation process informs the various organisations of the Development, thereby providing an opportunity to submit comments and to offer information relevant to the preparation of this EIAR. Responses can be found in **Volume IV**, **Appendix 1.1: Consultation Responses.**

[9] Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment, August 2018. Available online: https://www.opr.ie/wp-content/uploads/2019/08/2018-Environmental-Impact-Assessment-1.pdf [Accessed 22/07/2022]

Table 1.7: Scoping Responses Received on The Project

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
Cork County Council	A pre-planning meeting was held via Microsoft Teams on 14/01/2021 and 17/11/2022. A presentation was given outlining the project purpose, impact assessments carried out and the application process under Strategic Infrastructure Development guidelines. The main points of interest during the consultations included:	At the pre-planning meeting held via Microsoft Teams on 14/01/2021, a significantly different and larger scope of works was proposed to what was proposed at the meeting on 17/11/2022. All items raised were considered during the design and assessment processes.	**Ecology** addressed in Chapters 5 and 6 **Ornithology** addressed in Chapter 7 **Hydrology** addressed in Chapter 9 **Soils and Geology** addressed in Chapter 8 **Grid Connection Options** addressed in Chapter 3 **Landscape and Visual Amenity** addressed in Chapter 12 **Selected Grid Connection** assessed in Chapters 5-15
	• CDP objective HE2-3 Biodiversity outside protected areas and the Heritage Chapter as a whole	The study area of the Project was extended to approximately 2 km from the Redline Boundary for the checking of potential bat roosts. The underground grid connection route was also included in the study area. For the Turbine Delivery Route, an assessment was made of locations where physical works are required to facilitate the passing of the vehicles. The following frame of reference was used in determining the importance of ecological features identified during the desk study and surveys: -International and European -National (Ireland) -County (County Cork) -Local (lower value / higher value) -Site (wind farm immediate study area) The value of habitats has been measured against published selection criteria where available. The ecological evaluation and impact assessment approach used in this report is based on EPA Guidance (2022) and Guidelines for Ecological Impact Assessment in the United Kingdom and Ireland ("CIEEM guidelines") (CIEEM, 2019) (Biodiversity is addressed in	

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		Chapter 5: Terrestrial Ecology, **Chapter 6: Aquatic Ecology** and **Chapter 7: Ornithology).**	
	• Rationale for view point locations, suggested some additional viewing points from the new N22 would be of value	All of the scenic routes where the Zone of Theoretical Visibility (ZTV) indicates potential visibility were investigated during fieldwork to determine whether actual views of the Development might be afforded. Where visibility may occur, a viewpoint has been selected for use in the visual impact appraisal later in this chapter (**Chapter 12: Landscape and Visual Amenity**). A variety of receptor locations was also selected that are likely to provide views of the proposed wind farm from different distances, different angles and different contexts. The visual impact of a Development is assessed using up to 6 categories of receptor type as listed below: -Key Views (from features of national or international importance); -Designated Scenic Routes and Views; -Local Community views; -Centres of Population; -Major Routes; and -Amenity and heritage features The N22 is the only major route within the study area with any reasonable potential for visual impacts. As this route is a designated scenic route for the entire portion of the study area it is discussed in the context of scenic designations specifically in respect of View Points(VP19 and VP20).	

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		Taking into consideration consultation with Cork County Council regarding the N22 Ballyvourney Bypass, potential views from the new road alignment are considered. Viewing Point VP25 was selected for this purpose.	
	• Ecology unit identified some turbines they had concerns with.	Only one turbine, T1, will be constructed on habitats (wet heath/blanket bog) of significant ecological interest. This will result in the loss of 2 ha of wet heath/blanket bog . A Habitat Enhancement Area will be established as part of this Project to directly mitigate this effect., 11 ha of degraded blanket bog to the west of the Development will be rehabilitated as part of the enhancement area. The significance of the residual effect on wet heath/blanket bog is rated as a Moderate Adverse Effect of Long-term Duration. The other turbines and infrastructure are largely in commercial forest.	
	• Welcomed the stated approach to avoid bog	Blanket Bog and other Annex I habitats have been avoided where possible. This habitat is widespread in this part of the County. A habitat enhancement plan has been prepared and will be implemented to offset the impacts where these habitats have been lost (**Appendix 6.1 Habitat Enhancement Plan**).	
	• Welcomed distances achieved from residential units, in line with draft national guidelines.	There are 39 houses within 2 km of the proposed turbines. This can be seen in **Figure 1.3**. The closest property to a proposed turbine is 753 m	

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		away from T2. All houses located within 2 km of the proposed turbines are shown in **Figure 1.3**. There are no inhabited dwellings contained within the specified setback distance of 740 m stated in the Draft Revised Wind Energy Development Guidelines (2019) based on the maximum proposed tip height of the turbines.	
	Following the pre-planning meeting Scoping Opinion was received on 22/01/2021. The main points were as follows:		
	• The EIAR and construction practice and methodology should take into account existing ground conditions onsite and best practice. Disposal or elimination of waste/surplus material from construction/site clearance, particularly significant for peatland sites.	Existing ground conditions have been taken into consideration. A Site Investigation Report and Peat Stability Risk Assessment are included as **Appendix 8.1**. The estimated potential total volume of excavated material has been calculated in **Appendix 2.1 CEMP**, Management Plan 4: Peat and Spoil Management Plan. All excavated material apart from that along the Grid Connection Route will be reused onsite. The excavated material arising from the Grid Connection Route Construction will be removed to a licensed facility.	
	• Grid connection needs to be finalised - Should the grid connection not form part of the planning application, the EIAR should indicate the most likely corridor of the grid connection, its width and route and the likely nature of the connection in terms of	The grid connection is being assessed as part of the EIAR. However, planning permission is not being sought for the grid connection.	

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	line voltage, whether it will be underground (preferred) or over ground (including details of pole type) and any ancillary equipment (e.g., substations).	It is proposed to construct one 38kV electricity substation within the Site, as shown on Figure 2.2. This will provide a connection point between the wind farm and the grid connection point at the existing Ballyvouskill 220kV Substation. Electricity transmitted between the turbines and the substation on the Site will be at 20 kV. The width of a 38kV cable trench based on a trefoil formation will be 600 mm. The depth of the trench for 38kV cables is 1 m. The overall length of the grid connection between the substation and the existing 220 kV GIS substation (**Figure 1.2**) is 19.9 km, of which 1.3 km is within the Site. The remaining 18.6 km is located off-road and in third-party lands through the townlands of Inchamore, Derryreag, Derreenaling, Cummeenavrick, Glashacormick, Clydaghroe, Cummeennabuddoge and Caherdowney. The proposed grid connection will consist of underground 110 38 kV cables. This grid cable will pass through the townlands of, Derryreag, Cummeenavrick, Glashacormick, Clydaghroe, Cummeennabuddoge and Caherdowney. The Grid Connection Route and a summary of the activities are outlined in **Chapter 2: Project Description**. Assessment of all elements of the application for the construction of Inchamore Wind Farm including the Grid Connection Route are assessed in **Chapters 4-17**.	

Consultee Organisation	Response Received	Implications for the EIA/Design	EIA Chapter/Section where comments have been addressed
	Comments received from the Ecology Office in November 2022. The main points included:		
	○ Potential for impact on sites designated or proposed to be designated for protection of biodiversity;	The layout of the Development has been designed to minimise the potential environmental effects of the wind farm while utilising the maximum energy yield from the Site's wind resource. Layout design constraints are outlined in Section 2.5.1 **Chapter 2: Project Design.**	
	○ Potential for impact on habitats of high natural value; and	A habitat survey was carried out and has been included in **Chapter 5: Terrestrial Ecology**. Habitats of high natural value were only noted to exist in proximity to the proposed location of T1. Potential effects on all habitats surveyed have been assessed and mitigation measures have been recommended and will be implemented where necessary. A Residual Effect exists by the loss of wet heath/blanket bog habitat, which is rated as a Moderate Adverse Effect of Long-term Duration. However the loss of 2 ha of wet heath/blanket bog will be mitigated by the restoration and protection of 11 ha of degraded bog within the habitat enhancement area which is located directly adjacent to the site .	
	○ Potential for impact on protected species.	Protected species at the Site have been identified and potential effects of the Project on these protected species such as Kerry Slug, bats, otter etc. have been assessed in **Chapter**	

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
		5: Terrestrial Ecology. Mitigation measures listed in this chapter will be implemented during the pre-construction, construction, operational and decommissioning phases of the Project. With mitigation, no significant impacts are predicted on protected species.	
	• With regard to bat activity, if commuting and foraging routes of bats relative to proposals could be presented and if these routes could also be presented respective of habitats on site including any habitat loss associated with the development.	The ecological study area encompasses the Project. A Zone of Influence (minimum 15 km radius) was also considered as part of the review of designated sites. Industry best practice/guidance will be used to avoid the potential impacts on bats. Bat activity surveys targeted a range of foraging and commuting habitats present within the study area and those associated with linear features such e.g., roadside margins (**Chapter 6: Biodiversity**). Bat roost inspection surveys identified trees, structures, dwellings etc where bat roosts may occur and also assessed the surrounding habitat for suitable commuting and foraging areas.	
	• It is generally recommended to avoid intact upland habitats, in particular peatland habitats when identifying appropriate sites for development of wind farms.	The heath/bog habitat mosaic in the western area of the site has been rated as of Significant at a County level. Losses will be mitigated through the significant addition of restored bog habitats **Appendix 6.1 Habitat Enhancement Plan** (**Chapter 6: Biodiversity**), with the residual adverse effect reduced to Moderate significance of long term duration.	

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
		Given the upland nature of the proposed works at Inchamore predominantly located within upland peatland habitats with coniferous plantations, there will be no significant loss of bat foraging/commuting habitat such as woodland edge associated with the Development.	
	• Per above comments and based on constraints mapping, it is recommended that development is avoided within areas identified as:		
	- 'largely intact upland blanket bog' and 'cutaway blanket bog with intact areas' located in proximity to turbine 3 and associated developable areas within the vicinity of these habitats; and	A constraints map has been prepared (**Figure 3.1**) as part of this EIAR. This was a key factor in deciding the area in which to develop the wind farm. Environmental sensitivities, such as sensitive habitats and watercourse buffer zones etc., dictate a large proportion of design constraints. The developable area, including the proposed locations for turbines and site infrastructure avoids largely intact upland blanket bog, wet heath and cutover bog..	
	- areas comprising of a 'Mosaic of Upland Blanket Bog and Wet Heath' in proximity to the developable area associated with turbine 1.	Annex I habitats have been avoided where possible. The habitat enhancement plan has been prepared and will be implemented to offset the effects where these habitats have been lost (**Appendix 6.1 Habitat Enhancement Plan**).	
	• Potential for the project to give rise to negative effects on freshwater habitats and having particular regard to potential impacts on Fresh water pearl Mussel and Salmon. To this end, there should be a focus at design stage on providing for an appropriately designed surface water management system which minimises risk of release of	Mitigation measures for the construction, operational, and decommissioning phases are embedded in Chapter 5: **Terrestrial Ecology, Chapter 6: Aquatic Ecology** and **Chapter 7: Ornithology**. Included in the design is an appropriately designed surface water management system, which minimises risk of	

Consultee Organisation	Response Received	Implications for the EIA/Design	EIA Chapter/Section where comments have been addressed
	contaminants to surface waters and ensures that there is no increase in surface water run-off from the site. Avoidance of disturbance of peat based habitats will greatly assist with this.	release of contaminants to surface waters and ensures that there is no increase in surface water run-off from the site. The **Surface Water Management Plan (Appendix 2.1)** details the site drainage that has been designed for the site using the principles of Sustainable Drainage Systems (SuDS). The drainage system for the Development is designed in a manner to ensure there are no changes to the baseline water quality within or downstream of the Site. A comprehensive suite of drainage measures have been developed to protect all receiving waters from potential impacts during the construction, operation and decommissioning of the Development in the catchment of the Site and along the proposed Grid Connection Route. The assessment and associated proposed mitigation measures are in **Chapter 6: Aquatic Ecology** and **Chapter 9: Hydrology and Hydrogeology**. The Peat Stability Assessment Risk Ranking ranged from 'Very Low with isolated pockets associated with localised elevated stability risk' to 'Moderate'. The risk of peat-slide is further addressed in **Chapter 8: Soils and Geology.**	
	• Any species specific surveys which are deemed to be required including bird surveys must be completed by qualified and experienced practitioners following recognised best practise	All aquatic, terrestrial, and ornithological surveys were undertaken by qualified and experienced professionals following best practice methods. Details of surveyor qualifications and experience	

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	methods. It should be noted that up to two years' full season surveys are required for certain bird species should a potential impact on any such species be identified as a possible risk having regard to reference.	and accompanying best practice methods followed are described in **Chapter 5: Terrestrial Ecology, 6: Aquatic Ecology,** and **7: Ornithology.**	
	• Decommissioning and reinstatement should be considered in detail and shall include opportunities for biodiversity enhancement where possible.	Detailed decommissioning works are provided in the Decommissioning Plan (**Appendix 2.1**). Following expert ecological guidance, natural succession will be allowed to prevail post the decommissioning period i.e., post removal of turbines. The Habitat Enhancement Plan will allow for the restoration of Annex I habitats that have been degraded by over-grazing. It is anticipated that various species of flora and fauna will utilise the area as the habitats are rehabilitated and improve in quality. The objectives for this plan are achievable as similar work has been carried out successfully at other sites throughout Ireland.	
Kerry County Council	Response received 26/08/2021. The observations/comments by the area planner to the Grid Connection and Turbine Delivery Route for the Development which are located within in County Kerry. are as follows: Environmental Impact Assessment. Appropriate Assessment. Archaeology assessments are all required.	The Grid Connection Route and the Turbine Delivery Route for the Project have been assessed as part of the EIAR. They are also assessed in the Natura Impact Statement prepared for this Project.	**Ecology** addressed in Chapters 5 and 6 **Ornithology** addressed in Chapter 7 **Hydrology** addressed in Chapter 9 **Soils and Geology** addressed in Chapter 8 **Grid Connection Options** addressed in Chapters 3
	Transport Infrastructure Ireland/N22 implications to be assessed. Area is zoned Secondary Special Amenity in the County Development Plan.	Transport Infrastructure Ireland have been consulted and a Road Safety Audit has been prepared as part of the Project. Please see **Chapter 15: Traffic and Transportation** for more details.	

Consultee Organisation	Response Received	Implications for the EIA/Design	EIA R Chapter/Section where comments have been addressed
	It should be noted that the Site (of the grid connection works and Turbine Delivery Route works in Co. Kerry) is outside of the area zoned as "open to consideration" in the Renewable Energy Strategy.	Additionally, a Planning and Policy Statement has been included as part of the planning application. It is noted that elements of the Project (i.e., Sections of the Grid Connection Route and sections of Site Access Road and nodes of off-site roads) are within County Kerry and as such, a separate planning application has been prepared for such works and has been issued to Kerry County Council (Planning Authority).	**Landscape and Visual Amenity** addressed in Chapter 12 **Cultural Heritage** Addressed in Chapter 14 **Selected Grid Connection** assessed in Chapters 5-15 **Chapter 15: Traffic and Transportation**
	A pre-planning meeting was held via Microsoft Teams on 03/11/2022. From that meeting, Fiona O'Sullivan (Killarney Area Planner) noted the following: • the applicant is to submit an EIAR and AA Screening Report, • Regarding the EIAR - the applicant should include an ecological impact assessment on terrestrial and aquatic habitats and protected species, if applicable, identified. All supporting survey work should be undertaken to current best practices with competencies of staff outlined. Please consult with IFI and NPWS as applicable,	An Environmental Impact Assessment Report, Appropriate Assessment Screening Report and Natura Impact Statement have been prepared as part of this application. The potential effects of the Project on terrestrial ecology (**Chapter 5: Terrestrial Ecology),** aquatic ecology (**Chapter 6: Aquatic Ecology)** and ornithology (**Chapter 7: Ornithology**) have been assessed. This includes designated areas of ecological importance. All survey work has been carried out under best practice by competent experts. Please see the relevant chapters for details.	
	• Regarding likely significant effects on European sites, I note the application is outside of European Sites but upstream of the Killarney National Park, Macgillycuddy Reeks and Caragh River Catchment cSAC and in proximity to other European sites including those designated for birds of SCI,	Potential sensitive receptors have been identified and the likelihood and significance of potential effects on European sites have been assessed in the Natura Impact Statement which accompanies this planning application.	

Consultee Organisation	Response Received	Implications for the EIA/Design	EIA R Chapter/Section where comments have been addressed
	• As the applicant is no doubt aware, any measures intended to avoid or reduce harmful effects on European sites should not be included at screening stage,	Mitigation measures intended to avoid or reduce harmful effects on European sites as a result of this Project have not been considered at screening stage.	
	• Any ornithology surveys should be robust and supported by at least 1 year of winter and breeding survey undertaken to concurrent best practices,	Robust ornithology surveys have been completed and are detailed in **Chapter 7: Ornithology**.	
	• Likely impacts on White Tailed Sea Eagle should be specifically assessed, advisable to consult with NPWS in relation to same and note mitigation provided in the recently adopted Kerry County Development Plan for mitigation of any likely impacts on the species.	The potential effects on White Tailed Sea Eagle from the Development have been assessed in **Chapter 7: Ornithology**. National Parks and Wildlife Service have been consulted with at the scoping stage of this application and responses can be seen within this Table.	
	• The application should include and assess all in-combination/accumulative effects of all elements of the project (grid connection etc) and/or other projects in the environs of the proposed development.	The EIAR has assessed the cumulative impact of the Project on the various specific subject chapters. Please see the relevant effects assessed in each of the EIAR assessment chapters as prepared by the relevant experts.	
	• The Planning Report should clearly outline that this application forms part of a larger proposed development and details should be given of the application submitted to Cork Co Co.	The EIAR has introduced the Project Description in Section 1.5 and also in **Chapter 2: Project Description**.	
Minister for Housing, Planning and Local Government	No response received	n/a	n/a
Aviation			
Cork Airport	No response received	n/a	n/a

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
IAA	Scoping response received 17th December 2020. The main points were as follows: • Contact Kerry Airport and request to assess whether a preliminary screening assessment is required • In the event of planning consent being granted, the applicant should be conditioned to contact the Irish Aviation Authority to: ○ Agree an aeronautical obstacle warning light scheme for the wind farm development ○ Provide as-constructed coordinates in WGS84 format together with round and tip height elevations at each wind turbine location	Kerry Airport were contacted on 12th November 2020, 22nd November 2022 and 13th February 2023.. A response was received on 8th March 2023. In the event that planning permission is granted for the Project, the Irish Aviation Authority will be contacted prior to the commencement of any works for consultation. All items considered during the design process. No implications for the EIA/Design	**Aviation** discussed in **Chapter 13 Material Assets** An Aviation impact Assessment is included as **Appendix 13.3**.
Kerry Airport	Kerry Airport were contacted on 12th November 2020, 22nd November 2022 and 13th February 2023. A response was received on 8th March 2023. From an initial review the development would appear to be outside Kerry Airports 15 km OLS area. However, as you have highlighted in your scoping document section 4.2, the development has potential to impact on aviation coverage, and as such I would recommend that this be investigated further to confirm the development will not impact on the safe operation of aircraft and maintain current aviation associated coverage such as radio, radar, navigational aids etc. The requirements for lighting and inclusion of the structures on associated maps etc. will I am sure be addressed by the IAA. Further correspondence received on 18th April 2023 included:	Communication specialists, Ai Bridges were commissioned to undertake an aviation impact assessment of the operational phase of the Project, which is attached as **Appendix 13.3**.	**Aviation** discussed in **Chapter 13 Material Assets** An Aviation impact Assessment is included as **Appendix 13.3**.

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	For the assessment report (Appendix 13.3) 1. Section 2.2 as the proposed development penetrates the Annex 15 Aerodrome surfaces, the developer must ensure the development does not impact or increase current published operating minima associated with Kerry Airport. 2. Section 2.3 MSA's- any development must ensure that there is no impact on the current published MSA's associated with Kerry Airport. 3. Section 2.8- Obstacle warning lights- the developer should liaise with the Aviation Authority to ensure that the development is included on maps and lighted in the interest of aviation safeguarding. 4. The assessment and planning should include the assessment of the construction phase as part of planning to ensure cranes or other equipment involved in the development do not impact on Aviation safety during the construction phase.	1. The development does not impact or increase current published operating minima associated with Kerry Airport. 2. There is no impact on the current published MSA's associated with Kerry Airport. 3. The Aviation Authority has been consulted with regarding aviation safeguarding and their response has been included in this table. 4. The construction phase has been assessed and the Development will not impact on aviation safety.	
Ecology			
An Taisce	No response has been received.	n/a	n/a
Development Applications Unit,	Scoping response received 19th April 2021. The main points were as follows:	All items considered during the design process. No further implications for the EIA/Design	**Aquatic Ecology** addressed in Chapter 6 **Ornithology** addressed in Chapter 7 **Hydrology** addressed in Chapter 8 **Soils and Geology** addressed in Chapter 9
	The proposed wind farm is within the catchment of the River Sullane, which, in addition to fish species of conservation importance (please consult Inland Fisheries Ireland for scoping), contains a population of the freshwater pearl mussel. The (high) water quality requirements of this species should be taken into account in designing siltation control measures. The	Inland Fisheries Ireland were consulted and a Scoping Opinion was received 23/11/2020 and a pre-planning meeting was held via Microsoft Teams 08/01/2021. Please see response to the scoping opinion below in this Table.	

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	combination of clean water diversion, lined multicelled stone-constructed sediment ponds which can be cleaned by suction rather than excavated out, an environmental management plan, alarmed autosamplers, and previous best-practice upland construction experience indicates that a sediment control system could control sediment release such that it will not have an adverse effect on freshwater life downstream.	Inland Fisheries Ireland will be consulted with again prior to the commencement of any construction activities. Potential effects of the Development on aquatic life have been assessed in **Chapter 6: Aquatic Ecology** while water quality has been further assessed in **Chapter 9: Hydrology and Hydrogeology**. A Surface Water Management Plan and a Water Quality Management Plan have been prepared as part of **Appendix 2.1 Construction Environmental Management Plan**, **Chapter 2: Project Description**. Sustainable Drainage Systems (SuDS) have been included in the design phase of the Project.	**Landscape and Visual Amenity** addressed in Chapter 12 **Drainage Design** is addressed in the CEMP
	3. In connection with the above also, a thorough geotechnical stability risk and hydrogeological assessment needs to be carried out of areas of relatively deep peat soil, not just for turbine foundations, but also for access roads, borrow pits, drains, etc. There are a number of cases of peat slides during upland wind farm construction, and the scientific investigations of the causes of these should be taken into account in the EIAR.	A comprehensive geotechnical stability risk and hydrogeological assessment have been carried out at proposed turbine locations, access roads, drains and borrow pit areas, as part of the preparation of this EIAR. A Peat and Spoil Management Plan (Management Plan 4) has been included as part of Appendix 2.1: Construction Environmental Management Plan, **Chapter 2: Project Description**. A Peat Slide Risk Assessment has been appended to **Chapter 8: Soils and Geology** as Appendix 8.1 PSRA and has been fully assessed in the chapter. An Emergency Response Plan has also been prepared as part of Appendix 2.1: CEMP, **Chapter 2: Project Description** and **Chapter**	

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
		16: Major Accidents and Natural Disasters also assesses the impact of peat slippage.	
	4. Other protected species that require species-appropriate survey methods following published best practice are (a) red grouse, (b) merlin, (c) hen harrier, (d) golden plover, (e) curlew (f) Leisler's bat, (g) Kerry slug and (h) marsh fritillary. For red grouse, the long-term effect of increased human access (on foot, motorbike or ORV) via roadways (and potentially fox access), as well as increased perches and food for hooded crows, needs to be considered in terms of the likelihood of increased predation on this species. Note that both merlin and roosting hen harrier are often difficult to detect, and have been underestimated previously in some EIARs, so experienced observers are recommended. Golden plover must be taken into account in cumulative assessment with other wind farms in the Cork/Kerry Mountains. Leisler's bat may be more susceptible to collision or baro-trauma, so turbine locations which overlap with feeding features need to be taken into account. A licence application for addressing any direct impacts on Kerry slug habitat may be necessary. Marsh fritillary may not be present in suitable habitat every year due to their metapopulation dynamics, so suitable habitat should also be recorded (as mentioned on page 6 of the Scoping Report).	All species mentioned were surveyed for following published best practice. Potential effects on these species as a result of the Development are assessed in **Chapter 5: Terrestrial Ecology** and **Chapter 7: Ornithology**.	

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	5. There are a few upland protected plant species (including mosses and liverworts – see Statutory Instrument. No. 356 of 2015, Flora Protection Order) which need to be surveyed for, if or where suitable habitat exists in the development footprint. The discovery of the small cudweed (*Filago minima*) is mentioned in the Scoping Report, and it needs to be established if this can be avoided by the development.	Site surveys were completed to identify upland protected plant species. Potential effects on the identified protected plant species (*Filago minima*) as a result of the Development have been assessed in **Chapter 5: Terrestrial Ecology**. Mitigation measures will be implemented to prevent potential effects on *Filago minima*.	
	6. It is now well established that climate change is likely to have a considerable impact on biodiversity and wildlife, due to droughts, floods, sea level rise, changes in seasonal weather, etc. The impact of CO2 emissions from extensive peat excavation, if this is to be carried out, needs to be fully accounted.	A carbon calculation has been completed as part of this EIAR. This is detailed in **Chapter 10: Air and Climate**.	
	7. Impacts from associated works: (a) The likelihood of increases in nutrient loading of the River Sullane from forestry felling should also be assessed; (b) The effect of haul road widening and bridge upgrade works on protected species (e.g. otter, Kerry slug, Daubenton's and other bat species) should also be assessed; (c) if underground cables are to transport electricity, then river/stream crossings need to be examined, especially if in designated rivers; (d) effects of any fencing, lattice anemometer towers, etc., on red grouse collisions should be assessed.	a. The likelihood and significance of nutrient loading on watercourses as a result of forestry felling activities at the Development has been assessed in **Chapter 9: Hydrology and Hydrogeology**. A monitoring plan will be implemented as part of the Project. b. The effect of haul road widening and bridge upgrade works on protected species (e.g. otter, Kerry slug, Daubenton's and other bat species) have been assessed in **Chapter 5: Terrestrial Ecology**. c. **Chapter 9: Hydrology and Hydrogeology** assesses the impact of crossings on water quality. d. Potential effects of any fencing, lattice anemometer towers, etc., on red grouse collisions is assessed in **Chapter 7: Ornithology**. A Collision Risk Model	

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
		(CRM) has been included in this assessment.	
	8. The focus on habitats of conservation importance which are not protected, in the Scoping Report (page 6), is welcome. It should be kept in mind that some external funding agencies at European or global level are now expecting no net loss of biodiversity as part of their funding requirements.	A Habitat Enhancement Plan (**Appendix 5.5** of **Chapter 5: Terrestrial Ecology**) has been prepared as part of this EIAR to counter any potential loss of habitat as a result of the Development.	
	9. The visibility of the turbines from Killarney National Park, although not an ecological issue, needs to be assessed elsewhere in the EIAR.	The visibility of the turbines has been assessed in **Chapter 12: Landscape and Visual**.	
	10. Section 3.6 refers to assessment of ornithological impacts during construction and operation. Assessment of decommissioning, because of its often-similar disturbance effects to construction, should also be assessed.	Potential effects during the decommissioning phase of the Project have been assessed in all technical chapters of the EIAR. In addition to this, a Decommissioning Plan has been prepared as part of **Appendix 2.1: Construction Environmental Management Plan**.	
	11. Finally, reliance on post-planning approval of detailed works (e.g., river crossings), and monitoring design, by the National Parks and Wildlife Service (NPWS) of the Department, should be avoided as (a) it may indicate inadequacies of assessment by the EIAR, and (b) staff may not be available to support this in the time frame of an active construction project.	Reliance on post-planning approval of detailed works (e.g., river crossings), and monitoring design, by the National Parks and Wildlife Service (NPWS) of the Department has been avoided.	
Bat Conservation Ireland	No response received.	n/a	n/a
Birdwatch Ireland	Acknowledgement of Scoping Receipt (17/11/2020) No response received.	n/a	n/a
Irish Wildlife Trust	Response received (16/02/2021) stating they did not have the capacity to respond right now. Follow up	n/a	n/a

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	communication was made between the Applicant and Irish Wildlife Trust but no response was provided.		
Soils and Water			
Geological Survey of Ireland	Scoping response received 20/11/2020 and include the following comments: • Geoheritage: Records show there are no unaudited County Geological Site (CGS) in the vicinity of the proposed development.	Consultation with available maps (GSI) indicates that there are no recorded 'Geoheritage' sites located within the redline boundary of the Site or within the near vicinity. All items considered during the design process. No implications for the EIA/Design	**Chapter 8: Soils and Geology**
	• Groundwater: The Groundwater Vulnerability map indicates the proposed wind farm area is of variable vulnerability. We would therefore recommend use of the Groundwater Viewer to identify areas of High to Extreme Vulnerability and 'Rock at or near surface' which can be used to inform appropriate mitigation measures.	Consultation with the GSI Groundwater Map Viewer (2022) indicates that the Wind Farm Site is underlain by areas classified predominantly mapped as 'Extreme (E)' vulnerability rating which tend to be at lower elevations, with some areas mapped as 'Rock at or Near Surface (X)' vulnerability rating particularly at higher elevations. Both the Turbine Delivery Route and Grid Connection Route traverse land with groundwater vulnerability ratings ranging from 'Moderately Vulnerable' to 'Extreme Vulnerability' (**Figure 9.9a – Groundwater Vulnerability**).	**Chapter 9: Hydrology and Hydrogeology**
	• Geological Mapping: Geological Survey Ireland (GSI) maintains online datasets of bedrock and subsoils geological mapping that is reliable, accessible and meets the requirements of all users including depth to bedrock and physiographic maps and the GSI encourages the use of these.	Consultation with the Geological Survey Ireland online data sets as well as site visits were carried out.	**Chapter 8: Soils and Geology**
	• Geohazards: Landslide susceptibility in the area of the proposed wind farm is variable and is classed from Moderately Low / Moderately High to High.	Peat and slope stability investigations at the Site (**Appendix 8.1**) indicate that the Site has a generally low risk probability with respect to peat	**Chapter 8: Soils and Geology**

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
		slippage and slope failure under the footprint of the Development. Considering the assessment conclusions are related to the Development and construction activities including vehicular movements will be limited to the Development, areas of potentially high risk (Geohazards, for example, GSI high risk landslide susceptibility) in terms of peat and slope stability will be avoided.	
	• Natural Resources (Mineral / Aggregates): In keeping with a sustainable approach, we would recommend use of our data and mapping viewers to identify and ensure that natural resources used in the proposed development are sustainably sourced from properly recognised and licensed facilities.	GSI data and map viewers have been consulted in the preparation of this EIAR. Imported stone will be from licensed facilities, as discussed in **Chapter 15: Traffic and Transportation**.	**Chapter 15: Traffic and Transportation**
Inland Fisheries Ireland	Scoping Opinion received 23/11/2020 and pre-planning meeting via Microsoft Teams 08/01/2021. The following comments were made: • There should be no drainage or other physical interference with the bed or bank of any watercourse without prior consultation with IFI.	All items considered during the design process and IFI will be consulted prior to any construction works. IFI will be consulted with prior to any works commencing on the Development. All water crossings as part of the Development will be clear span bridges and will avoid permanent disruption to the stream beds and banks, protecting fishery habitats. There will be 113 No. culvert crossings and three watercourse/bridge crossings will occur along the Grid Connection Route as part of the Project. This is further detailed in **Chapter 2: Project Description**.	**Ecology** addressed in Chapter 6 **Hydrology and Hydrogeology** addressed in Chapter 9 **Soils and Geology** addressed in Chapter 8

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
		The original slope of the riverbank will be maintained with no sudden drops on the downstream side. Design details on the proposed clear span bridges (three (3 No.)) have been included in the Planning Drawings and have been assessed in the EIAR.	
	• Suspended solids and or hydrocarbon contaminated site run-off waters must be controlled adequately so that no pollution of surface waters can occur.	All site drainage will be directed through either sediment traps, settlement ponds and/or buffered drainage outfalls to ensure that total suspended solid levels in all waters discharging to any watercourse will not exceed 25 mg/L. This is detailed in **Chapter 2: Project Description** and **Chapter 9 Hydrology and Hydrogeology**. Construction phase drainage proposed can be seen in the Surface Water Management Plan as part of **Appendix 2.1 Construction Environmental Management Plan**.	**Chapter 2: project Description** **Chapter 9: Hydrology and Hydrogeology** **Appendix 2.1 CEMP, Management Plan 2 Surface Water Management Plan**
	• The following issues should be addressed ○ Identifying and zoning the project for environmental impact should a peat slip occur ○ Setting out contingency plan should a peat movement occur. ○ Setting out a plan for the control of silt in such a scenario, including measures to be put in place at the initial stages of construction.	The design of the Project has taken into consideration the depth of peat and angle of slope onsite. A constraints study was completed to provide a developable area. This is discussed in **Chapter 3: Alternatives Considered**. A Peat Slide Risk Assessment was carried out and can be seen as **Appendix 8.1** of **Chapter 8: Soils and Geology**. An Emergency Response Plan has been prepared as part of **Appendix 2.1:**	

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
		Construction Environmental Management Plan (Management Plan 1). Emergency procedures in the case of the unlikely movement of peat have also been included in **Chapter 8: Soils and Geology**. Construction phase drainage proposed can be seen in the Surface Water Management Plan as part of **Appendix 2.1 Construction Environmental Management Plan**.	
	• In the event of any watercourse crossings being bridged or culverted the following general criteria should apply, o The free passage of fish must not be obstructed. o The original slope of the river bed should be maintained with no sudden drops on the downstream side. Design details on any proposed crossing should be incorporated at planning stage o Bridges are preferable to culverts.	All water crossings as part of the Development will be clear span bridges and will avoid permanent disruption to the stream beds and banks, protecting fishery habitats. There will be 113 No. culvert crossings and three watercourse/bridge crossings will occur along the Grid Connection Route as part of the Project. This is further detailed in **Chapter 2: Project Description**. The original slope of the riverbank will be maintained with no sudden drops on the downstream side. Design details on the proposed clear span bridges (three (3 No.)) have been included in the Planning Drawings and have been assessed in the EIAR.	**Chapter 2: Project Description** **Appendix 2.1: CEMP, Management Plan 2: Water Quality Management Plan** **Appendix 2.1: CEMP, Management Plan 3: Surface Water Management Plan** **Chapter 6 Aquatic Ecology** **Chapter 9: Hydrology and Hydrogeology**
	All instream works should be carried out only in the May-September period.	All instream works will be carried out during the period of May to September only.	

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
Irish Peatland Conservation Council	Scoping response received 15/02/2021 stating they had no comments to make at this time.	n/a	n/a
Telecommunications			
Broadcasting Authority of Ireland	Scoping response received 16/11/2020 and made the following comment: The BAI does not perform an in-depth analysis of the effect of wind turbines on FM networks. However, we are not aware of any issues from the existing windfarms into existing FM networks. Also, the proposed windfarms are not located close to any existing or planned FM transmission sites.	No implications for the EIA/Design	n/a
Eir Limited	Scoping response received 27/11/2020 stating there should be no impact on the eircom Ltd microwave radio network.	No implications for the EIA/Design	Radio link discussed in Chapter 13
ENET	Scoping response received 19/02/2021 highlighting the ENET link near the proposed turbines.	All items considered during the design process. No implications for the EIA/Design.	**Telecommunications** discussed in **Chapter 13: Material Assets** and **Chapter 3: Alternatives Considered**
RTÉ	Scoping response received 17/11/2020 highlighting that there was a risk of interference to DTT viewers receiving from the Mullaghanish site. Several pre-planning meetings were held with 2RN (trading name of RTÉ) on behalf of RTÉ to discuss the existing links and minimum buffers required.	Telecommunications specialist (AI Bridges) was employed to inform the turbine layout to minimise impact to existing links.	**Telecommunications** discussed in **Chapter 13: Material Assets**
Tetra Ireland	Scoping response received 09/12/2020 stating no impact from the development was anticipated.	No implications for the EIA/Design	n/a
Three Ireland (Hutchison) Limited	No response received	n/a	n/a

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
Virgin Media Television	Scoping response received 16/11/2020 and stated Virgin Media does not have any record of underground services at this location.	No implications for the EIA/Design	n/a
Vodafone	Scoping response received 15/02/2021 highlighting the links that will be effected by the proposed development.	Telecommunications specialist (AI Bridges) was employed to inform the turbine layout to minimise impact to existing links.	**Telecommunications** discussed in **Chapter 13: Material Assets**
Other			
Commission for Communications Regulation	No response received	n/a	n/a
Department of Agriculture	No response received	n/a	n/a
Department of Defence	Scoping response received 08/12/2020 and included the following points: • In all locations where wind farms are permitted it should be a condition that they meet the following lighting requirements:	All items considered during the design process. No implications for the EIA/Design	**Aviation** discussed in Chapter 13
	• Single turbines or structures, or turbine delineating corners of a wind farm should be illuminated by high intensity obstacle lights.	High intensity obstacle lighting will be used on selected turbines within the Development.	
	○ Obstruction lighting elsewhere in a wind farm will be of a pattern that will allow the hazard to be identified and avoided by aircraft in flight.	Obstruction lighting elsewhere in the wind farm will be of a pattern that will allow the hazard to be identified and avoided by aircraft in flight.	
	• Construction lights used should be incandescent or of a type visible to Night Vision Equipment. Obstruction lighting fitted to obstacles must emit light at the near Infra-Red (IR) range of the electromagnetic spectrum specifically at or near 850nanometres (nm) of wavelength. Light intensity to be of similar value to that emitted in the visible spectrum of light.	Construction lights used will be incandescent or of a type visible to Night Vision Equipment. Obstruction lighting fitted to obstacles will emit light at the near Infra-Red (IR) range of the electromagnetic spectrum specifically at or near 850 nanometres (nm) of wavelength. Light intensity will be of similar value to that emitted in the visible spectrum of light.	

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
Department of Transport, Tourism and Sport	• Scoping response received 26/11/2020 and includes the following points:	All items considered during the design process. No implications for the EIA/Design	**Alternatives Considered** discussed in Chapter 3 **Traffic and Transport** discussed in Chapter 15
	• The EIAR should include information on what impact the proposed development may have on the public road network both during construction and in the longer term.	**Chapter 15: Traffic and Transportation** of the EIAR and **Management Plan 7, Traffic Management Plan** of **Appendix 2.1: Construction Environmental Management Plan** includes information on what impact the proposed development may have on the public road network both during construction and in the longer term.	**Chapter 15: Traffic and Transportation** **Appendix 2.1: CEMP**
	• The EIAR should indicate whether it is proposed to use public roads to connect the windfarm to the grid and if that is the case specify the extent of the works required including drainage, diversions, relocation of services and road re-instatement.	**Chapter 2: Project Description** details the extent of works relating to the Grid Connection Network within the public road infrastructure. Please also see **Appendix 2.4: Grid Connection Details**.	**Chapter 2: Project Description** **Appendix 2.4: Grid Connection Details**
	• The EIAR should also address the future maintenance requirements related to the installation of the cables in public roads and the cost implications for the relevant local authority. Consideration should also be given to how cabling needs to be organised and, where a number of cables are envisaged from existing, approved and proposed developments, rationalised into one cable or a group of cables in one trench in order to minimise the impacts on the road network and the environment along the road boundary (hedgerows).	All items considered during the design process. No implications for the EIA/Design. The only instance in which cables will be installed in public roads is via directional drilling under the N22 and therefore, the road surface will not be disturbed and there will be no requirement for future maintenance by the local authority. All items considered during the design process. No implications for the EIA/Design **Chapter 2: Project Description** details the extent of works relating to the Grid Connection Network within the public road infrastructure. Please also see **Appendix 2.4: Grid Connection Details**.**Chapter 15: Traffic and**	**Chapter 2: Project Description** **Appendix 2.4: Grid Connection Details** **Chapter 5: Terrestrial Ecology**

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
		Transportation of the EIAR and **Management Plan 7, Traffic Management Plan** of **Appendix 2.1: Construction Environmental Management Plan** includes information on what impact the proposed development may have on the public road network both during construction and in the longer term.	
	• In addition the EIAR should consider the possibility of over-ground solutions for the transmission of electricity as an alternative.	All items considered during the design process. No implications for the EIA/Design **Chapter 2: Project Description** details the extent of works relating to the Grid Connection Network within the public road infrastructure. Please also see **Appendix 2.4: Grid Connection Details**.	**Appendix 2.4: Grid Connection Details** **Chapter 3: Alternatives Considered**
Environmental Protection Agency	Acknowledgement of Scoping Receipt (13/11/2021)	n/a	n/a
Fáilte Ireland	Scoping response received 23/11/2020 and includes the following points:	All items considered during the design process.	Addressed in Chapters 2-16 – Tourism is addressed specifically in **Chapter 4: Population and Human Health**
	• Project descriptions are required to describe the location of the project, the physical characteristics of the whole project, the main characteristics of the operational phase of the project and an estimate, by type and quantity, of the expected residues and emissions. The location of the project should include identifying key sensitive receptors (including tourism receptors). In the operational phase of the project any tourism based, or potentially tourism related activity, should be identified.	A description of the location of the project, the physical characteristics of the whole project can be found in **Chapter 2: Project Description** and has been summarised and assessed in full in each chapter of the EIAR. The main characteristics of the operational phase of the project have been summarised throughout the EIAR and an estimate, by type and quantity, of the expected residues and	**Chapter 2: Project Description** **Chapter 4: Population and Human Health** **Chapter 13: Material Assets**

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
		emissions has been included in **Chapter 13: Material Assets** and **Chapter 10: Air and Climate**. Key human sensitive receptors (including tourism receptors) have been identified in **Chapter 4: Population and Human Health**.	**Chapter 10: Air and Climate**
	• Detail the key considerations culminating in the selection of the design, the reasoning for these and the environmental effect of these decisions. The developer is expected to consider reasonable alternatives. What is considered reasonable may vary from case to case.	Cumulative effects have been assessed throughout the entire EIAR. Cumulative effects in relation to tourism have been included in **Chapter 4: Population and Human Health**. Reasonable alternatives have been considered in the design of the Project as detailed in **Chapter 3: Alternatives Considered**.	**Chapter 3: Alternatives Considered** **Chapter 4: Population and Human Health**
	• Baseline assessments should identify any tourism sensitivities in the zone of influence of a development. This zone of influence of a development is highly dependent on its **Context, Character, Significance,** and **Sensitivity**, as outlined in the Draft Guidelines. These characteristics apply to both the development and the environment.	All items considered during the design process. No implications for the EIA/Design. Tourism receptors have been identified and have been assessed in **Chapter 4: Population and Human Health** and **Chapter 13: Material Assets**.	**Chapter 4: Population and Human Health**
	• Impact assessment should contain the likely significant effects of a development arising from both construction and operation of a development. Advice on describing the effects is contained within the Draft Guidelines and includes the **quality, significance, extent, probability, type** and **duration** of the effect, with particular descriptors for each. Impact assessment should be carried out as per EPA guidelines and the best practice for that prescribed topic. It may be considered appropriate to consider impact on tourism assets under the 'material assets' topic below.	All items have been considered and addressed throughout the EIAR. Tourism has been assessed in **Chapter 4: Population and Human Health** and **Chapter 13: Material Assets**.	**Chapter 4: Population and Human Health** **Chapter 13: Material Assets**

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	• The impact upon tourism can be considered within this section through the sensitivities of Hospitality, Safety and Pace of Life. Changes in population can impact the perception of pace of life or safety in a particular location. Impacts upon these issues in areas which rely heavily on tourism or have a particular sensitive tourism generator should be considered in this section.	All items have been considered and addressed throughout the EIAR. Tourism has been assessed in **Chapter 4: Population and Human Health** and **Chapter 13: Material Assets**.	**Chapter 4: Population and Human Health** **Chapter 13: Material Assets**
	• The disturbance to ecology must be managed to minimise impact. Biodiversity is also a tourism asset and should be protected as such from other development and should be provided for in proposals where possible.	All items have been considered and addressed in the EIAR. Disturbance to ecology will be managed through mitigation measures included in: • **Chapter 5: Terrestrial Ecology,** • **Chapter 6: Aquatic Ecology** • **Chapter 7: Ornithology**	**Chapter 4: Population and Human Health** **Chapter 5: Terrestrial Ecology,** **Chapter 6: Aquatic Ecology** **Chapter 7: Ornithology** **Chapter 13: Material Assets** **Chapter 14: Cultural Heritage**
	• Negative impacts to Soils and Geology, Air and Climate, Water should be avoided	All items have been considered and addressed in the EIAR. No implications for the EIA/Design. Potential effects have been assessed in: • **Chapter 8: Soils and Geology** • **Chapter 10: Air and Climate** • **Chapter 9: Hydrology and Hydrogeology**	**Chapter 8: Soils and Geology** **Chapter 10: Air and Climate** **Chapter 9: Hydrology and Hydrogeology**

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
		Potential negative impacts on Soils and Geology have been assessed in **Chapter 8: Soils and Geology**. Potential negative impacts have been assessed in **Chapter 9: Hydrology and Hydrogeology**. All items have been considered and addressed in the EIAR. No implications for the EIA/Design. Buffer zones have been implemented into the design of the Development to prevent negative impacts. Air Quality has been fully assessed and potential negative impacts have been identified in **Chapter 10: Air and Climate**. All items have been considered and addressed in the EIAR	
	• A link between tourism and this prescribed environmental factor, beyond the normal development impacts, is rare, however the impact upon tourism of issues of noise and vibration can be significant. Construction for example should consider the sensitivity of the development and ensure mitigation is in place.	All items have been considered and addressed in the EIAR. Potential effects from noise and vibrations created as a result of this Development have been assessed in **Chapter 11: Noise**.	**Chapter 11: Noise**
	• The construction programme of developments should work to avoid peak tourism periods in tourism areas and should consider planned or anticipated tourism events and festivals.	All items have been considered and addressed in the EIAR. Potential effects on Tourism have been identified and mitigation measures have been proposed in **Chapter 4: Population and Human Health**. No tourism events are anticipated within the vicinity of the Development during the construction, operational or decommissioning phases of the Project. Peak tourism periods will be avoided.	**Chapter 4: Population and Human Health**

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
		Potential effects on tourism as a result of the Development have been assessed in **Chapter 4: Population and Human Health**.	
	• Cultural heritage should be strongly considered in non-tourism developments and the impact upon tourism considered as a potential impact.	All items have been considered and addressed in the EIAR. A small section of the grid route (640 m) is located along the Beara to Breifne Way. Works along this section will take up to seven days to complete. Pedestrian access will be maintained during the construction and decommissioning phases and works will be completed outside peak tourist season where possible. Potential effects on cultural heritage as a result of the Development have been assessed in **Chapter 14: Cultural Heritage.**	**Chapter 14: Cultural Heritage**
	• Waste and Waste disposal issues can also impact the perception of an unspoiled environment, effecting tourism, which should be considered.	All items have been considered and addressed in the EIAR. An assessment of potential effects as a result of waste generated during the construction, operational and decommissioning phases of the Project has been included in **Chapter 13: Material Assets**. In addition to this, a Waste Management Plan has been prepared as an appendix to the Construction Environmental Management Plan.	**Chapter 13: Material Assets** **Appendix 2.1 CEMP; Management Plan 5**: **Waste Management Plan**
	• Tourism could be considered a material asset as its impact upon the economy and the infrastructure in place to support it is a material consideration in assessing economic impact.	All items have been considered and addressed in the EIAR. There are many walking and cycling routes in the vicinity of the Development and within Counties Cork and Kerry. These routes provide activities for both international visitors and local	**Chapter 13: Material Assets**

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
		tourists bringing with them, minor economic gains to the locality. All items have been considered and addressed in **Chapter 4: Population and Human Health** and **Chapter 13: Material Assets**.	
	• The visual impact of a tourism development, especially in locations which are visually sensitive or renowned for their scenic or landscape beauty, should be considered carefully. A development intended to utilise or enjoy a particular vista or environment should minimise impact upon that environment.	All items have been considered and addressed in the EIAR. There are many scenic, walking and cycling routes within the vicinity of the Development and within Counties Cork and Kerry. These routes provide activities for both international visitors and local tourists. The impact of the Development on the landscape as well as the cumulative effects of other developments in the area have been assessed in **Chapter 12: Landscape and Visual**.	**Chapter 12: Landscape and Visual**
	Major Accident and Natural Disaster There is a requirement for developments to describe expected significant effects on the environment of the proposed development's vulnerability to major accidents and/or natural disasters relevant to it. Where appropriate measures should be identified to prevent or mitigate the significant adverse effects of such accidents or disasters, including resulting from climate change, on the environment and detail the preparedness for the proposed response.	All items have been considered and addressed in the EIAR. A separate chapter has been prepared to assess the impacts of major accidents and natural disasters.	**Chapter 16: Major Accidents and Natural Disasters**
	Interaction of Effects Where two or more environmental impacts combine or interact they should be considered under the prescribed topics. It is best practice to provide a table of interactions within an EIAR or EIAR Screening Report.	All items have been considered and addressed in the EIAR.	**Chapter 17: Interactions of the Foregoing**
	Mitigation	All items have been considered and addressed in the EIAR. Mitigation measures have been	**Appendix 17.1 Schedule of Mitigation Measures**

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	Mitigation should follow the hierarchy of minimisation in descending order of preference- Avoid, Reduce, Remedy. Mitigation measures must be measurable and achievable within the bounds of the project.	included in each technical chapter of the EIAR for the construction, operational and decommissioning phases. A schedule of mitigation measures has also been appended to **Chapter 17: Interactions of the Foregoing**.	
	Cumulative Impact The cumulative impact is that of the project combined with any known likely project which will interact or compound an environmental impact.	All items have been considered and addressed in the EIAR. All technical chapters of this EIAR include an assessment of cumulative effects.	Chapters 4-16
	Transboundary Impact Transboundary impacts should be included in EIAR. In the case of tourism, especially international travel, the transboundary impacts may not be proximate to the EIAR site	n/a	n/a
Health Service Executive	A response was received on 10/12/2020 and contains the following points:	All items considered during the design process.	Addressed in chapters 2-16
	• The Environmental Impact Assessment should examine all likely significant impacts and provide the following information for each: a) Description of the receiving environment; b) The nature and scale of the impact; c) An assessment of the significance of the impact; d) Proposed mitigation measures; e) Residual impacts.	All items have been included in the technical chapters of the EIAR. A description of the baseline conditions of the receiving environment has been included in each technical assessment of the EIAR. The potential effects of the Development on the receiving environment have been identified in each technical chapter of the EIAR. This includes the significance of the potential effects. Mitigation measures have been proposed against the potential effects identified and the	Chapters 4-16

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
		residual impacts have been identified and their significance has been included in each technical chapter of the EIAR.	
	• Population and Human Health should be adequately assessed.	All items have been considered and addressed in the EIAR.	**Chapter 4: Population and Human Health**
	• In addition to any likely significant negative impacts from the proposed development, any positive likely significant impacts should also be assessed. The HSE will consider the final EIAR accompanying the SID/ planning application and will make comments to An Bord Pleanála and Cork County Council on the methodology used for assessing the likely significant impacts and the evaluation criteria used in assessing the significance of the impact.	All potential effects of the Development on the receiving environment have been identified in each technical chapter of the EIAR. The methodology for assessing the potential effects has been included in each of the relevant chapters. All items have been considered and addressed in the EIAR.	
	Public Consultation • It is strongly recommended that early and meaningful public consultation with the local community should be carried out to ensure all potentially significant impacts have been adequately addressed. All parties affected by the proposed development, including those who may benefit financially from the project, must be fully informed of what the proposal entails, especially with regard to potential impacts on surrounding areas. • Sensitive receptors and other stakeholders should be identified to ensure all necessary and appropriate mitigation measures are put in place to avoid any complaints about the proposed wind farm development in the future. • It is acknowledged that current restrictions around public gatherings as a result of Covid 19 prevention measures will impact on opportunities for public consultation events. However, it is expected that	The project at an early stage appointed a local Community Liaison Officer (CLO) in July 2020. Sensitive receptors and stakeholders were identified. Initially the CLO's direct engagement focused on calling to houses within 2km of the Development. Three (3 No.) Newsletters were sent to houses within 2 km of the Development between July 2020 and September 2021. A Project update letter was circulated to the same residences in November 2021. An introduction letter to FuturEnergy Ireland was circulated to the residences in December 2021. A further project update letter was circulated in March/April 2022 ad in November 2022.	Section 1.7.1 Public Consultation **Appendix 1.3: Community Consultation Report**

Consultee Organisation	Response Received	Implications for the EIA/Design	EIA R Chapter/Section where comments have been addressed
	meaningful public consultation, where the local community is fully informed of the proposed development, will be undertaken. Members of the public should be given sufficient opportunities to express their views on the proposal wind farm. • The Environmental Impact Assessment Report (EIAR) should clearly demonstrate the link between public consultations and how those consultations have influenced the decision-making process in the EIA. • To assist with the consultation and planning process it is recommended that the applicant develops a dedicated website for the proposed wind energy project. All correspondence, maps, project updates and documentation including the EIAR should be uploaded to this site.	Five (5 No.) national schools in the vicinity of the Development were included in an Educational Programme around Climate Change. A media release in March 2023 launched the project brochure and virtual tour exhibition. The brochure was circulated to residences within 5 km of the Development and to elected representatives. Advertisements in local newspapers displayed details of the public information days. Two public information days were held in a location that was easily accessible to local residents. All documentation availableat the public information days was in English and Irish and Irish speaking representatives were on hand to discuss the Development with local Irish speaking residents. A Pre-Application Community Consultation (PACC) Report has been submitted to Cork County Council and Kerry County Council as a standalone document as part of this planning application. The PACC Report summarises the engagement and consultation that has taken place with the local community over the project lifecycle to date. Starting from the introduction of the project through to the project's submission into planning, the PACC report includes reports of the public information day, how the Developer intends to continually engage with the local	

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
		community into the future and how comments received have been addressed and incorporated by the Project. A dedicated project website was launched (https://inchamorewindfarm.ie/) and provides updates to the public regarding the progress of the Project.	
	Decommissioning Phase • The EIAR should detail what the eventual fate of the turbines and associated material will be, i.e., will the material be recycled or how will it be disposed of. Information should also be provided regarding the proposed methodology to be used for the disposal of the materials forming the foundations of the wind turbines. The EIAR should indicate the proposed future use of the wind farm site at the end of the planning permission period.	The decommissioning phase of the Project has been assessed in each of the technical chapters. The decommissioning of the wind farm is as follows: • Removal of five wind turbines and concrete plinths. • Removal of permanent meteorological mast. • Removal of all associated underground electrical and communications cabling connecting the wind turbines to the wind farm substation. Ducting is to remain in-situ. • All other elements of the Development will remain in-situ. The Site Access Roads and associated drainage systems will serve ongoing forestry and agriculture activity in the area. All other hard surfaced areas will be allowed to revegetate naturally. Based on the experience of the project team monitoring operational wind farm sites throughout the country, the approach of allowing these areas to revegetate naturally has proven to be very successful • Cranes of similar size to those used for construction will disassemble each turbine	**Appendix 2.1, Management Plan 6: Decommissioning Plan**

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
		using the same crane hardstands. The towers, blades and all above ground components will be removed from site and reused, recycled, or disposed of in a suitably licensed facility. (The financial costs of decommissioning, at current material values, will be more than met by the recycling value of the turbine components.) • Turbines will be cut on site so as to fit on articulated trucks, therefore allowing the use of the civil construction delivery route for removal. A Decommissioning Plan has been prepared as part of the CEMP.	
	Siting, Location and details of Turbines • The EIAR should include a map and a description of the proposed location of each of the proposed wind turbines. • The Environmental Health Service expects that details (height and model) of the turbines to be installed will be available at the time planning permission is sought and will be included in the EIAR. • Details of turbine foundation structures, including depth, quantity and material to be used should be included in the EIAR.	All items have been considered and addressed in the EIAR. No implications for the EIA/Design.	n/a
	Opportunity for Health Gain • The proposed development should be assessed with a view to the potential to include opportunities for health gain within the site of the proposed wind farm by including greenways, cycle-paths or walking trails within the development site.	Areas of Coillte lands within the Development will continue to subject to the Open Forestry Policy implemented by Coillte with the Development not impacting on the use of forestry for reasons of health gain.	

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	Assessment of Consideration of Alternatives • The EIAR should consider an assessment of alternatives. The EHS recommends that alternative renewable energy options to on shore wind farms should be assessed as part of the EIAR.	All items have been considered and addressed in the EIAR. The EIAR considers alternatives to on-shore wind energy developments in **Chapter 3: Alternatives Considered**	**Chapter 3: Alternatives considered**
	Noise & Vibration • The potential impacts for noise and vibration from the proposed development on all noise sensitive locations must be clearly identified in the EIAR. The EIAR must also consider the appropriateness and effectiveness of all proposed mitigation measures to minimise noise and vibration. • A baseline noise monitoring survey should be undertaken to establish the existing background noise levels. Noise from any existing turbines in the area should not be included as part of the back ground levels. • In addition, an assessment of the predicted noise impacts during the construction phase and the operational phase of the proposed wind farm development must be undertaken which details the change in the noise environment resulting from the proposed wind farm development. • The Draft Revised Wind Energy Development Guidelines were published in December 2019. Whilst these have yet to be adopted, any proposed wind farm development should have consideration of the draft Guidelines.	All items have been considered and addressed in the EIAR. A baseline noise monitoring survey was undertaken to establish baseline conditions. Potential effects of Noise and Vibration on sensitive receptors have been fully assessed and mitigation measures have been proposed where necessary. This has been completed for the construction, operational and decommissioning phases of the Project and can be found in **Chapter 11: Noise**. The Draft Revised Wind Energy Development Guidelines, 2019 have been considered in the assessment.	**Chapter 11: Noise**
	Shadow Flicker • It is recommended that a shadow flicker assessment is undertaken to identify any dwellings and sensitive receptors which may be impacted by shadow flicker. The assessment must include all proposed mitigation measures. Dwellings should include all	All items have been considered and addressed in the EIAR. A shadow flicker assessment was completed as part of **Chapter 4: Population and Human**	**Appendix 4.1: Shadow Flicker Analysis**

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	occupied properties and any existing or proposed properties for which planning consent has been granted for construction or refurbishment. • It is recommended that turbine selection will be based on the most advanced available technology that permits shut down during times when residents are exposed to shadow flicker. As a result, no dwelling should be exposed to shadow flicker.	**Health**. A schedule of mitigation measures has also been included in this chapter. The Development which currently complies with the WEDG (2006) shadow flicker guidelines will comply with the 2019 Draft WEDG if/when they come into effect by automatically shutting down when the control system detects that the sunlight is strong enough to cast a shadow, and the shadow falls on a property or properties.	
	Air Quality • A Construction Environmental Management Plan (CEMP) should be included in the EIAR which details dust control and mitigation measures. Measures should include: - Sweeping of hard road surfaces - Provision of a water bowser on site, regular spraying of haul roads - Wheel washing facilities at site exit - Restrict speed on site - Provide covers to all delivery trucks to minimise dust generation - Inspect and clean public roads in the vicinity if necessary - Material stockpiling provided with adequate protection from the wind - Dust monitoring at the site boundary - Truck inspection and maintenance plan - Details of a road maintenance agreement between the wind farm operator and the Local Roads Authority to clarify responsibility for the upkeep and repair of access roads during the construction phase of the project.	The potential effects of the Development on Air Quality have been assessed as part of **Chapter 10: Air and Climate**. Mitigation measures against these potential effects have been included in this chapter. All construction phase mitigation measures have been included in the Construction Environmental Management Plan which has been prepared as Appendix 2.1 of **Chapter 2: Project Description**. In addition to this, a full Schedule of Mitigation Measures has been included as Appendix 17.1 of **Chapter 17: Interactions of the Foregoing**. All items have been considered and addressed in the EIAR. Mitigation measures have included all items.	**Chapter 10: Air Quality**
	Surface and Ground Water Quality	The **Surface Water Management Plan (Appendix 2.1)** details the site drainage that has	**Chapter 8: Soils and Geology**

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	• All drinking water sources, both surface and ground water, must be identified. Public and Group Water Scheme sources and supplies should be identified. Measures to ensure that all sources and supplies are protected should be described. The Environmental Health Service recommends that a walk over survey of the site is undertaken in addition to a desktop analysis of Geological Survey of Ireland data in order to identify the location of private wells used for drinking water purposes. Any potential significant impacts to drinking water sources should be assessed. Details of bedrock, overburden, vulnerability, groundwater flows, aquifers and catchment areas should be considered when assessing potential impacts and any proposed mitigation measures.	been designed for the site using the principles of Sustainable Drainage Systems (SuDS). The drainage system for the Development is designed in a manner to ensure there are no changes to the baseline water quality within or downstream of the Site. A comprehensive suite of drainage measures have been developed to protect all receiving waters from potential impacts during the construction, operation and decommissioning of the Development in the catchment of the Site and along the proposed Grid Connection Route. The assessment and associated proposed mitigation measures are in **Chapter 6: Aquatic Ecology** and **Chapter 9: Hydrology and Hydrogeology**. Consultation with GSI (2022) well database indicates there are no mapped wells within the Redline Boundary. Governing industry guidelines stipulate a buffer zone of 250 m is required of from boreholes used for drinking water abstraction when assessing excavations for Turbine Foundations. The closest mapped wells are more than 800 m from the Redline Boundary (southeast of proposed T5 works), suggesting that any potential impact from the Development is low risk for wells in the immediate vicinity. With reference to the Baseline Description in this report, the groundwater aquifer underlying the Inchamore Windfarm Site is classified as a Locally Important Aquifer (LI) – Bedrock which is Moderately Productive only in Local Zones.	**Chapter 9: Hydrology and Hydrogeology**

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
		The Grid Connection Route traverses land underlain by a LI aquifer. Similarly, a small portion of the Turbine Delivery Route, c. 5 km, is underlain by a PI, the remaining track has been routed over a LI aquifer. Any identified boreholes along these routes will highlight the significant potential for the proposed developments to impact groundwater supplies in local zones.	
	Geological impacts • A detailed assessment of the current ground stability of the site for the proposed wind farm extension and all proposed mitigation measures should be detailed in the EIAR. The assessment should include the impact construction work may have on the future stability of ground conditions, taking into consideration extreme weather events, site drainage and the potential for soil erosion. • Reference is made to a peat slide which occurred near Ballybofey in Co. Donegal on November 13th 2020 which may have been linked to construction activity at Meenbog Wind Farm. Potential impacts on water supply associated with contamination following a peat slide include sedimentation and alteration of pH levels. • The Environmental Health Service recommends that a detailed Peat Stability Assessment should be undertaken to assess the suitability of the soil for the proposed development. The EIAR should include provision for a peat stability monitoring programme to identify early signs of potential bog slides ('pre-failure indicators' see the Scottish Government's 'Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Developments 2017).	Ground conditions and peat depths have been assessed as part of the EIAR. A peat slide risk assessment has been prepared as part of the EIAR. All of the items have been assessed in the EIAR.	**Chapter 8: Soils and Geology**

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	Ancillary Facilities • The EIAR should include details of the location of all site office, construction compound, fuel storage depot, sanitary accommodation and canteen, First Aid facilities, disposal of wastewater and the provision of a potable water supply to the site canteen.	All items have been included in the planning drawings accompanying this application.	n/a
	Cumulative Impacts • All existing or proposed wind farm developments in the vicinity should be clearly identified in the EIAR. The impact on sensitive receptors of the proposed development combined with any other wind farm developments in the vicinity should be considered. The EIAR should include a detailed assessment of any likely significant cumulative impacts of the proposed renewable energy development.	Cumulative effects have been assessed in all technical chapters of this EIAR.	Chapters 4-16.
Irish Water	Scoping response received 02/12/2020 and stated IW currently does not have the capacity to advise on scoping of individual projects. However, in general we would like the following aspects of Water Services to be considered in the scope of an EIAR where relevant; Impacts of the development on the capacity of water services (do existing water services have the capacity to cater for the new development if required). This is confirmed by IW in the form of a Confirmation of Feasibility (COF). If a development will require a connection to either a public water supply or sewage collection system the developer is advised to submit a Pre Connection Enquiry (PCE) enquiry to IW to	All items considered during the design process. No implications for the EIA/Design a) No connection to the public water supply is required. b) No upgrade to public water services is required. c) Trade effluent will not be discharged from the Development. d) There will be no discharge to sewers within the Development. e) Drinking Water Sources have been identified and assessed within Chapter	**Hydrology** addressed in Chapter 9 **Soils and Geology** addressed in Chapter 8

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	determine the feasibility of connection to the Irish Water network. All pre-connection enquiry forms are available fromhttps://www.water.ie/connections/get-connected/ b) Any up-grading of water services infrastructure that would be required to accommodate the development. c) In relation to a development that would discharge trade effluent – any upstream treatment or attenuation of discharges required prior to discharging to an IW collection network d) In relation to the management of surface water; the potential impact of surface water discharges to combined sewer networks & potential measures to minimise/stop surface waters from combined sewers e) Any physical impact on IW assets – reservoir, drinking water source, treatment works, pipes, pumping stations, discharges outfalls etc. including any relocation of assets f) If you are considering a development proposal, it is best practice to contact us in advance of designing your proposal to determine the location of public water services assets. Details, where known, can be obtained by emailing an Ordinance Survey map identifying the proposed location of your intended development to datarequests@water.ie. Other indicators or methodologies for identifying infrastructure located within your lands are the presence of registered wayleave agreements, visible manholes, vent stacks, valve chambers, marker posts etc. within the proposed site.	9. There were no implications on the design of the Project. f) No public water infrastructure traverses the Site. Irish Water will be consulted with prior to the commencement of works. g) Items have been addressed in Chapter 9. A Surface Water Management Plan has been prepared as part of the EIAR. h) Items have been addressed in Chapter 9. i) No connection to the public water supply/wastewater treatment is required. j) All items have been considered and assessed in the EIAR.	

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	g) Any potential impacts on the assimilative capacity of receiving waters in relation to IW discharge outfalls including changes in dispersion /circulation characterises h) Any potential impact on the contributing catchment of water sources either in terms of water abstraction for the development (and resultant potential impact on the capacity of the source) or the potential of the development to influence/ present a risk to the quality of the water abstracted by IW for public supply. i)Where a development proposes to connect to an IW network and that network either abstracts water or discharges waste water to a "protected"/sensitive area, consideration as to whether the integrity of the site/conservation objectives of the site would be compromised. j) Mitigation measures in relation to any of the above *This is not an exhaustive list.* Please note ▪ The Confirmation of Feasibility from IW, to the applicant, should be issued prior to applying for planning permission. ▪ Irish Water will not accept new surface water discharges to combined sewer networks		
Minister for Environment, Climate and Communications	See scoping response received on 20th November 2020 from Geological Survey of Ireland a division of the Department of Environment, Climate and Communications. **Geoheritage** Geological Survey Ireland is in partnership with the National Parks and Wildlife Service (NPWS, Department	All items considered during the design process. Consultation with available maps (GSI) indicates that there are no recorded 'Geoheritage' sites located within the redline boundary of the Site or within the near vicinity.	**Hydrology** addressed in Chapter 9 **Soils and Geology** addressed in Chapter 8

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	of Culture, Heritage and Gaeltacht), to identify and select important geological and geomorphological sites throughout the country for designation as geological NHAs (Natural Heritage Areas). This is addressed by the Geoheritage Programme of Geological Survey Ireland, under 16 different geological themes, in which the minimum number of scientifically significant sites that best represent the theme are rigorously selected by a panel of theme experts. County Geological Sites (CGS), as adopted under the National Heritage Plan are now included in County Development Plans and in the GIS of planning departments, to ensure the recognition and appropriate protection of geological heritage within the planning system. The audit for Co. Cork has not yet been completed, however unaudited CGSs can be viewed online under the Geological Heritage tab on the online Map Viewer. **Our records show that there are no unaudited CGSs in the vicinity of the proposed wind farm development.** **Groundwater** We recommend using our National Aquifer, Vulnerability and Recharge maps. The Groundwater Vulnerability map indicates the proposed wind farm area is of variable vulnerability. We would therefore recommend use of the Groundwater Viewer to identify areas of High to Extreme Vulnerability and 'Rock at or near surface' which can be used to inform appropriate mitigation measures. Although primarily focused on karst areas, this may provide information to benefit the proposed wind farm development. We recommend using out GWFlood tools found under our programme activities (in conjunction with OPW data), to this end.	All items considered during the design process. No implications for the EIA/Design Consultation with the GSI Groundwater Map Viewer (2022) indicates that the Wind Farm Site is underlain by areas classified predominantly mapped as 'Extreme (E)' vulnerability rating which tend to be at lower elevations, with some areas mapped as 'Rock at or Near Surface (X)' vulnerability rating particularly at higher elevations. Both the Turbine Delivery Route and Grid Connection Route traverse land with groundwater vulnerability ratings ranging from 'Moderately Vulnerable' to 'Extreme Vulnerability' (**Figure 9.9a – Groundwater Vulnerability**). Consultation with the Geological Survey Ireland online data sets as well as site visits were carried out. Peat and slope stability investigations at the Site (**Appendix 8.1**) indicate that the Site has a generally low risk probability with respect to peat slippage and slope failure under the footprint of the Development. Considering the assessment conclusions are related to the Development and construction activities including vehicular movements will be limited to the Development, areas of potentially high risk (Geohazards, for example, GSI high risk landslide susceptibility) in terms of peat and slope stability will be avoided. GSI data and map viewers have been consulted in the preparation of this EIAR.	

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	Geological Mapping We encourage the use of the Geological Survey Ireland datasets in assessments. **Geohazards** Landslide susceptibility in the area of the proposed wind farm is variable and is classed from Moderately Low/ Moderately High to High. We recommend that geohazards be taken into consideration, especially when developing areas where these risks are prevalent, and we encourage the use of our data when doing so. **Natural Resources (Minerals/Aggregates)** In keeping with a sustainable approach, we would recommend use of our data and mapping viewers to identify and ensure that natural resources used in the proposed development are sustainably sourced from properly recognised and licensed facilities. **Other Comments** Geological Survey Ireland would much appreciate a copy of reports detailing any site investigations carried out. Should any significant bedrock cuttings be created, we would ask that they will be designed to remain visible as rock exposure rather than covered with soil and vegetated, in accordance with safety guidelines and engineering constraints.	Imported stone will be from licensed facilities, as discussed in **Chapter 15: Traffic and Transportation**.	
Transport Infrastructure Ireland	Scoping response received 07/12/2020 and stated Transport Infrastructure Ireland (TII) is not in a position to engage directly with planning applicants with respect to proposed Developments. TII will endeavour to consider and response to planning applications referred to it, given its status and duties as a statutory consultee under the Planning Acts.	No implications for the EIA/Design	n/a

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
OPW	No response received	n/a	n/a
The Heritage Council	No response received	n/a	n/a
The Arts Council	No response received	n/a	n/a
Údarás na Gaeltachta	Acknowledgement of Scoping Receipt (16/11/2020) No response received	n/a	n/a

1.11 AVAILABILITY OF INFORMATION

The EIAR may be viewed online on the following website (www.inchamorewindfarm.ie).

The planning application may be inspected or purchased at a fee not exceeding the reasonable cost of making a copy, at the offices of the planning authority during its public opening hours at the following address.

The Offices of Cork County Council, Ground Floor, County Hall, Carrigrohane Road, Cork, T12 R2NC.

1.12 GLOSSARY OF COMMON ACRONYMS

The common acronyms used throughout this EIAR are contained in Volume IV: **Appendix 1.2**.

2 PROJECT DESCRIPTION

2.1 INTRODUCTION

This Chapter of the EIAR provides a description of all elements of the Project and forms the basis of the assessments presented within Chapters 4 to 17. This Chapter provides details of the construction, operational and decommissioning phases.

This Chapter includes an overview of the Project followed by a detailed description of the main components and their method of construction. Measures that have been built into the design of the Project to reduce effects, also known as 'Embedded Mitigation' measures, are set out throughout the EIAR. In addition to these Embedded Mitigation measures, mitigation and enhancement measures where specifically relevant to their assessment topic are also set out.

This Chapter of the EIAR is supported by Figures in **Volume III** and the following Appendix documents provided in **Volume IV**:

- Construction Environmental Management Plan (CEMP) in **Appendix 2.1**
- Wind Farms within 20 km of the Development in **Appendix 2.2**
- Grid Connection Details in **Appendix 2.3**
- List of Projects for Cumulative Assessment in **Appendix 2.4**
- Consideration of Afforestation in **Appendix 2.5**

Common acronyms used throughout this EIAR can be found in **Appendix 1.2**.

2.2 PROJECT DESCRIPTION

Permission is being sought by the Developer for the construction of 5 No. Wind Turbines, a meteorological mast, an on-site substation, Turbine Delivery Route and all ancillary works.

The development will consist of

- A wind farm with an operational lifespan of 35 years (from the date of commissioning of the development).
- The construction of five turbines with an overall ground to blade tip height ranging from 177 m to 185 m inclusive; a rotor diameter ranging from 149 m to 155 m inclusive; and a hub height ranging from 102.5 m to 110.5 m inclusive.
- Construction of permanent turbine hardstands and turbine foundations.
- Construction of one temporary construction compound with associated temporary site offices, parking areas and security fencing.

- Installation of a (35-year life cycle) meteorological mast with a height of 110 m and a 4 m lightning pole on top, such that the overall structure height will be 114 m.
- Development of one on-site borrow pit.
- Construction of new permanent internal site access roads and upgrade of existing internal site access roads to include passing bays and all associated drainage infrastructure.
- Development of a permanent internal site drainage network and sediment control systems.
- Construction of a permanent 38 kV electrical substation including a control building with welfare facilities, all associated electrical plant and equipment, parking, security fencing and gates, all associated underground cabling, wastewater holding tank, and all ancillary structures and works.
- All associated underground electrical and communications cabling connecting the wind turbines to the on-site wind farm substation.
- Ancillary forestry felling to facilitate construction of the Development.
- All associated site development works including berms, landscaping, and soil excavation.
- Upgrade of existing forest access roads to include passing bays and all associated drainage infrastructure.
- Upgrade works on the Turbine Delivery Route to include the following:
    - Works at an entrance to an existing forest road accessed off the N22 to include localised widening of the forest road and creation of a splayed entrance, removal of existing vegetation for visibility splays and removal of street furniture to facilitate construction traffic including the delivery of abnormal loads and turbine component deliveries.

A 10-year planning permission and 35-year operational life for the wind turbines and met mast, from the date of commissioning of the entire wind farm is being sought. This reflects the lifespan of modern-day turbines.

A permanent planning permission is being sought for the substation and all associated electrical plant, equipment cabling security fencing and gates, wastewater holding tank, and all ancillary structures and works as these will become an asset of the national grid under the management of ESB & EirGrid and will remain in place upon decommissioning of the wind farm.

The Grid Connection consists of one 38 kV substation (to include one control building with welfare facilities, all associated electrical plant and equipment, security fencing and gates, all associated underground cabling, wastewater holding tank, and all ancillary structures and works) and a 38 kV cable to connect to Ballyvouskill 220 kV Substation.

A temporary access road off the N22 in the townland of Cummeenavrick will facilitate the safe turning of vehicles leaving the Site.

Permission is not being sought for a Grid Connection Route or the turning area in Cummeenavrick, however the below is assessed as part of the Project in the EIAR:

- All works associated with the permanent connection of the wind farm to the national electricity grid comprising a 38 kV underground cable in permanent cable ducts from the proposed, permanent, on-site substation, in the townland of Inchamore and onto the townlands of Inchamore, Derreenaling, Derryreag, Cummeenavrick, Glashacormick, Clydaghroe and Cummeennabuddoge to the existing Ballyvouskill 220 kV Substation in the townland of Caherdowney.
- The construction of a temporary access road off the N22 in the townland of Cummeenavrick to facilitate a 180 degrees turning manoeuvre by construction vehicles and reinstatement at the end of the construction period.

2.3 SITE LOCATION AND ENVIRONS

2.3.1 Introduction / Existing Land Use

The Site, as shown in **Figure 2.1**, is located within an agricultural and forested landscape. Inchamore is situated between Milleeny, Co. Cork, Coomagearlahy, and Derryreag, in Co. Kerry. The Site is located 5.9 km west of Ballyvourney, Co. Cork and borders the county boundary between Cork and Kerry. It is 54 km west of Cork City, and 23 km north-east of Kenmare, Co. Kerry.

The Development is located within the townlands of Inchamore, Mileeny Derryreag and Derreenaling.

The overall length of the grid connection between the substation and the existing 220 kV GIS substation (**Figure 1.2**) is 19.9 km, of which 1.3 km is within the Site. The remaining 18.6 km is located off-road and in third-party lands through the townlands of Inchamore, Derryreag, Derreenaling, Cummeenavrick, Glashacormick, Clydaghroe, Cummeennabuddoge and Caherdowney. The proposed grid connection will consist of underground 38 kV cables.

Temporary works will be required to accommodate the delivery of the turbine components. These temporary works are included as part of this application and are located on the access road from the N22 to the Site.

The Site extends to 170.1 ha of which 145.4 ha largely consists of low yielding, commercial forestry. Coillte own 76.0 ha of the forestry (53% of forestry on site) while 69.4 ha (47%) of the forestry is owned privately.
Coillte owned land comprises different stages of coniferous plantation forestry. The species comprise mainly of Sitka Spruce with small pockets containing Lodgepole Pine, Alder, Birch and Beech.

The remaining land (24.6 ha) is third party property and the principal land use in the general area consists of a mix of agricultural sheep and cattle grazing, farmland, residential properties, agricultural structures and open mountain heath.

There are 39 houses within 2 km of the proposed turbines.

In addition to this, there is an abandoned house located to the west of the proposed substation, on Coillte lands and within the Site. This house is under the ownership of Coillte and will not be occupied for the lifetime of the Development.

Of the 39 No. houses within 2 km of the proposed turbines, the closest house to a turbine that is to be assessed as part of this EIAR, is H1. This is located 753 m from T2. All houses located within 2 km of the proposed turbines are shown on **Figure 1.3**.

2.3.2 Removal of Forestry and Replant Lands

The Site contains 142.4 ha of commercial forestry. Turbines T2, T3, T4 and T5 are surrounded by forestry. Tree felling will be required as part of the Project. To facilitate the construction of access roads, civil works, site compounds, borrow pits and Turbine Hardstands, 26.43 ha coniferous forestry will need to be permanently clearfelled. The felling area proposed is the minimum necessary to construct the Development and to comply with any environmental mitigation.

To ensure a tree clearance method that reduces the potential for sediment and nutrient runoff, the construction methodology will follow the specifications set out in:

- Forest Service's (Department of the Marine and Natural Resources) Forestry and Water Quality Guidelines (2000)

  - Buffer Zone Guidelines
  - Ground Preparation and Drainage
  - Roads
  - Harvesting
- Forest Service's (Department of the Marine and Natural Resources) Forest Harvesting and the Environmental Guidelines (2000)
  - Harvesting
  - Roading

The use of existing forestry infrastructure will be maximised to lessen disturbance from machines used for felling.

In this regard, before any felling works commence on site all personnel, particularly machine operators, will be made aware of the following and will have copies of relevant documentation, including:

- The felling plan, surface water management, construction management, emergency plans and any contingency plans (Please see **Appendix 2.1** and **Appendix 2.2**);
- Environmental issues relating to the site;
- The outer perimeter of all buffer and exclusion zones;
- All health & safety issues relating to the site.

All construction of tracks, including the creation of buffer zones and roadside drainage, will take into consideration the following specifications, which have been developed by the Forest Service (Department of Agriculture, Food and the Marine (DAFM)):

- Forest Protection Guidelines (Forest Service - Department of Marine and Natural Resources)
  - Protecting against future threats – pests and diseases
- Forestry and Water Quality Guidelines (Forest Service - Department of Communications, Marine and Natural Resources)
  - Buffer Zone Guidelines
  - Ground Preparation and Drainage
  - Roads
    - Harvesting
- Forest Harvesting and Environmental Guidelines (Forest Service - Department of Marine and Natural Resources)
  - Harvesting
  - Roading

- Forestry and Freshwater Pearl Mussel Requirements - Site Assessment and Mitigation Measures
- Forest Biodiversity Guidelines
- Forestry and The Landscape Guidelines
- Forestry and Archaeology Guidelines

This forestry to be felled is mostly consisting of Sitka Spruce or Lodgepole Pine and the felling is expected to take up to 3 months.

The above felling hectarage includes some areas which have recently been felled already for commercial timber extraction. Detailed consideration of the approach to afforestation requirements associated with the Project is included in **Appendix 2.5: Consideration of Afforestation**. It should be noted that the permanent clearfelling of trees in the State requires a felling licence. The associated afforestation of alternative lands equivalent in area to those lands being permanently clearfelled is also subject to licensing ('afforestation licensing'). The Forest Service of the Department of Agriculture, Food & the Marine is Ireland's national forest authority and is responsible for all forest licensing. In light of the foregoing and for the purposes of this Project, the Developer commits that the location of any replanting (alternative afforestation) associated with the project will be greater than 10 km from the (wind farm) Site and also outside any potential hydrological pathways of connectivity i.e., outside the catchment within which the proposed project is located. On this basis it is reasonable to conclude that there will be no more than imperceptible, indirect or in-combination effects associated with the replanting. In addition, the Developer commits to not commencing the Project until both felling and afforestation licences are in place and this ensures the afforested lands are identified, assessed and licensed appropriately by the consenting authority.

2.3.3 Wind Farms in the Area

There are 27 wind farms within 20 km of the Site. **Figure 2.3** shows the location of proposed, permitted and operational wind farms within a 20 km radius of the proposed turbines. **Appendix 2.2** provides further information on these wind farms.

- The nearest operational wind farm is Coomagearlaghy Kilgarvin Wind Farm which is located 2.7 km to the south-west of the Site.
- The nearest permitted but not yet constructed wind farm is Gortnakilla, Clonkeen Killarney, 1.87 km to the west.
- Gortyrahilly Wind Farm is a proposed 14 No. turbine wind farm located 4.95 km south of Inchamore Wind Farm. Gortyrahilly Wind Farm has the same developers as Inchamore Wind farm.

- Wind farms which are in the pre-application stages have also been included. Cummeennabuddoge Wind Farm has been included and is being designed and developed by the same developers as the proposed Inchamore Wind Farm.

Please see further details in **Appendix 2.2**.

2.3.4 Land Ownership

A portion of the Site (76.0 ha) is owned by Coillte. However, the majority of the Site is located on lands under the ownership of third-party private landowners who have consented to the application and the Development. Letters of consent accompany this application.

2.4 WIND RESOURCE

Due to the location, in the south-west of Ireland, and elevation, the Site experiences high average annual wind speeds. The Irish Wind Atlas produced by Sustainable Energy Ireland shows average wind speeds for the country and it shows that wind speeds on the Site are consistent with those that can facilitate a wind farm development (8.2 m/s at 75 m, 8.3 m/s at 100 m and 9.05 m/s at 150 m).

2.5 SITE INFRASTRUCTURE AND CONSTRUCTION

2.5.1 Proposed Layout Design

The layout of the Development has been designed to minimise the potential environmental effects of the wind farm while utilising the maximum energy yield from the Site's wind resource. The layout design was informed by the following constraints and buffers:

- No works will occur within a distance of at least 65 m from watercourses (excluding Road and Grid crossings).
- No works will occur within a distance to land drains (i.e., perforated drain pipes, used in domestic, commercial, agricultural and industrial areas to stop the ground from being waterlogged) of at least 25 m (excluding Road and Grid crossings).
- No works will occur within a distance to archaeological monuments and structures of at least 100 m.
- No works will occur within a distance from turbines to inhabited houses of at least 740 m.
- Avoidance of ground slopes of greater than 10 - 14 %.
- Avoidance of existing telecommunications infrastructure and links that traverse the site.
- Avoidance of sensitive watercourses containing Freshwater Pearl Mussel (*Margaritifera margaritifera*).

The overall layout of the Site is shown in **Figure 2.2**. This figure shows the proposed locations of the wind turbines and associated hardstanding areas, electrical substation, met mast, temporary construction compound, borrow pit, internal access roads and the site entrance. The ITM coordinates of the five turbines are listed in **Table 2.1**.

Table 2.1: Turbine ITM Coordinates

Turbine No.	ITM Easting (m)	ITM Northing (m)	Elevation (m)
T1	512358	578940	450.90
T2	512852	578514	371.56
T3	512972	579041	400.12
T4	513613	579050	370.92
T5	513947	578689	371.72

2.5.2 Wind Turbine

The proposed turbines will be of modern design and will be a three-bladed, rotor upwind of the tower, variable speed, pitched blade regulated machine. Turbine appearance will be a matt non-reflective finish in a white, off-white or grey colour. The foundation-to-tip height will range from 177 m to 185 m.

The turbine will have a circular based tower, sitting on a reinforced concrete foundation. The tower will support the nacelle, rotor hub, and rotor blades. Commercial wind turbine towers are made of steel or a hybrid of steel and concrete. The components within the nacelle are mainly metal (steel, copper, aluminium, etc.) with a metal/plastic/glass-reinforced plastic (GRP) body. The blades can be made of a matrix of glass-fibre reinforced polyester or wood-epoxy or similar composite materials.

Each turbine will have a generator with a capacity of between 5.6 MW and 6.6 MW. The turbines may be direct drive machines or contain a gearbox. The final turbine will be chosen in a competitive tendering process as part of the Project financing process, after all necessary consents have been secured.

A schematic drawing of the candidate turbines is shown on **Figure 1.4**.

This EIAR assessment considers and assesses all scenarios within the range of turbine parameters. The range of turbine parameters can be seen in **Table 2.2**.

Table 2.2: Turbine Parameters

Turbine Parameter	Assessment Envelope
Turbine Blade Tip Height	177 m to 185 m
Rotor Diameter	149 m to 155 m
Hub Height	102.5 m to 110.5 m
Turbine Foundations (Diameter) Turbine Foundations (Depth) Turbine Foundations (Plinth Diameter)	22 m to 25.5 m 2.8 m to 3.2 m 5 m and 6 m

2.5.3 Turbine Hardstands and Turbine Foundations

The Turbine Hardstand is designed to accommodate the delivery, laydown, and assembly of turbine components (in particular, rotor assembly) prior to turbine lifting and assembly and is shown in **Figure 2.4**. The Turbine Hardstands are needed to support the cranes during turbine construction, operation and maintenance and for decommissioning. The Turbine Hardstands will be constructed first and used to facilitate Turbine Foundation construction, such as steel reinforcement delivery and pouring of concrete.

The total area of each Turbine Hardstand will be 4,740 m^2 and includes the main crane hardstand (2,770 m^2), the component set down area (1,290 m^2), the assist crane hardstands (290 m^2) and the vehicle parking (390 m^2) as shown in **Figure 2.4**. These areas will consist of hardcore material topped with crushed stone. 'Areas cleared of any obstacles' (3,060 m^2) will be left as greenfield areas for lifting operations associated with wind turbine components.

Construction of the Turbine Hardstand and met mast hardstand will require the excavation of soils, the laying of a geotextile material on the formation surface and placing engineered stone and a top dressing. The main Turbine Hardstands and associated storage and assembly areas will cover an area of 4,740 m^2 each and will be 0.6 m in depth depending on the local bedrock profile and the varying soil depth. This gives a surface area of 23,700 m^2 for the five turbines.

The Turbine Foundations will range between 22 m to 25.5 m in diameter and have a depth ranging from 2.8 m to 3.2 m. The Turbine Foundation design will depend on the turbine type and will be decided by the structural engineers at detailed design stage and will be within these design parameters. The central part of the foundation (plinth) as seen on **Drawing No. 6226-PL-701** and **6226-PL-702**, will range between 5 m and 6 m in diameter and will be raised from the main Turbine Foundation below ground level. It will encompass a cast-in insert or bolts to connect to the bottom of the turbine tower and reinforced bar structural elements.

The area around and above the Turbine Foundation will be backfilled with compacted stone or crushed rock.

Further site investigations will be undertaken post consent to confirm that conditions do not vary from those encountered during site investigations. Traditional gravity foundations are considered for EIA purposes as the results of the site investigation indicate that piled foundations are not predicted to be required. These are concrete structures that depend on their own weight to achieve sufficient stability against overturning and sliding.

Turbine Foundations will need to be taken down to a level where the underlying soil or rock can bear the weight of a structure without shifting or compressing. This will be done by excavating through the peat / soil, subsoil and rock where necessary (depending on the various geological locations).

The method of construction for a Turbine Foundation is described as follows:

- Install temporary drainage around the perimeter of the excavation;
- Excavate peat / soil and rock;
- Back fill the foundation with excavated rock;
- Form a level working area to build the foundation;
- Install formwork and reinforcement;
- Pour the concrete;
- Once the concrete has set and the earthing system is in place, backfill the foundation with suitable excavated material, and
- Use the soil to build up the area around the Turbine Foundation perimeters (0.6 m width x 0.6 m depth).
- All excess soil will be placed in the on-site borrow pit.

2.5.3.1 Machinery Access for Felling

For the 26.43 ha of felling, it is intended that much of the existing forest road infrastructure will be utilised. The turbine layout seeks to maximise use of the forestry access tracks and fire lines already present. Where there is already a road there will be less intrusion and disturbance to the soil and surrounding trees. Some widening and building up of the existing road network will be required as part of the infrastructure for the Development which will minimise impacts on habitats compared to the construction of new forest roads. These upgraded roads will also be used for access for felling.

2.5.4 Access to the Site

The proposed site entrance is located to the north of the Site on the N22. The Turbine Delivery and Construction Haul Route will utilise this site entrance. The site entrance is shown on **Figure 2.5**.

It is proposed that the turbine nacelles, tower hubs and rotor blades will be landed at Ringaskiddy Port, County Cork. From there they will be transported to the N22 and on to the access track on private lands and on to the Site. Works required to the forest roads within the site include widening, reducing the gradient of road sections, surfacing with bitumen macadam and implementing a drainage plan.

For abnormal loads between Ringaskiddy Port and the Site, works will be required to facilitate the delivery of turbine components. These will be relatively minor in nature, for example, temporary removal of street furniture and signage. The extent of works has been determined by reference to the Collett Report of October 2021 (**Appendix 15.1**) and to the results of a swept path analysis. The Swept Path Analysis drawings are included as **Appendix 15.2**.

The delivery of the turbines will require co-ordination with a number of statutory bodies including Cork County Council, An Garda Síochána and delivery details are set out in **Chapter 15: Traffic and Transportation**.

2.5.5 Site Access Roads (Internal Road Network)

The Site Access Roads are necessary to allow access for cranes and delivery trucks during construction of the Development and during servicing/repairs to the wind turbines. The existing forest tracks/Site Access Roads will be used as far as possible to minimise additional land take. These roads will be upgraded as necessary so that the maximum width will be 4.5 m. Site Access Roads will be wider at bends and at passing bay locations where the width will be 5.5 m. Gradients will be limited to no more than 1 in 7 (14%) and a stone layer provided, so as to provide a good grip during wet weather. Gradients of Site Access Roads will not exceed this value.

Table 2.3: Estimated Excavation for Road Construction

Road Section	Length (m)	Width (m)	Area (m^2)	Average Peat Depth (m)	Depth to firm Sub-soil/Rock (m)	Depth of Sub soil to be excavated (m)	Total Volume to be excavated (m^3)	Vol of peat to be excavated (m^3)	Vol of soil to be excavated (m^3)	Vol of rock to be excavated (m^3)
Upgraded Site Access Road	3,102	2.00	6,203	0.60	0.70	0.10	4,342	3,722	677	-
New Site Access Road	3,555	4.50	15,998	0.60	0.70	0.10	11,199	9,599	1,714	-
Off-site Road Upgrade Nodes at N22	-	-	1,118	-	0.30	0.30	335	-	335	-
Totals	**6,657**	**6.50**	**25,024**	**1.20**	**1.70**	**0.50**	**15,876**	**13,321**	**2,556**	**-**

As set out in **Table 2.3**, 3,102 m of the existing Site Access Road will be upgraded. This will involve widening the roads to cater for larger vehicles and loads. Site Access Roads are shown on **Figure 2.6**. Upgraded Site Access Roads will be approximately 6,203 m^2 in surface area and will require approximately 1,400 m^3 of crushed stone material.

There will also be 3,555 m of new Site Access Roads required for the Development, none of which will be floated, based on the results of the site investigations. These will be constructed to provide a width of 4.5 m and 5.5 m at bends and will cover an area of 15,998 m^2 and require 1,700 m^3 of crushed rock. These roads will be excavated to a level where the underlying soil or rock that can bear the weight of traffic without shifting or compressing. They will be constructed using rock from the on-site borrow pit and capping stone from nearby quarries listed in section 15.2 of **Chapter 15: Traffic and Transportation**. The Site Access Roads will facilitate a minimum 12 tonne axle construction loading. The design will consist of 250 mm to 510 mm of sub-base material. The Site Access Road construction detail is shown in **Figures 2.7 and 2.8.**

The Site Access Road layout avoids environmental constraints and follows the natural contours of the land. Every effort has been made to minimise the length of road necessary.

Site Access Roads will be maintained during the construction phase. This will involve cleaning and surface improvement works. Harmful constituents from fuel spills and drips such as hydrocarbons pose a risk of environmental contamination and also a risk to human health if found in drinking water sources. All imported stone to the Site will have undergone appropriate quality testing. When weathered, the stone will not contain any constituents which may be harmful to the environment, surface and groundwater in particular. Further details of the prevention of this can be found in the Emergency and Response Management Plan of the CEMP in **Appendix 2.1**.

There are three proposed crossings of land drains and natural streams/flushes along the internal Site Access Roads. All crossings are Clear Span Bridges. The bridges will be constructed with reinforced concrete and will join to the gravel Site Access Tracks. The bridges will range from 10 m to 27.5 m in length. Timber post and rail fencing will be included with galvanised chain link fence on the internal face. Further to consultation with Inland Fisheries Ireland (IFI), the proposed crossings have been designed in accordance with Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters, 2016 as set out in **Management Plan 2: Water Quality Management Plan** of the CEMP (**Appendix 2.1**). Details of the crossings are included in Drawings No.'s **6226 PL WC-01 to 6225 PL WC 03**.

In addition to this, six service crossings, 113 No. existing culvert crossings and three watercourse/bridge crossings occur along the Grid Connection Route. This is detailed in **Appendix 2.4: Grid Connection details**.

2.5.6 Met Mast

As part of the grid code[1] requirements and as an independent assessment of wind farm performance, all wind farms with an installed capacity of greater than 10 MW are required to supply continuous, real-time weather data for the wind farm location. The data required is the wind speed and wind direction at turbine hub height, air temperature and air pressure. The data required for the Development will be provided by a dedicated meteorological mast measuring 110 m in height with a 4 m lightning mast (location as detailed in **Figure 2.2**).

The Met Mast will be located in the south-west of the Site as detailed in **Figure 2.2**. It will be a free-standing lattice type structure as shown in **Figure 2.9**. The Met Mast foundation will be 10 m by 10 m, with a depth of 2.25 m. It will be designed and constructed similarly to the Turbine Foundations. It will encompass a cast-in insert or bolts to connect to the

[1] EirGrid (15 December 2021). EirGrid Grid Code Version 10

bottom of the met mast and reinforced bar structural elements. The area around and above the foundation will be backfilled with compacted crushed rock. The Met Mast will be linked to 38 kV Substation via buried Internal Cabling for power and communication. It will be required for the full operational duration of the Development.

2.5.7 Electrical Substation, Control Building and Associated Compound

It is proposed to construct one 38 kV electricity substation within the Site, as shown on **Figure 2.2.** This will provide a connection point between the wind farm and the grid connection point at the existing Ballyvouskill 220 kV Substation. Electricity transmitted between the turbines and the substation on the Site will be at 38 kV. The layout of the substation and compound is further detailed in **Figure 2.10**.

The substation will serve two main functions:

1) provide housing for switchgear, control equipment, monitoring equipment, and storage space necessary for the proper functioning of the wind farm, and
2) allow for metering and for switchgear to connect to the National grid.

The construction and electrical components of the substation will be to EirGrid specifications. The substation compound area will be 1,314 m^2 and the foundation will be 0.6 m in depth and will be constructed from engineered stone material using similar construction techniques (as detailed in **Appendix 2.1**) as for the Turbine Hardstands. The overall compound will be enclosed by a 2.65 m high palisade fence and will contain a single control building, ancillary equipment, including the transformers, switch gear, fault protection, metering, car parking and other ancillary elements necessary for the operation of the Development. It will also include a container sized unit which can be used to accommodate a statcom (for grid reactive power compensation) or a harmonic filter for grid stabilisation.

The control building will contain an ESB room, control room, switchgear room, small store, an office and toilet. The control components will include metering equipment, switchgear, the central computer system and electrical control panels. A spare parts store and workshop will also be located in the control building. The control building will be a single story pitched roof structure with traditional rendered finishes. Details of the control building are shown on **Figure 2.10**. The appearance and finish of the control building will be similar to an agricultural building with a slated roof and nap plaster finish. It will have a suitably sized footpath around it and an adjacent parking area. The final finish of the control building will be an off-white or grey colour.

There will be four lightning monopole protection masts which will range between 16 m and 18 m in height and associated site works. Warning / health & safety signage will be displayed as is normal practice for such installations. Motion sensitive lighting only will be used. It is proposed to install a rainwater harvesting system as the source of water for toilet facilities. A potable water supply will be brought on site in bottles. Wastewater from the staff welfare facilities in the control building will be collected in a sealed storage tank, fitted with a high-level alarm. This is a device installed in a fuel storage tank that is capable of sounding an alarm, during a filling operation, when the liquid level nears the top of the tank. All wastewater will be tankered off-site by a licensed waste collector to the nearest wastewater treatment plant, Ballyvourney/Ballymakeera. There will be no on-site treatment of wastewater.

A telecommunication antenna will be fixed externally to the substation control building for communication and control purposes (e.g., for the Supervisory Control and Data Acquisition (SCADA) System).

2.5.8 Transformers and Internal Cabling

Each turbine will be connected to the substation on site via underground Medium Voltage (MV) 38 kV cables. There will be circa 4,243 m of internal cabling. Fibre-optic cables will also connect each wind turbine to the wind turbine control system located within the Control Building. The electrical and fibre-optic cables running from the turbines to the substation compound will be run in cable ducts 1 m below the ground surface within the Site Roads and/or their verges.

2.5.9 Grid Connection

A Grid Connection offer will be sought from the grid system operator by application to EirGrid. The substation will connect via underground 38 kV cables to the existing Ballyvouskill 220 kV substation. The cable will connect into existing infrastructure within the confines of the substation and its compound.

The route of this underground Grid Connection Route is provided in **Figure 1.2.** The overall length of the Grid Connection Route between the substation and the existing 220 kV GIS substation is 19.9 km, of which 1.3 km is within the Site. The remaining 18.6 km is located off-road and in third-party lands.

The proposed grid route will follow the old route of the N22 for a short distance (c.0.469 km) before following forestry tracks to the existing Ballyvouskill Substation.

The Grid Connection will be constructed to the requirements and specifications (CDS-GFS-00-001-R1) of EirGrid. The electricity will be transmitted as a three-phase power supply meaning there will be three individual conductors in each cable circuit. The three conductors will be laid in separate ducts which will be laid in accordance with EirGrid functional specifications (CDS-GFS-00-001-R1[2]) for 38 kV underground cables. The width of a 38 kV cable trench with a trefoil formation will be 600 mm. The depth of the trench for 38 kV cables is 1.22 m. A separate duct will be provided within the trench for fibre optic communications. (Please see **Appendix 2.4**)

The following is a summary of the main activities for the installation of ducts:

- Confirmatory drawings for all existing services will be obtained from EirGrid, Gas Networks Ireland, Eir, Local Authorities and Irish Water.
- Immediately prior to construction taking place, the area where excavation is planned will be surveyed by CAT scan (sub-surface survey technique to locate any below-ground utilities) and all existing services will be verified. Temporary warning signs will be erected.
- Clear and visible temporary safety signage will be erected all around the perimeter of the live work area to visibly warn members of the public of the hazards of ongoing construction works.
- A 13-tonne rubber tracked 360-degree excavators will be used to excavate the trench to the dimensions of 600 mm wide by 1.22 m deep.
- A silt fencing filtration system will be installed on all existing drainage channels before and for the duration of the cable construction to prevent contamination of any watercourse.
- Once the trench is excavated, a 50 mm depth base layer of sand (in road trench) or concrete (off road trench) will be installed and compacted. All concrete will be offloaded directly from the concrete truck into the trench.
- uPVC ducts will be installed on top of the compacted base layer material in the trench.
- Once the ducts are installed, couplers (a device used for joining pipes) will be fitted and capped to prevent any dirt entering the unjointed open end of the duct.
- The as-built location of the installed ducts will be surveyed and recorded using a total station/GPS before the trench is backfilled to record the exact location of the ducts.
- The co-ordinates will be plotted on as-built record drawings for the grid connection cable operational phase.

[2] https://www.eirgridgroup.com/site-files/library/EirGrid/110kV-Underground-Cable-Functional-Specification-General-Requirements.pdf

- When ducts have been installed in the correct position on the trench base layer, sand (in road trench) or concrete (off road trench) will be carefully installed in the trench around the ducts so as not to displace the duct and compacted.
- Timber spacer templates will be used during installation so that the correct cover of duct surround material is achieved above, below and at the sides of the duct in the trench.
- A red cable protection strip will be installed above the layer of material surrounding the duct and for the full length of the cable route.
- A layer of concrete (in road) or excavated material (off road) will be installed on top of the duct as a surround material to a level 300 mm below the finished surface level.
- Yellow marker warning tape will be installed for the full width of the trench, and for the full length of the cable route, 300 mm from the finished surface level.
- The finished surface of the road will then be reinstated and finished with a bituminous layer. For off-road sections of the Grid Connection Route, the trenches will be reinstated with the related excavated material.
- Precast concrete cable joint bays (junction boxes see Section 2.5.9.1 below) will be installed within the excavated trench.
- The junction boxes will be backfilled and the surface above the junction box will be finished with a bituminous layer. The cable junction boxes will be opened a second time during cable pulling and jointing, after which the finished surface above the joint bays will be reinstated again to its original condition.
- When trenching and ducting is complete, the installation of the grid connection cable will commence between the substation and the existing 220 kV substation at Ballyvouskill.
- The underground cable will be pulled through the installed ducts from a cable drum set up at one joint bay and using a winch system which is set up at the next joint bay, the cable will be pulled through.
- The cables will be jointed together within the precast concrete Joint Bay.
- The surface above each cable joint bay will be finished with a bituminous layer to the satisfaction of the Local Authority and as good as the pre-existing condition.

2.5.9.1 Joint Bays

Joint Bays are pre-cast concrete chambers along the Grid Connection Route where individual lengths of cables will be joined to form one continuous cable. A joint bay is constructed in a pit. Each joint bay will be 6 m long x 2.5 m x 2.3 m deep. A reinforced concreted slab will be constructed on top of the bay.

The 18 No. joint bay locations have been dictated by suitable terrain and access to facilitate the operation of cable pulling equipment at any phase of the development and future operation of the installation in accordance with the EirGrid specifications (CDS-GFS-00-001-R1).

Communication chambers, which are similar to small manholes, will be installed at the joint bay locations to facilitate connection of fibre-optic communication cables.

2.5.9.2 Directional Drilling Works

Three water crossings along the proposed Grid Connection route (**Appendix 2.4, Part 4**) will be constructed by means of directional drilling technology and the rest will be by watercourse/bridge crossings (three) or open trenching of existing culverts. Where the Grid Connection Route is within existing road infrastructure, these watercourse crossings have already been established. For off-road sections, there are no proposed water course crossings.

Directional drilling is the practice of drilling holes in a horizontal direction for the laying of ducts which contain cables beneath features such as a watercourse. The directional drilling commences at an excavated area known as the launch pit which is the entry point for pipes and ducts to be placed. The drill rods are pushed through the ground from the launch pit to the reception pit (similar to launch pit but at the other side of the watercourse). At the reception pit, the pipes are attached to the lead drill rod and pulled back through the ground to the launch pit. The crossings will comprise 4 x 110 mm High Performance Polyethylene (HPPE) pipes/ducts. Two separate excavations will be made either side of the watercourse to a depth of 2 metres to accommodate the directional drilling launch and reception pits. Spoil arisings will be stored adjacent to the pit locations for reinstatement, at a minimum 25 metre buffer distance from the watercourse. These temporary spoil mounds will have side slopes battered back to 1:1. Silt fencing will be erected around the base of each temporary mound prior to excavation. The excavation launch and reception pits will be reinstated on completion of drilling and jointing operations.

The drill head will be placed in the open excavation (launch pit) and it will be guided in by the operator for the first 1-2 metres. A series of drill rods will be connected to the head as it travels further along the shaft.

The drill position is always known to the operator and the drill can be manoeuvred in three planes / axes. A surveyor will monitor drilling works to ensure that the modelled stresses and collapse pressures are not exceeded. A drilling lubricant will be required. This will be delivered directly to the drill head by hydraulics. The lubricant will be chemically inert bentonite slurry mixture which lubricates the drill head and removes the drilled earth and stone. Once the crossing is drilled, the drill head is exposed at the reception pit and removed. Once the first pilot hole has been completed a hole-opener or back reamer will be fitted in the exit pit and will pull a drill pipe back through the bore to the entry side. The drill rods are connected to the duct pipe and the drill is reversed by pulling the pipe back through the channel.

A spoil volume of 4 m^3 will be excavated for each 100 m run of four pipes. This spoil will be largely subsoil material. This material will exit the launch pit within the bentonite slurry mixture. A mobile bunded tank will be located next to the launch pit into which the material/slurry mixture will be pumped. This will be stored outside of the 65 m watercourse buffer zone.

2.5.10 Borrow Pit

One borrow pit will be constructed as part of the Development, as per **Figure 2.2**. It will be located west of T5 and covers an area of 38,674 m^2. As outlined in **Table 2.4**, the borrow pit will provide 50,276 m^3 excavated material to provide fill for the roads, hardstands, upfill to foundations and the temporary compound. The borrow pit will be excavated only as required. Where rock and fill material are available from the excavation of Turbine Foundations (as per **Table 2.4 and Table 2.5**), this material will be used first. The use of an on-site borrow pit will reduce the need to transport material to the Site.

Once the required rock has been extracted from the borrow pit, it will be reinstated using any surplus inert material from the site and made secure using permanent stock proof fencing. The method for restoration of the borrow pit is to encourage stabilisation and early establishment of vegetation cover, where available, vegetative sods/turves or other topsoil in keeping with the surrounding vegetation type will be used to provide a dressing for the final surface. The borrow pit will be reinstated with excavated material from the Site and will be capped to a level of 0.8 m above the existing ground level.

Table 2.4a: Volume of Rock required from Borrow Pits

Volume of imported rock required for road and hardstand surfacing (m^3)	Rock required for Road Construction/ Upgrade (m^3)	Rock required for Turbine Hardstand Construction (m^3)	Total Rock required for Construction (m^3)	Volume of Rock to be Extracted from Excavations (m^3)	Rock required from Borrow Pits (m^3)
4,979	13,741	39,105	52,846	3,004	49,842

Table 2.4b: Volume of Rock to be Extracted from Borrow Pits

Area (m^2)	Depth (m)	Volume to be extracted from Borrow Pits (m^3)
38,674	1.3	50,276

Table 2.4c: Volume of Excavated Material to be Re-used On-Site

Total Volume (m^3) of Excavated Material to be stored on site	Volume of Borrow Pits (m^3)	Volume used to top borrow pits (m^3)	Total Volume of material to be stored in Borrow Pits (m^3)	Volume to be used in berms (m^3)
77,478	50,276	30,939	81,215	605

Excavated material will be used in berms around Turbine Foundations and Turbine Hardstands. The remainder of the material will be used to reinstate the onsite borrow pit (**Appendix 2.1 CEMP, Management Plan 4: Peat and Spoil Management Plan**).

Site investigation borehole logs indicate that bedrock is showing minor signs of weathering at the Site. Unconfined Compressive Strength results indicate the bedrock underlying the Site is considered weak. Details of the site investigations that were carried out and the stone type/suitability are provided in **Appendix 8.1: Site Investigation Survey**. **Tables 2.4 a, 2.4 b** and **2.4 c** are based on the trial pit and borehole log data within **Appendix 8.1**. Where rock is seen as unsuitable, rock will be imported from local quarries, as identified in **Chapter 15: Traffic and Transportation**.

When the borrow pit is no longer required, it will be reinstated using any surplus inert material such as peat and subsoil from the Site, allowed to restore naturally and made secure using permanent stock proof fencing.

The rock will be extracted from the proposed borrow pit using two main methods, rock breaking and rock blasting. The primary method will be rock breaking. These are discussed below.

2.5.10.1 Rock Breaking

Weaker rock will be extracted using a hydraulic excavator and a ripper. Where stronger rock is encountered and cannot be extracted using an excavator, then rock breaking equipment will be employed. This will typically involve the use of a 40-60 tonne 360-degree hydraulic excavator with a rock breaker. The rock breaker is supported by a smaller 30-40 tonne rock breaker which breaks the rock down further for feeding into the rock crusher machine. The larger rock breaker breaks out the rock in a progressive manner from the borrow pit and the smaller rock breaker breaks it down further.

The broken-down rock is loaded into mobile crusher using a wheeled loading shovel machine and crushed down into the correct grade for use in the construction of Site Access Roads and Turbine Hardstands.

2.5.10.2 Rock Blasting

Where rock is very strong and blasting is required, this is carried out using a mobile drilling rig which is used to drill vertical holes into the rock area that requires blasting. This is where explosives are used. It will take the drilling rig 3 to 4 days to drill the number of holes required for a single blast. A specialist engineer will be employed to determine the locations and depths of blasting required. The specialist blasting engineer will arrange for the correct amount of explosives to be delivered to the Site for each blast. The management of explosives delivery and storage on-site will be agreed with An Garda Síochána in advance. The blast engineer will set the explosives and manage the blast. The rock generated from the blast will usually be the correct size to be loaded directly into the mobile crusher. The effects of blasting on noise are assessed in **Chapter 10: Noise and Vibration.**

2.5.11 Onsite Drainage

The existing surface water runoff is contained within natural and artificial drainage channels that include stream and river waterbodies, drainage ditches, and other minor natural and artificial manmade drainage features.

Drainage measures will be provided to attenuate runoff, guard against soil erosion, soil compaction, and safeguard local water quality. There is a total of 28 No. stilling ponds proposed and located throughout the Site and can be seen on **Figure 2.6**. Details of the drainage system are shown on **Figures 2.11-2.14** and outlined in detail in the Surface Water Management Plan, part of the CEMP **(Appendix 2.1**). Full details of the proposed drainage are provided in **Chapter 9: Hydrology and Hydrogeology.**

There are three streams in total on Site, made up of one waterbody (Sullane_010). A buffer zone of at least 65 m will be in place for these streams. Where this is not possible for example, at the three watercourse crossings where Site Access Roads will be constructed; construction methods incorporating mitigation measures from this EIAR are set out in **Appendix 2.1: CEMP** and **Appendix 17.1: Schedule of Mitigation Measures.**

Sustainable Drainage System (SuDS) principles namely separation of overland flow from construction areas, the mimicking of diverted overland flow around construction areas and treatment trains to treat water from construction areas, will all be employed as explained in **Chapter 9: Hydrology and Hydrogeology**. Associated controls are listed below:

Source controls for surface water

- Interceptor drains, vee-drains, diversion drains, flume pipes, erosion and velocity control measures such as use of sandbags, oyster bags filled with gravel, filter fabrics, and other similar/equivalent or appropriate systems. Detailed plates and figures of these can be found in **Appendix 2.1**.
- Maintaining small working areas; covering stockpiles with geotextiles to protect against water erosion and runoff in rainy weather, and/or cessation of works in certain areas such as working on a high gradient during wet and windy weather.

In-line controls for surface water

- In line controls are controls which are directly applied to the surface water body including interceptor drains, vee-drains, oversized swales, erosion and velocity control measures such as check dams, sandbags, oyster bags, straw bales, flow limiters, weirs, baffles, silt bags, silt fences, sedimats, filter fabrics, and collection sumps, temporary sumps/attenuation lagoons, sediment traps, pumping systems, settlement ponds and/or temporary pumping chambers.

Treatment systems for surface water:

- Temporary sumps and attenuation ponds, temporary storage lagoons, sediment traps, and settlement ponds, and proprietary settlement systems such as Siltbusters.

When heavy rainfall is predicted works will be suspended or scaled back.

It is proposed that all drainage will be left in place upon completion of the construction phase. Full details on drainage management and mitigation can be found in **Chapter 9: Hydrology and Hydrogeology** and the **Surface Water Management Plan** attached as part of the CEMP in **Appendix 2.1**.

2.5.12 Table of Key Development Infrastructure Metrics

The Key Development Infrastructure Metrics are contained in **Table 2.5**. This table is provided for ease of access to these metrics for reference by the personnel writing the other EIAR Chapters. The dimensions of each element of site infrastructure can be seen in Series 100 Site Layout Plans 6226-PL-100-108 Planning Drawings.

Table 2.5: Key Development Infrastructure Metrics

Description	Length (m)	Width (m)	Depth (m)	No.	Area (m^2)	Volume of Excavation (m^3)
Upgraded Site Access Road	3,102	2.00	0.60	1	6,203	3,722
New Site Access Road	3,555	4.50	0.60	1	15,998	9,599
Off-site Road Upgrade Nodes	-	-	0.60	1	1,118	671
Turbine Hardstands – cranes	-	-	1.20	5	23,700	28,440
Turbine Foundations (25.5 m diameter)	-	-	2.85	5	3,064	8,732
Met Mast foundation	10	10.00	2.25	1	100	225
Electrical Substation	-	-	0.60	1	1,314	788
Site Compound	70	52.00	0.60	1	3,640	2,184
Internal Cabling	4,743	0.45	1.00	1	2,134	2,134
110 kV Cable Trench	4,743	0.60	1.34	1	2,846	3,813
Joint Bays	6	2.50	2.00	18	270	540
Link box	2	1.25	1.00	18	45	45
Comms box	1	1.03	1.29	18	19	24
Drainage	-	-	1.00	1	2,368	2,368
Borrow Pit	-	-	1.30	1	38,674	50,276

Table 2.6: Summary of Estimated Excavation Quantities (m^3)

**All excavated materials will be disposed of at a licensed facility*

Excavated Material Type	Excavated Material Volume (m^3)	Proposed Re-Use Volume		Comments
Roads	15,876	13,321	m^3 peat	Peat and subsoil material will be used to reinstate the onsite borrow pits.
		2,556	m^3 subsoil	
Turbine Foundations	7,250	1,562	m^3 peat	Peat will be used as backfill to foundations. Any surplus will be used to reinstate the borrow pits after extraction.
		3,083	m^3 subsoil	Subsoil will be deposited locally adjacent to Turbine Bases. 144 m^3 will be used as berms around Turbines. Any surplus will be used to reinstate the borrow pits after extraction.
		2,605	m^3 rock	Rock will be crushed and used as hardcore in Site Access Tracks and Turbine Hardstands.
Turbine Hardstands	41,949	14,220	m^3 peat	Peat and subsoil are to be deposited locally at hardstand edges. 360 m^3 will be used as berms around Turbine Hardstands. Any outstanding peat will be air dried and used to fill borrow pits.
		27,729	m^3 subsoil	
Electrical Sub-Stations & temporary Compounds.	9,907	1,385	m^3 peat	Peat is to be temporally stored and re-used to reinstate the Temporary Compound Areas.
		8,522	m^3 subsoil	Subsoil will be dried and used to reinstate the borrow pits after extraction
		0	m^3 rock	
Grid Connection*	6,854	0	m^3 peat	To be disposed of at a licensed facility (LoW 17 05 03*, 17 05 04) Please see Waste Management Plan for more details
		6,557	m^3 subsoil	
		297	m^3 rock	

Excavated Material Type	Excavated Material Volume (m^3)	Proposed Re-Use Volume	Comments
Drainage	2,280	2,280 m^3 peat	Peat is to be temporally stored and re-used to reinstate the Temporary Compound Areas.

2.6 CONSTRUCTION

The first phase of the Development will comprise the construction phase. This phase will begin with site preparation works and will be complete when the turbines are built and ready for commissioning, and when all wastes have been removed from the site. For this Development, it is envisaged that the construction phase will last approximately 21 months, with commissioning taking a further three months. An indicated construction programme is set out at **Table 2.7**.

2.6.1 Construction Sequencing

It is envisaged that the following will be the sequence of construction for the Development:

1. Site Preparation including felling and drainage (e.g., stilling ponds);
2. Site Roads and further tree felling;
3. Contractor Compound and Welfare Facilities;
4. Turbine Hardstands, Turbine Foundations, met mast foundations, Internal cable ducting, 38 kV substation;
5. Installation of the Grid Connection;
6. Erection of wind turbines and met mast;
7. Commissioning and Energisation.

The first step will be to prepare the Site for construction. This will include felling and implementing the designed drainage measures for all site infrastructure. The Site Access Roads will then be constructed and/or upgraded. The next step will be to construct the Temporary Construction Compound and Welfare Facilities. The next step will be to prepare the areas of the site where site infrastructure is to be located by marking out the construction works corridor, the relevant environmental buffer zones.

Following the site preparation, construction of the crane hard-standing areas for the five turbines will occur. The five Turbine Foundations will then be excavated and foundations constructed using reinforcing bar (rebar) and imported concrete. No concrete batching will take place on site.

Following the construction of the Turbine Foundations, internal cable ducting from the turbine locations to the on-site 38 kV substation will be laid in trenches along the constructed access roads.

The Grid Connection Route will then be constructed. There will be 19.9 km of trenches for underground cabling (UGC) to Ballyvouskil 220 kV substation. The ducts to be installed in an excavated trench which will be 600 mm wide and 1 m deep. There will be variations on this design to adapt to bridge crossings, service crossings and watercourse crossings as per TLI Technical notes included in **Appendix 2.4**.

The last step will be to erect the five wind turbines on the foundations using two cranes. Commissioning and testing of the turbines can then proceed.

Table 2.7: Indicative Construction Programme

Activity	Month																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Site Establishment/Felling and Fencing	X	X	X	X																X	
Internal Access Road Upgrade & Construction		X	X	X	X	X	X			X	X									X	
Substation & Compound Construction		X	X	X	X	X	X	X													
Substation Electrical Works									X	X	X	X	X	X	X	X	X				
Substation Commissioning																X	X				
Excavation & Construction of Turbine Foundations & Hardstands		X	X	X	X	X	X	X	X	X	X										
Internal Cabling Installation										X	X	X	X	X	X	X					

Activity	Month																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Turbine Delivery and Erection											X	X	X	X	X	X					
Grid Connection						X	X	X	X	X	X	X	X	X	X	X	X				
Energisation																		X			
Turbine Commissioning																			X	X	X
Site Restoration																		X	X	X	X

2.6.2 Construction and Environmental Management Plan (CEMP)

A CEMP is appended to the EIAR in **Appendix 2.1**. The CEMP includes an Emergency Response Plan, Peat and Spoil Management Plan, Surface Water Management Plan, Water Quality Management Plan, Waste Management Plan, Decommissioning Plan and Traffic Management Plan. The CEMP includes all the mitigation measures proposed within the EIAR and the NIS related to the Construction Phase. A Summary of all the mitigation measures of the EIAR is also included in **Appendix 17.1**.

The CEMP provides a commitment to mitigation and monitoring and reduces the risk of pollution whilst improving the sustainable management of resources. The environmental commitments of the Development will be managed through the CEMP and will be secured in contract documentation and arrangements for construction and later phases, such that there will be a robust mechanism in place for their implementation. The CEMP addresses the construction phase, and will be continued through to the commissioning, operation and final decommissioning phases. An Environmental Manager / Ecological Clerk of Works (ECoW) with appropriate experience having completed a similar role will be appointed for the duration of the construction phase so that the CEMP is effectively implemented.

In the event planning consent is granted for the Development, the CEMP will be updated prior to commencement of development to address the requirements of any relevant planning conditions, including any additional mitigation measures, which are conditioned and will be submitted to the planning authority for written approval.

The following sections describe key activities which, if unmitigated against, may cause harm or nuisance to the public. The potential impacts of each are considered in each chapter of this EIAR.

2.6.3 Refuelling

Vehicles will be refuelled off-site where possible. For vehicles that require refuelling on-site, fuels will be stored in the temporary construction compound and bunded to at least 110% of the storage capacity of fuels to be stored. Refuelling will take place via a mobile double skinned fuel bowser. The bowser will be a double axle refuelling trailer which will be towed to the refuelling locations by a 4x4 vehicle. The 4x4 will carry, a drip tray, spill kit and absorbent mats in case of any accidental spillages. Only designated competent personnel will refuel plant and machinery on the Site.

2.6.4 Concrete

There will be no concrete batching on the Site. Rather, it will be transported to the Site as it is required. A dedicated, bunded area will be created to cater for concrete wash-out and this will be within the temporary construction compound located to the north-east of T3. This will be for the wash-out of the chutes only after the pour. Concrete trucks will then exit the Site and return to the supply plant to wash out the mixer itself.

The main concrete pours at the turbine locations will be planned in advance and proposed mitigation measures (detailed in **Chapter 9: Hydrology and Hydrogeology**) are summarised as follows:

- Avoiding large concrete pours, for Turbine Foundations for example, on days when heavy or prolonged rainfall is forecast i.e., 25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or rainfall depth greater than monthly average in seven days (prolonged heavy rainfall over a week). Concrete pouring will be avoided during a period in which a Met Éireann Status Red weather event has been implemented
- Ensuring that all concrete pour areas are dewatered prior to pouring concrete and while the concrete is curing
- Making covers available so that areas can be covered if heavy rain arrives during the curing process which will prevent runoff of concrete which has a high pH

2.6.5 Dust Suppression

During periods of dry and windy weather, there is potential for dust to become friable and cause nuisance to nearby residences and users of the local road network (assessed in **Chapter 10: Air and Climate**). Damping down of internal roads and other site infrastructure will be required in this instance to see that dust does not become friable. This is most likely to occur during periods of dry and/or windy weather. This requires wetting the material and ensuring water is supplied at the correct levels for the duration of the work activity.

To reduce mud and debris from getting onto the local road network, a wheel wash facility will be employed at the site exit which will wash mud and debris from vehicles egressing the Site.

Where rock is sourced from off-site (see locations in **Figure 15.3**), HGVs entering the Site carrying rock will be covered to prevent dust generation. A road sweeper will be available for use in case of any mud or debris making it onto the public road network.

2.6.6 Construction Hours

The Development will have approximately 25 construction workers during the peak of the construction phase. Working hours for construction will be from 07:00 to 19:00 on weekdays, with reduced working hours at weekends, from 08:00 to 13:00 on a Saturday. It should be noted that during the turbine erection phase, operations will need to take place outside those hours with concrete pours commencing at 05:00 and continuing till 16:00, to facilitate Turbine Foundation construction and so that lifting operations are completed safely. Hours of working for Turbine Foundation construction will be agreed with Cork County Council prior to the commencement of Turbine Foundation construction. **Chapter 15: Traffic and Transportation** refers to this in further detail. A detailed Traffic Management Plan (**Appendix 2.1**) will be implemented during the construction phase.

2.6.7 Construction Compound and Temporary Works Area

The temporary construction compound will be set up upon commencement of the construction phase. The proposed location for the temporary construction compound is north-east of T3 as shown in **Figure 2.15** and the layout is shown in **Figure 2.16**. The compound will be 70 m by 50 m and will comprise a stoned platform 0.6 m in depth [3,500 m² / 2,100 m³]. The compound will be used as a secure storage area for construction materials and to contain temporary site accommodation units for staff welfare facilities. The compound will contain cabins for offices space, meeting rooms, canteen area, a drying room, parking facilities, and similar personnel facilities.

An area within the compound will be used for the storage of fuel and oils and this will be suitably bunded and the bund will be lined with an impermeable membrane in order to prevent any contamination of the surrounding soils, vegetation and water table. Double protection containers / equipment will be used along with drip trays and details are included in the CEMP, included as **Appendix 2.1**.

During the construction phase, water will be supplied to the temporary compound by water bowser. The maximum wastewater production is estimated to be the same as the maximum water consumption (2,000 litres per day)[3]. The project will include an enclosed wastewater management system at the temporary compound to deal with wastewater arising from staff (**Figure 2.16**) and capable of handling the demand during the construction phase with 25 construction workers on site at peak. A holding tank is proposed for wastewater management. Wastewater will be removed off-site weekly, by a licensed wastewater disposal company and disposed at an appropriate licenced facility, likely to be in Ballyvourney/Ballymakeera.

2.6.8 Construction of Crane Hardstands and Foundations

The construction method for all the crane hardstands will be via excavated approach. Each crane hardstand will be 4,670 m^2. Foundations will be taken down to competent bearing strata by excavating through the soil, subsoil, and rock if necessary.

The method of construction for Turbine Foundation is described below:

- Install drainage around perimeter of excavation (see **Chapter 9: Hydrology and Hydrogeology** for full details of proposed drainage);
- Excavate soil and rock and temporarily store adjacent to the works;
- Form a level working area to build foundation;
- Install formwork and reinforcement;
- Pour concrete;
- Cure concrete;
- Once the concrete has set and the earthing system is in place, backfill the foundation with rock, and
- Use excavated soil to build up the area around the turbine base.
- The remaining volume of excavated material is to be used to reinstate the borrow pit.

2.6.9 Construction Turbine Assembly

Once on Site, the wind turbine components will follow a prescribed route to minimise manoeuvring. Components will be placed on Turbine Hardstands prior to assembly. A 'just in time' delivery strategy will be in place for turbine blades to reduce the need for temporary set down areas. One large crane will be required for erecting the turbines, assisted by a smaller crane. The same number of cranes will also be required during the operational phase for maintenance and replacement works.

[3] Table 3 of the EPA WW treatment Manual (Treatment systems for Small Communities, Business, Leisure Centres and Hotels), Environmental Protection Agency, 1999. Quarry (excluding canteen) best reflects a construction site.
[Available online: https://www.epa.ie/publications/compliance--enforcement/wastewater/EPA_water_treatment_manual_-small-comm_business.pdf]

The towers will be delivered in sections, and work on assembly will not start until a suitable weather window is available, e.g., Wind Gust Speed Threshold of less than 6 ms^{-1}. The bottom tower section will be bolted onto the concrete foundations. The mid tower section will then be lifted into position and bolted to the bottom tower section. Finally, the top tower section will be lifted into position and bolted to the mid tower section. Three methods can be used to attach the blades:

1. The blades can be attached to the nacelle and hub on the ground. The hub and blades are then lifted as one. The nacelle of a wind turbine houses the drive train and other tower-top components. The hub of the wind turbine connects the blades to the main shaft and ultimately to the rest of the drive train.
2. The hub can be attached to the nacelle and the two blades attached to the hub while the nacelle is on the ground – the "bunny lift". The nacelle is then lifted into position and the third blade lifted into place separately. This requires manoeuvring of several components on the ground and usually the repositioning of cranes.
3. Lifting the nacelle and hub as one unit, as described above and then attaching the blades one at a time, rotating the hub between lifts. The blade lifting operations do not require repositioning of the crane.

The most appropriate method will be decided by the lifting contractor and the turbine manufacturer, prior to turbine erection.

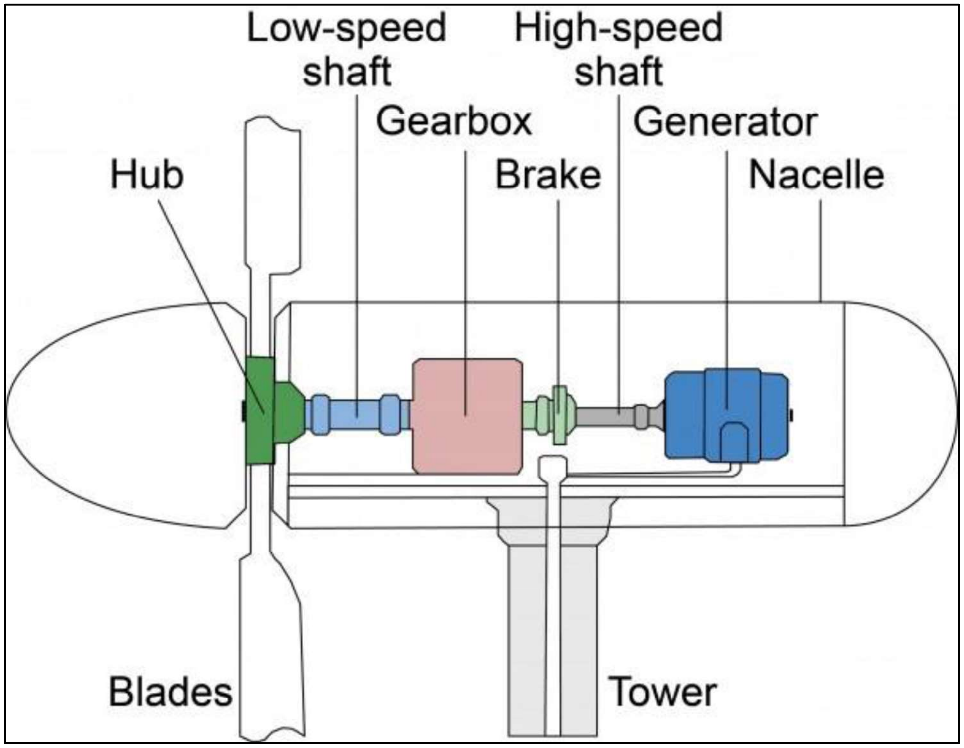


Plate 2.1: Turbine components[4] Source: (University of Michigan, 2022)

2.6.10 Construction Traffic

It is estimated in **Chapter 15**, that during civil construction, 1,781 fully loaded Heavy Goods Vehicle trips will be required for the Development. This breaks down to 162 loads per month or an average of 7 to 9 loads per day.

The peak number of deliveries per day will occur during the concrete pour for Turbine Foundation construction. An estimated 140 concrete deliveries will be required per Turbine Foundation. Other materials will also be delivered on such days, so a realistic estimation of peak deliveries is 150 deliveries per day (for at least six separate days in the construction programme when the Turbine Foundations will be poured). On these concrete pour days, 14-18 deliveries per hour will be required.

2.6.11 Reinstatement and Monitoring

Following completion of construction, all plant and machinery will be removed from the Site. The construction compound and other temporary works/assembly areas needed for the construction period, will be reinstated using the original spoil material removed and

[4] (Michigan, 2022)
University of Michigan, 2022. *Center for Sustainable Systems.* [Online]
Available at: https://css.umich.edu/publications/factsheets/energy/wind-energy-factsheet
[Accessed 29 August 2022].

stockpiled close to the location from where it was excavated as explained in **Chapter 5: Terrestrial Ecology** and **Chapter 8: Soils and Geology**. Stockpiles will be restricted to less than 2 m in height and located outside of the surface water buffer zones. All stockpiling locations will be subject to approval by the Site Manager and Project Ecological Clerk of Works (ECoW).

The grid route will be completed as described in Section 2.5.9.

All on-site installed drainage network will be left in place. This will be monitored on a quarterly basis to see that it is operating to its stated design purpose. Water monitoring on nearby natural watercourses will be undertaken prior to, during and post construction to determine if any pollution has migrated off-site, and if so, implement measures to rectify the impact. Details of this can be found in **Chapter 9: Hydrology and Hydrogeology.**

There will be no reinstatement works required during the decommissioning phase.

2.6.12 Construction Supervision and Monitoring

The construction activities will be monitored by a Site Engineer, Geotechnical Engineer, a qualified archaeologist and an Ecological Clerk of Works (ECoW).

The Geotechnical Engineer will be contracted for the detailed design phase and their services retained throughout the construction and reinstatement phases. The Geotechnical Engineer will oversee all earthworks and excavation activities and monitor for issues such as ground stability, water ingress into excavations etc. Roles and responsibilities are further detailed in **Appendix 2.1**.

Daily monitoring of excavations by the Geotechnical/Site Engineer will occur during the construction phase. If high levels of seepage inflow occur, excavation work will immediately be stopped and a geotechnical assessment undertaken. Further details of what this will involve are detailed in **Chapter 8: Soils and Geology** and **Chapter 9: Hydrology and Hydrogeology**.

The ECoW will be employed prior to the commencement of the construction phase to monitor and review the pollution control measures and working practices during construction and have input into site remediation. The ECoW will have stop work authority if, for example, a sensitive habitat feature is encroached upon or there is the possibility of silt/pollution runoff to natural watercourses.

The potential exists for the presence of unrecorded, sub-surface archaeological features within green field locations in proposed construction areas within the Site. A series of construction phase archaeological investigations under licence by the National Monuments Service will be carried out by a suitably qualified archaeologist. The archaeologist will have responsibility for ensuring that potential archaeological features are protected should any be discovered during excavations. The Site will be accessible to the appointed archaeologist at all times during working hours and the nominated archaeologist will monitor all invasive works.

If any sub-surface archaeological remains are identified during site investigations, they will be cleaned, recorded and left to remain *in situ* within cordoned off areas while the National Monuments Service are notified and consulted in relation to appropriate future mitigation strategies, which may entail preservation *in situ* by avoidance or preservation by record by archaeological excavations.

Water monitoring details are included in **Management Plan 2: Water Quality Management Plan** as part of **Appendix 2.1** and will be implemented prior to commencement of construction. Regular inspections of the installed drainage system will be undertaken by the Ecological Clerk of Works, especially after heavy rainfall events, to check blockages and see that there is no build-up of standing water in any part of the system where is it not designed to be.

Excess build-up of silt will be removed at check dams, attenuation/settlement ponds or any other drainage feature by scraper or excavator and under the supervision of the ECoW. During the construction phase, field testing and laboratory analysis of a range of parameters with relevant regulatory limits and Environmental Quality Standards will be undertaken for each watercourse close to the site, and specifically following heavy rainfall events (i.e., weekly, monthly and event based). The locations and are included in **Chapter 9: Hydrology and Hydrogeology**.

The CEMP for the Development sets out the proposed site organisation, sequencing of works, methodologies, mitigation measures and monitoring measures.

The local road network near the Site is used to transport construction materials and will be monitored during construction, so that any damage caused by construction traffic associated with the Development can be identified and repaired, as local roads are more prone to damage than national roads. This monitoring will be undertaken on the N22 and at the Development entrance. Readymix concrete will be sourced from local quarries when required (see locations in **Figure 15.4**) and monitoring, such as visual inspections, will also be undertaken on the route from these, as required. This is detailed and assessed in **Chapter 15: Traffic and Transportation**.

2.6.13 Construction Employment

Based on our experience, it is estimated that between 36 and 63 direct and indirect jobs could be created during the construction phase of the Project. It is not expected that all of these jobs will be based at the Site.

2.7 COMMISSIONING

Wind farm commissioning can take in the region of three months to complete from the erection of the final turbine to the commercial exportation of power to the national grid. It involves electrical and mechanical testing and control measures to check that the wind farm will perform and export power to the national grid, as designed and commissioning engineers working through an entire schedule of SCADA (Supervisory Control and Data Acquisition).

2.8 OPERATION AND MAINTENANCE

During the operation of the wind farm, the turbine manufacturer, the wind farm operator, or a service company will carry out regular maintenance of the turbines, substation and site infrastructure. Personnel will enter the site via the site entrance at the N22. Monthly routine inspection and preventative maintenance visits will be necessary to provide for the smooth and efficient running of the wind farm. This will occur over one day with one vehicle attending the Site. In addition, operation and monitoring activities will be carried out remotely with the aid of computers connected via a telephone broadband link.

The permanent site infrastructure can be utilised in the event that replacement turbine components are required, such as a new blade.

2.9 DECOMMISSIONING

The Applicant is applying for a consent for a period of 35 years for the operation of the wind farm. The full description of the decommissioning is as follows:

- Removal of five wind turbines and above ground concrete plinths.
- Removal of above ground meteorological mast structure.
- Removal of all associated underground electrical and communications cabling connecting the wind turbines to the wind farm substation. Ducting is to remain *in-situ*.

All other elements of the proposed development including the on-site substation, will remain in-situ. The Site Access Roads and associated drainage systems will serve ongoing forestry and agriculture activity in the area. All other hard surfaced areas will be allowed to revegetate naturally. Based on the experience of the EIAR project team of monitoring operational wind farm sites throughout the country, the approach of allowing these areas to revegetate naturally has proven to be very successful and less environmentally impactful than removing this infrastructure.

Cranes of similar size to those used for construction will disassemble each turbine using the same crane hardstands. The towers, blades and all above ground components will be removed from site and reused, recycled, or disposed of in a suitably licenced facility. Turbine parts will be cut on site so as to fit on articulated trucks (The financial costs of decommissioning, at current material values, will be more than met by the recycling value of the turbine components).

Potential impacts will be similar to that of the construction phase, albeit to a lesser extent and are described in each chapter of this EIAR.

A decommissioning plan is included as part of the CEMP in **Appendix 2.1**. Prior to the decommissioning works, a plan will be submitted to the planning authority for written agreement. The plan will take account of contemporary best practice.

2.10 COMMUNITY BENEFIT

In addition to helping Ireland reduce environmentally damaging fossil fuel emissions and helping avoid significant fines from the EU, Inchamore Wind Farm will also contribute positively to the national and regional economy.

A SEAI report indicated that in 2019 wind energy generated 32% of all electricity, avoided 3.9 million tonnes of CO_2 emissions; and avoided approximately €260 million in fossil fuel imports[5]. Additionally, a report published by Barringa in January 2019 states that:
"Our analysis indicates that the deployment of 4.1 GW of wind generation capacity in Ireland between 2000 and 2020 will result in a total net cost to consumers, over 20 years, of €0.1bn (€63 million to be exact), which equates to a cost of less than €1 per person per year."[6]

[5] https://www.seai.ie/publications/Energy-in-Ireland-2020.pdf [Accessed 08/02/2022]
[6] https://windenergyireland.com/images/files/baringa-wind-for-a-euro-report-january-2019.pdf [Accessed 08/02/2022]

In addition to the above financial costs and benefits, the Barringa report outlines that wind generation in Ireland avoids:

"33 million tonnes of power sector CO_2 emissions. The total carbon emissions from electricity generation in 2017 was 11.7 Mt, so a saving of 33 Mt is equivalent to almost 3 years of total carbon emissions in the electricity sector today. 137 TWh of fossil fuel consumption at a saving of €2.7bn. In comparison, Ireland consumed 44 TWh (3814 ktoe) of fossil fuels for electricity generation in 2017, so a saving of 137 TWh is equivalent to 3 years of current fossil fuel consumption for electricity generation."

The Project has the potential to bring significant positive benefits to local communities. It will support sustainable local employment; it will contribute annual rates between €280,000 to €330,000 to the local authority; and it will provide opportunity for local community investment in the project in line with the new Renewable Energy Support Scheme (RESS). This is a Government of Ireland initiative that provides support to renewable energy projects in Ireland. A Community Benefit Fund will be put in place for the RESS period (i.e., 15 years of the operation) of the Project to provide direct funding to those areas surrounding the Project. The significant annual community benefit fund will be established in line with Government policy which will include funding for both wider community initiatives and a Near Neighbour scheme focused on houses in close proximity to the Project.

It is anticipated that for each megawatt hour (MWh) of electricity produced by the wind farm, the project will contribute €2 into a community fund for the RESS period i.e., first 15 years of operation. If this commitment is improved upon in upcoming Government Policy, this will be adjusted accordingly.

The Project has the potential to contribute between €170,000 and €200,000 e per annum in the local area for community funding for the RESS period, consistent with Government Policy. However, the above figure is indicative only and is and will be dependent on the generation capacity of the wind farm which is influenced by a number of factors including:

- Number and type of wind turbines permitted
- Capacity and availability of energy production of the delivered turbines
- Quantity of wind and wind conditions in any given year

2.10.1 Fund Usage and Administration

The Community Benefit Fund belongs to the local community surrounding the Development. The premise of the fund is that it will be used to bring about significant, positive change in the local area. To make this happen, the first step will be to form a benefit fund development working group that clearly represents both the closest neighbours to the Project as well as nearby communities. Workshops will be organised to facilitate consideration of the priorities for the local fund. This group will then work on designing the governance and structure of a community entity that will administer the Community Benefit Fund.

It is acknowledged that the people living closest to a wind farm are the most important stakeholders and a proportion of the Community Benefit Fund will be set aside as a dedicated "Near Neighbour Fund". The exact structure of this will be confirmed as part of the development of the overall Community Benefit Fund but would typically provide support of varying degrees for properties up to 2 km from turbines. This is supported by the requirements set out in the RESS2 and may be adjusted in future RESS schemes that may relate to this Project.

2.10.2 Community Investment

The Renewable Energy Support Scheme (RESS) - RESS-2[7] sets out that future renewable energy project proposals will enable the possibility for local communities to invest in projects in a meaningful way as a means to directly gain from the financial dividends that a project can provide should it be consented, built and operated.

This element was not included in the RESS-1 or RESS-2 Schemes but it is expected to form part of later RESS-3 Scheme which likely will apply to this Project. In preparation for this, the Developer has been working with external agencies to develop workable models of Community Investment.

7 https://www.gov.ie/en/publication/7f0bb-renewable-electricity-support-scheme-2-ress-2/, Accessed 20/01/2022.

3 ALTERNATIVES CONSIDERED

3.1 INTRODUCTION

This Chapter of the Environmental Impact Assessment Report (EIAR) provides a description of the reasonable alternatives studied by the Developer, which are relevant to the Project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the Project on the environment. Alternatives were assessed taking commercial, construction, operational and key environmental constraints into consideration.

3.2 STATEMENT OF AUTHORITY

This chapter has been prepared by Ms. Sarah Moore with the assistance of Ms. Shirley Bradley of Jennings O'Donovan & Partners Limited.

Ms. Sarah Moore is a Senior Environmental Consultant and holds a Bachelor (Hons.) Degree in Environmental Science from University of Limerick and a MSc (Dist.) in Environmental Engineering from Queen's University, Belfast. She has worked in environmental consultancy for over fourteen years and has prepared AA Screenings, Environmental Reports and wind farm EIARs, including the consideration of alternatives.

Ms. Shirley Bradley is a Graduate Environmental Scientist with a First-Class Honours Degree (BSc. Hons) in Environmental Science from the Institute of Technology, Sligo. She was also awarded with the Governing Body award for a BSc in Environmental Protection. Shirley's key capabilities are in report writing, assisting Senior Consultants and GIS.

3.3 METHODOLOGY

3.3.1 Requirements for Alternatives Assessment

Annex IV of the EIA Directive as amended (Information Referred to in Article 5(1) (Information for the Environmental Impact Assessment Report) elaborates as follows*:*

"2. 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".

The Environmental Protection Agency (2022) states that "*It is generally sufficient to provide a broad description of each main alternative and the key issues associated with each,* *showing how environmental considerations were taken into account in deciding on the selected option".*

The EPA guidance documents on EIAR preparation[1] [2], stipulates the following:
"The presentation and consideration of the various alternatives investigated by the applicant is an important requirement of the EIA process…. and the alternatives can include:

- *alternative locations;*
- *alternative designs; and*
- *alternative processes*".

The objective is for the Developer to present a description of the reasonable alternatives studied by the Developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment.

In an effective EIA process, different types of alternatives may be considered at several key stages during the process. As environmental issues emerge during the preparation of the EIAR, alternative designs may need to be considered early in the process or alternative mitigation options may need to be considered towards the end of the process. These various levels of alternatives are set out in chapter.

Taking the legislative and guidance requirements into account, this chapter addresses alternatives under the following headings:

- 'Do Nothing' Option
- Strategic Site Selection
- Alternative Wind Farm Design and Layout
- Alternative Turbine Numbers and Specifications
- Alternative Grid Connection
- Alternative Renewable Energy Technologies
- Alternative Turbine Haul Route
- Alternative Mitigation Measures

[1] EPA. (2002). Guidelines on the information to be contained in Environmental Impact Statements.
[2] EPA. (2022). Guidelines on the information to be contained in Environmental Impact Assessment Reports.

When considering a wind farm development, given the intrinsic link between layout and design, the two will be considered together in this chapter.

3.3.2 Approach to Alternatives

The Environmental Impact Assessment of Projects - Guidance on the preparation of the Environmental Impact Assessment Report (European Union, 2017) states that reasonable alternatives *"must be relevant to the proposed project and its specific characteristics, and resources should only be spent on assessing these alternatives"* and that *"the selection of alternatives is limited in terms of feasibility. On the one hand, an alternative should not be ruled out simply because it would cause inconvenience or cost to the Developer. At the same time, if an alternative is very expensive or technically or legally difficult, it would be unreasonable to consider it to be a feasible alternative"*.

3.4 'DO-NOTHING' ALTERNATIVE

Annex IV, Part 3 of the EIA Directive as amended requires a *"description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without implementation of the project as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge."* This is referred to as the "do nothing" alternative. EU guidance (EU, 2017) states that this should involve the assessment of "an outline of what is likely to happen to the environment should the Project not be implemented – the so-called 'do-nothing' scenario'."

Ireland has adopted binding agreements to reduce dependency on fossil fuels and increase energy production from sustainable sources, creating a requirement for the nation to transition to a low carbon economy. The binding EU targets have been transposed into Irish National Policy in the 2023 Climate Action Plan which focuses up to 9 GW future electricity production on the wind energy sector. This demonstrates the significance of wind energy in the Irish energy context and highlights the need for the proposed Inchamore Wind Farm in reaching both EU and national renewable energy targets.

Ireland is obliged to ensure that 32% of the total energy consumed in heating, electricity and transport is generated from renewable resources by 2030 and reduce its greenhouse gas emissions by at least 55% by 2030, relative to its 1990 levels, with an overall objective of carbon neutrality by 2050. This is in order to help reduce the nation's CO_2 emissions and to promote the use of indigenous renewable sources of energy. These targets have been incorporated into national policy in the Climate Action Plan (2023) which aims to:

- Reduce CO_2 eq. emissions from the electricity sector by 62-81%.
- Deliver an early and complete phase-out of coal and peat fired electricity generation. (Note although peat-fired electricity generation has ceased in Ireland, coal and oil fired plants are still operational. Tarbert Power Station (620 MW) was supposed to close by 2023, and Moneypoint Power Station (915 MW) was supposed to close by 2025. This is now delayed arising from concerns about security of electricity supply. This delay means that more carbon emissions will arise. It highlights the urgency of constructing this and other wind farms).
- Increase electricity generated from renewable sources to 80%, indicatively comprised of:
  - Up to 9 GW onshore wind energy.

Furthermore, the Climate Action and Low Carbon Development (Amendment) Act (2021) will act to reduce 51% emissions over a ten-year period to 2030, in line with the programme for Government which commits to a 7% average yearly reduction in overall greenhouse gas emissions over the next decade, and to achieving net zero emissions by 2050.

Under a 'Do Nothing' alternative, the Project will not be constructed. The land upon which Project will occur would remain unchanged. The main land use of the Site would remain as commercial forestry and agriculture. Consequently, the environmental impacts, identified in the EIAR, positive and negative, would not occur. However, in the "Do-Nothing" scenario, the prospect of creating sustainable energy through County Cork's wind energy resource would be lost at this Site.

The nation's ability to produce sustainable energy and reduce greenhouse gas emissions to meet EU targets and National targets, as set out above, would be stifled. This may result in the nation incurring significant financial penalties from the EU if targets are not achieved.

The Development has the potential to prevent approximately between 30,038 and 35,373 tonnes of CO_2 emissions per annum, or between 1,051,334 and 1,238,059 tonnes of CO_2 emissions will be displaced over the proposed 35 year lifetime of the wind farm, see **Chapter 10: Air and Climate** for details on the Carbon Calculator method. This would otherwise be released to the atmosphere through the burning of fossil fuels in the "Do-Nothing" scenario. This would not assist in Ireland's contribution to reducing global warming and would fail to limit warming as agreed to in the Paris Agreement (2015). This will result in continued negative impacts to air quality and climate.

According to EirGrid Group's All-island Generation Capacity Statement 2021 – 2030 (EirGrid, 2021), the growth in energy demand for the next ten years on the Island of Ireland will be between 18% and 43%. In the 'Do-nothing' scenario, importation of fossil fuels to maintain growing energy supply will continue and Ireland's energy security will remain vulnerable. A "Do-nothing" scenario would contribute to strain on existing energy production and may impact on economic growth if energy demand cannot be met. The delay in closing Tarbert and Moneypoint means we continue to rely on imported fossil-fuels with unpredictable pricing, a vulnerable supply chain and higher carbon emissions.

Under the "Do-Nothing" scenario, the socio-economic benefits associated with the Project will be lost. These benefits include between 25 to 30 No. jobs during the construction phase of the project, and between 2 long-term jobs once operational. Furthermore, under the "Do-Nothing" scenario the local community will not benefit economically from the community benefit fund associated with the project which could be used to improve physical and social infrastructure within the vicinity of the Project.

The potential environmental effects of the 'Do-Nothing' Alternative when compared against the chosen option of developing a renewable energy project at this Site are presented in **Table 3.1**. Refer to each respective chapter for full details of residual impacts.

Table 3.1: Environmental effects of 'Do-Nothing' compared with a wind farm development

Criteria	Residual Impact of the Project	Do-Nothing Alternative
Population & Human Health (incl. Shadow Flicker)	Long-term positive economic benefit to local area due to job creation and Community Benefit fund.	No increase in local employment and no financial gains for the local economy or community via the community benefit fund. No upgrading of local forest tracks or creation of new tracks which can be used for walking and mountain biking. No potential for shadow flicker or noise to affect sensitive receptors.
Terrestrial Ecology	Slight negative impact on Annex 1 listed habitats. Overall positive benefit due to proposed biodiversity enhancements.	The ecology of the Site would be expected to remain similar as at present though any increase in grazing pressure could be detrimental to the quality of peatland habitats within the site. Also, any further afforestation on heath and bog habitats would be detrimental.

Criteria	Residual Impact of the Project	Do-Nothing Alternative
Aquatic Ecology	There will be no negative residual impact on any aquatic species, habitat or on water quality at a local or catchment level as a result of the Development.	If the development does not proceed, lands at and in the vicinity of the Site will continue to be used for forestry and agricultural purposes. This 'Do-Nothing' scenario would result in no significant change to aquatic ecology and habitats within or downstream of the Site subject to the continuation of current activities and practices.
Ornithology	Slight negative impact on birds following implementation of mitigation measures.	Without the proposed wind farm development proceeding, it is expected that the present main land uses on Site, namely livestock grazing and forestry, will continue. It is possible that further afforestation would occur on the Site in the future. The value of the Site for birds would be expected to remain similar as at present though any increase in grazing pressure could be detrimental to the quality of peatland habitats of the Site which could affect species such as Red Grouse. Also, any further afforestation on heath and bog habitats would be detrimental to peatland bird species, including Red Grouse, Meadow Pipit and Skylark.
Soils & Geology	The residual impacts on the soils and geology environment as a function of the Development is that there will be a change in ground conditions at the Site with natural materials such as peat, subsoil and bedrock being replaced by concrete, subgrade and surfacing materials. This is a localised, negative, moderate significance at a local scale	Should the proposed development not proceed, the existing land-use practices will continue with associated modification of the existing environment, including the underlying soils and geology, through agriculture and commercial forestry.
Hydrology & Hydrogeology	Non-significant impacts following implementation of mitigation measures.	Should the proposed development not proceed, the existing land-use practice of commercial afforestation and agricultural activities will continue with associated gradual alteration of the existing environment and associated pressures on surface water and groundwater quality.

Criteria	Residual Impact of the Project	Do-Nothing Alternative
Air & Climate	Long-term positive impact on air quality and climate due to avoidance of burning of fossil fuels and the net displacement of between 30,038 and 35,373 of CO_2 per annum.	There will be no increase in air quality or a reduction of greenhouse gas emissions. By the Development not proceeding it will not assist in achieving the renewable energy targets set out in the Climate Action Plan. As a result, fossil fuel power stations will be the alternative to provide the required quantities of electricity resulting in greenhouse gas and other air pollutant emissions.
Noise	Non-significant to slight temporary noise impacts associated with construction activities. Temporary moderate impact along the grid route at certain dwellings during construction. The operational noise impacts are imperceptible.	There will be no change in noise emissions.
Landscape & Visual	The scale of the proposed development will be well assimilated within its landscape context without undue conflicts of scale with underlying landform and land use patterns. For these reasons the magnitude of the landscape impact is deemed to be **High-medium** within the Site and its immediate environs (c.1 km) reducing to **Medium** and then **Medium-low** for the remainder of the central study area. Beyond 5 km from the Site, the magnitude of landscape impact is deemed to reduce to **Low** and **Negligible** at increasing distances as the wind farm becomes a proportionately smaller and integrated component of the overall landscape fabric.	In this instance, the existing forestry plantations contained within the Site would continue to be planted and felled in rotation in the do-nothing scenario. As this aligns with the current scenario, no additional landscape or visual impacts are likely to occur.
Material Assets	Positive impact by offsetting use of fossil fuel. Positive impact due to provision of electricity infrastructure.	No offset to fossil fuel use. No provision of additional renewable electricity generation infrastructure in the local area.
Cultural Heritage	No residual impacts.	There will be no potential for Cultural Heritage impacts.
Traffic and Transportation	Moderate localised short-term impact due to construction and decommissioning activities.	There will be no potential for Traffic and Transport impacts.

3.5 STRATEGIC SITE SELECTION

3.5.1 Strategic Site Screening

The Project Developers, FEI and SSE, continuously examine the lands under their stewardship for candidate sites for wind energy development.

There have been two main screening exercises undertaken by Coillte's Renewable Energy Development Team (now FEI) one in 2014 and one in 2017. The purpose of the site identification exercise was to identify an area that would be capable of accommodating a wind farm development while minimising the potential for adverse impact on the environment. To satisfy this requirement, a significant landholding that would yield a sufficient viable area for the siting of each element of the Development was required.

In 2014 Coillte's Renewable Energy Development Team (now FEI) undertook a detailed screening process, through Geographical Information Spatial software (GIS), using a number of criteria and stages to assess the potential of a large number of possible sites, on lands within its stewardship (c. 441,000 hectares), suitable to accommodate a wind energy development. The GIS database drew upon a wide array of key spatial datasets such as forestry data, ordnance survey land data, house location data, transport, existing wind energy and grid infrastructure data and environmental data such as ecological designations, landscape designations and wind energy strategy designations available at the time.

The following is a summary of the methodology used in this screening process:

Phase 1 – Initial Screening

This stage in the selection process discounted lands that were not available for development under a number of criteria, as follows:

1. Committed Lands for other developments
2. Millennium Sites (This is a Coillte environmental designation – these sites were planted and managed for provision of a tree for every household in the country as part of the Millennium tree planting project)
3. Life Site (This is a Coillte environmental designation – these former forested sites were cleared and are managed for biodiversity)
4. Wild Nephin Properties (This is a Coillte designation. Since 2014 these properties have been incorporated into National Parks)
5. Farm Partnerships and Leased Lands
6. National Parks
7. Natura 2000 and Nationally Designated Sites (SAC, SPA, NHA, pNHA)

Coillte also reviewed the relevant local authority's County Development Plan (CDP) and/or Renewable Energy Strategy (RES) provisions and did not proceed with further analysis where the policy context was not supportive of wind farm development. In this regard, areas were not brought forward for further analysis if they were not identified as being at least "open for consideration" for wind farm development.

Lands where the average wind speed at 80 metres above ground level was less than 7 meters per second and was therefore, potentially not suitable for a commercially viable wind energy development were also discounted at this stage. In addition, sites with a contiguous area of less than 300 hectares were discounted.

Phase 2 – Grid Constraints

The electricity transmission system is the backbone of the nation's power system, efficiently delivering large amounts of power from where it is generated to where it is needed. As part of the Site selection process, it was necessary to consider in principle the potential for grid connection, including in terms of distance to potential connection nodes and the grid capacity at the nodes, in the local area, to accommodate the connection.

Phase 3 – Screening

The next stage of screening out lands from further analysis was due to the presence of the following:

1. Sensitive Amenity or Scenic Areas designation in CDPs (at the time of the screening process);
2. Lands utilised for other wind farm developments;
3. Telecommunications masts and links;
4. Sensitive habitat/species of bird;
5. Land Ownership title issues;
6. Relatively high residential density in vicinity;
7. Unfavourable slopes and ground conditions.

This stage of screening was generally applied using in-house expertise and local knowledge and was subsequently validated externally in terms of the engineering considerations and the likelihood of obtaining a successful grant of planning permission based on industry trends in 2014.

Results of the Screening Process

Sites that emerged from the 2014 site selection process described above are listed below and have been brought forward as separate planning applications alone or with co-development partners:

- Croagh, Co. Leitrim;
- Carrownagowan, Co. Clare;
- Glenard, Co. Donegal;
- Bottlehill (Coom), Co. Cork;
- Castlebanny, Co. Kilkenny (consented).

Each is a project in its own right and is subject to EIA. As such a description of the reasonable alternatives studied which are relevant to each project and its specific characteristics, together with an indication of the main reasons for selecting the chosen option with regard to their environmental impacts is provided in the EIAR accompanying applications.

In 2017 Coillte once again examined the lands under its stewardship for candidate sites for wind energy development using the same site selection process as described above but this time reducing the required contiguous Site area from 300 ha to 50 ha. The proposed Inchamore Site emerged from this process and the process described in Section 3.5.1 below. Other sites which also emerged and for which FEI are in the process of preparing separate planning applications or are in the planning system are:

- Ballinagree, Co. Cork;
- Croaghaun, Co. Carlow;
- Cummeennabuddoge, Co. Cork;
- Gortyrahilly, Co. Cork;
- Inchamore, Co. Cork
- Lissinagroagh, Co. Leitrim.

Similar to the sites which emerged in 2014; the sites which emerged in 2017 are projects in their own right which will be subject to EIA. Ballinagree, Croaghaun and Gortyrahilly planning applications have been submitted.

As such a description of the reasonable alternatives studied which are relevant to each project and its specific characteristics, together with an indication of the main reasons for selecting the chosen option with regards to their environmental impacts has been, or will be, provided in the EIAR accompanying the applications for same.

The alternative to this would be to bring forward a site that did not pass the above phases of the screening process. In that instance, there would be the potential for the construction and operation of a wind energy development to have an adverse effect on ecologically designated or sensitive areas and visually sensitive (scenic) or amenity areas. There would also be the potential for greater shadow flicker, noise and traffic impacts if the candidate site was located in an area with a higher number of residential dwellings. In addition, a site with an average wind speed less than 7 m/s (at 80 m above ground level) and/or not located within practical proximity of existing grid infrastructure and may not be economically viable.

As stated above, Coillte conducted two reviews of its land in recent years in which it examined candidate sites for wind energy development. However, as also stated above Coillte (now FEI) continuously assesses its lands for wind opportunities and other sites can emerge periodically.

3.5.2 Suitability of the Candidate Site

It is critical for the Developer and their project team to ensure that the most suitable site for development of a proposed wind farm is identified and progressed through planning due to the financial commitments involved i.e., the cost of building each megawatt (MW) of electricity-generating capacity in a wind farm is in the region of €1.8 million to €2.0 million.

The site suitability has been fully informed by national, regional and local policy constraints and the location accords with these policies and objectives. (See Planning Statement accompanying this application.)

The site was further examined in the context of the following elements which are considered decisive in determining viability for a wind farm project:

- National Grid Connection Capacity;
- Designated sites;
- Wind Speeds, and
- Population Density.

3.5.2.1 National Grid Connection

Potential grid connectivity and constraints were also considered during the strategic site selection process as detailed in the strategic screening exercise. The Inchamore Site was found to be in proximity to two nodes on the national transmission system, notably Ballyvouskill 220 kV GIS substation and Cloonkeen 110 kV substation. These were assessed at a high level for connection and capacity. Ballyvouskill was selected because it had capacity available, as opposed to the very limited capacity at Clonkeen and is closer to the Site (i.e. within 13 km as the crow flies).

The assessment of the grid route options is described in detail in **Section 3.6.4.3**.

3.5.2.2 Designated Sites

It is preferable that wind energy development is not located in an area designated as a Natura 2000 site. The Project is not located within any area designated for ecological protection. The nearest Natura 2000 site, i.e., Special Area of Conservation (SAC) or Special Protection Area (SPA) to the Project is Killarney National Park, Macgillycuddy's reeks & Caragh River Catchment SAC. The closest distance between the cable route corridor and the Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC is 41 m. Killarney National Park, Macgillycuddy's reeks & Caragh River Catchment SAC is the closest Natura 2000 site to the Site, situated 3 km north of the Site at the nearest point. The nearest national designated site, i.e. Natural Heritage Area (NHA) to the Project is Sillahertane Bog NHA, which is located approximately 5.5 km to the south-west of the Site. Please note that there is no connectivity between Silahertane Bog NHA and the Project. The nearest proposed Natural Heritage Area (pNHA) to the Project is Killarney National Park, Macgillycuddy's reeks & Caragh River Catchment pNHA which is located 41 m from the grid route corridor at the closest point.

3.5.2.3 Wind Speeds

Wind speed was assessed at the Site in order to determine if wind energy development would be feasible. Wind speed analysis through the Irish Wind Atlas produced by Sustainable Energy Authority of Ireland (SEAI) was used to determine average wind speeds for the country. With the upland nature of the landscape, the Wind Atlas shows that wind speeds on the Site are consistent with a wind farm development (7.5 m/s at 30 m, 8.3 m/s at 75 m, 8.5 m/s at 100 m and 9.10 m/s at 150 m).

3.5.2.4 Population Density

Areas with low housing density are preferable for wind energy development so as to minimise potential disturbance to residential amenity. Having reviewed the settlement patterns in the vicinity of the Site, the study area has emerged as suitable to accommodate the proposal. The population density of the local Study Area (i.e. Study Area 1 as described in the **Chapter 4: Population and Human Health**) is 18.4 persons per square kilometre[3]. This is significantly lower than the average rural population density of 27 persons per square

[3] https://www.cso.ie/en/census/census2016reports/census2016smallareapopulationstatistics/ [Accessed, 22/06/2022]

kilometre in rural areas[4]. The low population density of the Site provides greater capacity for wind energy development, allowing for a greater number of turbines to be constructed while maintaining appropriate setback distances from dwellings as set out in the Wind Energy Development Guidelines.

3.5.2.5 Summary

From the review of the criteria set out above, the Site was identified as a suitable candidate site for the provision of a wind farm of the scale proposed. The Site is located predominantly within agricultural land and existing commercial forestry which allows the Site to take advantage of existing access roads (which will be upgraded in specific locations). This combined with the proximity to the existing Ballyvouskill substation further highlights the suitability of the Site as it can make further sustainable use of these established items of infrastructure. The Site is also designated as 'Open to Consideration' within the Cork County Development Plan 2022 - 2028, does not overlap with any designated sites and is located in an area with a relatively low population density with appropriate annual wind speeds.

3.6 WIND FARM DESIGN AND LAYOUT

The design of the Development has been informed by the designers, Developers, engineers, landowners, environmental, hydrological and geotechnical, archaeological specialists, telecommunication specialists, and traffic consultants. The aim is to reduce potential for environmental effects while designing a project capable of being constructed and viable and maximising wind resource. Throughout the preparation of the EIAR, the layout of the Development has been revised and refined to take account of the findings of all site investigations, which have brought the design from its first initial layout to the current proposed layout. The design process has also taken account of the recommendations and comments of the relevant statutory and non-statutory organisations, the local community and local authorities and as detailed in **Section 1.10** of **Chapter 1: Introduction**.

3.6.1 Constraints Led Approach

The design and layout of the Development follows the recommendations and industry guidelines set out in the 'Wind Energy Development Guidelines' (Department of the Environment, Heritage and Local Government, 2006), 'Best Practice Guidelines for the Irish Wind Energy Industry' (Irish Wind Energy Association, 2012) and the Draft Revised Wind Energy Development Guidelines, December 2019. The layout and design were an iterative process which followed the constraints-led design approach.

[4] https://www.cso.ie/en/releasesandpublications/ep/p-cp2tc/cp2pdm/pd/ [Accessed 22/06/2022]

The constraints-led design approach consists of the identification of environmental sensitivities within the Site by the design team with a view to identifying suitable areas in which wind turbines may be located. The resulting area is known as the 'Developable Area'.

The constraints identification process included the gathering of information through detailed desk-based assessments, field surveys and consultation. Sensitive receptors were mapped and the design constraints were applied. Setback buffers were placed around different types of constraints to clearly identify the areas within which no development works will take place. The size of the buffer zone for each constraint has been assigned using guidance presented in the Department of the Environment, Heritage and Local Government Wind Energy Guidelines (DoEHLG, 2006) and other relevant Best Practice standards, which are identified in each chapter of this EIAR. The proposed setbacks also comply with the Draft Wind Energy Guidelines 2019 requirements.

The constraints map for the Site, as shown in **Figure 3.1** encompasses the following constraints and associated buffers:

- 4 x tip height separation distance from residential properties in line with the new draft guidelines)
- Operator specific buffer from existing Telecommunication Links
- 65 m buffer of Watercourses
- 100 m buffer from Archaeological Sites or Monuments
- Available lands for development
- Separation distance (oversail) from landowners not involved in the Project (77.5 m)
- Distance from designated sites
- Good wind resource
- Existing access points and general accessibility of all areas of the Site due to existing road infrastructure
- Avoidance of environmental constraints identified from desk studies

The inclusion of the constraints on a map of the study area allowed for a viable developable area to be identified. The process included the identification of a developable area in the west of the site. However, this was not considered for development due to the size (could accommodate a single turbine) and the separation distance from the other turbines would have a negative visual impact.

The wind farm design process looked at all land that was available for development within and immediately surrounding the preliminary red-line boundary (**Figure 3.2a** and **3.2b**). The constraints, as discussed in **Section 3.6.1** and shown on **Figure 3.1**, associated with these lands were assessed. Some lands were discounted due to the telecommunication links running to the north and south of the site, the presence of habitats including Mosaic of Upland Blanket Bog and Wet Heath and residential receptors.

The first turbine layout (**Figures 3.3**) was then developed to take account of all the constraints mentioned above and their associated buffer zones and the separation distance required between the turbines.

Following the mapping of all known constraints, detailed site investigations were carried out by the project team. The ecological assessments of the Site encompassed habitat mapping and extensive surveying of birds and other fauna. These assessments, as described in **Chapter 5: Aquatic Ecology**, **Chapter 6: Terrestrial Ecology** and **Chapter 7: Ornithology**, optimised the decision on the siting of turbines as explained in Section 3.6.2.

Similarly, the hydrological and geotechnical investigations of the Site informed the proposed locations for turbines, roads and other components of the Development, such as the substation and the construction compound. This included peat depth and peat stability analysis (**Chapter 8: Soils and Geology**) and the identification of watercourses, groundwater constraints, flood risk and wells (**Chapter 9: Hydrology and Hydrogeology**). Where specific areas were deemed as being unsuitable (e.g., unstable peat giving high risk for slippage) for the siting of turbines or roads, etc., alternative locations were proposed and assessed, taking into account the areas that were already ruled out of consideration. The turbine layout for the proposed wind farm has also been informed by wind data which has been collected from an on-site meteorological mast and the results of noise assessments as they became available.

3.6.2 Turbine Layout

The final proposed turbine layout of the Development shown in **Figure 3.6** takes account of all site constraints and the distances to be maintained between turbines and from houses, roads, etc. The layout is based on the results of all site investigations and feedback from consultations that have been carried out during the EIAR process.

The final selection of turbine number and layout has had regard to wind-take by siting the turbines to achieve optimal performance (three times the rotor diameter (3d) in the crosswind direction and seven times the rotor diameter (7d) in the prevailing downwind direction). Potential noise emissions considerations were also incorporated into turbine layout by ensuring no turbines are constructed in a location that would lead to unacceptable noise impacts on nearby receptors. Potential shadow flicker impacts were also considered by maintaining a 4 x tip height buffer from sensitive receptors and selecting suitable candidate turbines with built in shadow shut down measures where the turbine operating control system detects when sunlight is strong enough to cast a shadow on a property or properties, and automatically shuts down for a period until the conditions resulting in the shadow impact have passed.

The EIAR and wind farm design process was an iterative process. As information regarding the Site was compiled and assessed, the number of turbines and the proposed layouts was revised and amended to take account of the physical constraints of the Site. The requirement for buffer zones and other areas in which no turbines could be located was also compiled and assessed. Findings at each stage of the assessment were used to further refine the design, always with the intention of minimising the potential for environmental impacts.

The Development of the final proposed wind farm layout has resulted following feedback from the various studies and assessments carried out as well as ongoing negotiations and discussions with landowners and the local community. The specific locations of the various turbines were reviewed during the optimisation of the Site layout. This was achieved by strictly adhering to the Developable Area for the location of the turbines and avoiding known constraints for the site infrastructure.

Preliminary Layouts

In 2018 and 2019, the Developer looked at layouts with 15 No. smaller turbines and 5 No. larger turbines at the selected Site respectively as shown in **Figure 3.2a** and **3.2b**. In 2018 a landscape and visual impact assessment was undertaken for the 15 turbine layout. It found the main issue with the layout was the sprawling lateral extent of the development, which was generally concentrated on one hillside/ridge, but extended across a shallow valley to the west to form another cluster which in-turn linked to an existing / permitted wind energy development on a skyline ridge to the west. Consequently, the western half of the scheme contributed disproportionality to a negative visual impact including negative cumulative impacts, which were considered to be a particular issue for the 15 turbine layout. The study therefore recommended to reduce the overall extent and scale of the proposed development to reduce localised impacts and also to maximise the buffer to the nearest large cluster of Kilgarvan wind farms. Following the 2018 assessment a new layout was designed in 2019 which reduced the turbine number to five significantly reducing the negative visual impact.

At the preliminary design stage in 2018 and 2019 the constraints-led approach was limited and did not include all the constraints listed in Section 3.6.1.

First Layout

In 2020 a constraints study was undertaken for the Site using all criteria outlined in 3.6.1. The redline boundary was reduced from that used in the preliminary design as a number of private landholders did not want to proceed with long-term lease agreements. The study identified a viable area within the overall study area suitable for five turbines. In line with the 2006 Wind Energy Guidelines a separation distance between the turbines of three times the rotor diameter (3d) in the crosswind direction and seven times the rotor diameter (7d) in the prevailing downwind direction was applied to ensure optimal performance.

The first layout in shown in **Figure 3.3**.

Second Layout

Following the design of the first layout and a review of the viable lands the number of turbines was increased from 5 No. to 6 No. as a result of additional technical information provided by the wind turbine supplier which allowed the separation distance between the turbines to be reduced from 7d to 5d.

The second layout is shown in **Figure 3.4**.

Third Layout

The third layout as presented in **Figure 3.5** takes account of all site constraints arising from the site investigation results collated during the EIAR (e.g., ecology, ornithology, hydrology, peat depths etc.) and design constraints (e.g., setback distances from houses and third-party lands/infrastructure and distances between turbines on-site etc.). As stated above this layout also takes account of the results of all detailed site investigations and baseline assessments that have been carried out during the EIAR process.

The turbine locations from the third layout remained the same as the second layout. However, the crane hardstand for T3 was adjusted as it was located in a potential landslide susceptibility area. The access road from T3 to T1 and T3 to T2 were also realigned to avoid high risk landslide susceptibility areas. The red-line boundary was reduced to encompass only the area of the Site that was now confirmed as viable for development see **Figure 3.1**. The area within the red-line boundary reduced from 481 ha to 170.1 ha.

Fourth and Final Layout

Following further conversations with the owner of H5, a derelict, unoccupied property which is shown in **Figure 1.3** as located within the 4 x tip height housing buffer, it was decided to remove a turbine, T6 (**Figure 3.5**). The final five turbine layout is show in **Figure 3.6**.

A comparison of the potential environmental effects of the three wind turbine layouts when compared against the final layout are presented in **Table 3.2**.

Table 3.2: Environmental effects from first and second layout iteration compared to the final layout

Criteria	First Layout (5 wind turbines)	Second Layout (6 wind turbines)	Third and Final Layout (6 wind turbines with realigned roads and hard standing for T3)	Fourth and Final Layout (5 wind Turbines)
Population & Human Health (incl. Shadow Flicker)	No material environmental difference for population or human health.	No material environmental difference for population or human health.	No material environmental difference for population or human health.	No material environmental difference for population or human health.
Biodiversity	No significant environmental impacts.	No significant environmental impacts.	No significant environmental impacts.	No significant environmental impacts.
Ornithology	No significant environmental constraints	No significant environmental constraints	No significant environmental constraints	No significant environmental constraints
Soils & Geology	Slight decrease in the volume of peat and spoil to be managed. Overall no significant environmental impacts.	Slight increase in the volume of peat and spoil to be managed. Overall no significant impacts.	This layout was amended following geotechnical investigations to avoid areas of peat slide susceptibility areas. Overall no significant environmental impacts	Slight decrease in the volume of peat and spoil to be managed. Overall no significant environmental impacts.
Hydrology & Hydrogeology	No significant environmental impacts.	An increase in the volume of peat and spoil to be managed on site would increase the potential for runoff. Overall no significant environmental impacts.	The hydrology and hydrogeology impacts remain the same as the second layout. Overall no significant environmental impacts.	No significant environmental impacts.

Criteria	First Layout (5 wind turbines)	Second Layout (6 wind turbines)	Third and Final Layout (6 wind turbines with realigned roads and hard standing for T3)	Fourth and Final Layout (5 wind Turbines)
Air & Climate	Slight increase in the carbon payback time. Overall a long-term, significant, positive impact on Climate.	Slight decrease in the carbon payback time. Overall a long-term, significant, positive impact on Climate.	The carbon payback time remains the same as the second layout. A long-term, significant, positive impact on Climate.	Slight increase in the carbon payback time. Overall a long-term, significant, positive impact on Climate.
Noise	No significant noise impacts	No significant noise impacts	No significant noise impacts	No significant noise impacts
Material Assets	Slight decrease in the area of forestry removal required. No significant impact on material assets.	Slight increase in forestry removal required. No significant impact on material assets.	The area of forestry is the same as the second layout. No significant impact on material assets.	Slight decrease in the area of forestry removal required. No significant impact on material assets.
Landscape & Visual	Slightly less visual impact. No significant landscape and visual impacts.	The visual impact is slightly increased with the additional turbine. However, overall there are no significant landscape and visual impacts.	The landscape and visual impacts are the same as the second layout. Overall no significant landscape and visual impacts.	Slightly less visual impact. No significant landscape and visual impacts.
Cultural Heritage	No significant cultural heritage impacts.	No significant cultural heritage impacts.	No significant cultural heritage impacts.	No significant cultural heritage impacts
Traffic and Transport	A smaller development footprint would require less construction traffic and the volume of construction traffic using public roads would be less. Overall no significant impact to traffic and transport.	Larger development footprint would lead to an increase in construction traffic using the public roads.	The volume of construction traffic would be the same as the second layout. Overall no significant impact to traffic and transport.	A smaller development footprint would require less construction traffic and the volume of construction traffic using public roads would be less. Overall no significant impact to traffic and transport.

3.6.3 Internal Site Access Road Layout

Roads must be of a gradient and width sufficient to allow safe movement of equipment and vehicles. It was deemed necessary during the initial design of the Development that existing roads would be utilised where possible to minimise the potential for impacts by constructing new roads as an alternative.

As the overall site layout was finalised, the most suitable routes between each component of the Development were identified, taking into account the existing roads and the physical constraints of the Site. Locations were identified where upgrading of the existing road would be required. This included where sections of new roads would need to be constructed, in order to ensure suitable access to and linkages between the various project elements, and efficient movement around the Site.

An alternative option to utilising the existing road network within the Site would be to construct a new road network, having no regard to existing roads. This approach was considered unfavourable, as it would require unnecessary disturbance to the Site and create the potential for additional environmental impacts to occur. It would also result in an unnecessary requirement for additional cut and fill material to be used in the construction of these new roads. A comparison of the potential environmental effects of constructing an entirely new road network when compared with maximising the use of the existing road network is presented in **Table 3.3**.

Table 3.3: Comparison of environmental effects from constructing a new Internal Site Access Road network verses utilising existing Site Access Roads and supplementing with new Site Access Roads where required

Criteria	Comment
Population & Human Health (incl. Shadow Flicker)	Larger development footprint results in additional dust and noise generated during construction.
Biodiversity	Larger development footprint will result in greater habitat loss.
Ornithology	Larger development footprint will result in greater habitat loss which could impact birds.
Soils & Geology	Larger development footprint will result in greater volumes of peat and spoil to be excavated and stored. Larger volume of stone required from on-site borrow pit for road construction.
Hydrology & Hydrogeology	Larger development footprint and increased number of new watercourse crossings, therefore, increasing the

Criteria	Comment
	potential for silty runoff to enter receiving watercourses.
Air & Climate	Potential for greater dust emissions due to the requirement of an increased volume of stone from the on-site borrow pit. Potential for greater vehicular emissions due to increased volume of construction traffic. However, these will not be significant.
Noise	Larger development footprint results in additional nose generated during construction.
Material Assets	Larger development footprint will result in greater land-take and a greater change in land use.
Landscape & Visual	Potential for visual and landscape impacts due to the construction of new roads. However, this will not be significant.
Cultural Heritage	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.
Traffic and Transport	Larger development footprint will increase the volume of construction traffic impacting the public road network. However, these will not be significant.

3.6.4 Location of Ancillary Structures

The alternatives considered are discussed for the following ancillary infrastructure required for the Development: a temporary construction compound (a single compound versus two smaller compounds) electricity substation (location) and borrow pit (using local quarries versus an onsite borrow pit).

3.6.4.1 Construction Compound

The use of a single temporary construction compound as opposed to two smaller compounds located in different areas of the Site is proposed and will result in less disturbances to the Site and a reduced visual impact during construction. A comparison of the potential environmental effects of constructing a single, large construction compound when compared against constructing two smaller compounds is presented in **Table 3.4**.

Table 3.4: Comparison of environmental effects from constructing two smaller construction compounds compared to one large construction compound

Criteria	Comment
Population & Human Health (incl. Shadow Flicker)	Potential for increased noise impacts on nearby sensitive receptors.
Biodiversity	Potential for a greater impact to the Site ecology by constructing two construction compounds in different areas of the Site as the footprint of two smaller construction compounds is larger than one large compound.
Ornithology	Potential for a greater impact to the Site ornithology by constructing two construction compounds in different areas of the Site.
Soils & Geology	Larger development footprint will result in greater volumes of peat and spoil to be excavated and stored. Larger volume of stone required from on-site borrow pit for road construction.
Hydrology & Hydrogeology	The use of multiple construction compounds sites has the potential to increase the risk of erosion and increase risk to watercourses.
Air & Climate	Potential for greater dust emissions due to the requirement of an increased volume of stone from the on-site borrow pit. Potential for greater vehicular emissions due to increased volume of construction traffic. However, these will not be significant.
Noise	Potential for increased noise impacts on nearby sensitive receptors.
Material Assets	Larger development footprint will result in greater land-take and a greater change in land use.
Landscape & Visual	Potential for visual and landscape impacts due to the construction of two construction compounds in different parts of the Site. However, this will not be significant
Cultural Heritage	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.
Traffic and Transport	More efficient movement and management of material across the Site.

3.6.4.2 Onsite Substation incorporating Control Building

The north and south of the Site were assessed for locating the Onsite Substation. Having regard to the Site constraints, the grid connection to Ballyvouskill and the EirGrid requirement to maintain 3.5 times the turbine fall over distance, the location of the Onsite Substation including Control Building the south of the Site was selected as the location of the Onsite Substation.

Table 3.5: Comparison of environmental effects from constructing an onsite substation in the South to one in the North of the Site

Criteria	Comment
Population & Human Health (incl. Shadow Flicker)	Potential for increased noise impacts on nearby sensitive receptors at both locations.
Biodiversity	Potential for increased noise impacts on nearby sensitive receptors at both locations.
Ornithology	No potential for impacts to ornithology at either location.
Soils & Geology	The volume of spoil removed for both sites will be the same.
Hydrology & Hydrogeology	The potential for silt or sediment laden run-off to impact surface water bodies and the aquatic ecology they support the same for both sites.
Air & Climate	The potential dust emissions and exhaust emissions the same for both locations.
Noise	The potential for noise impacts will be the same for both locations.
Material Assets	The land-take will be the same for both locations.
Landscape & Visual	The visual impact of the onsite substation will be the same or both locations.
Cultural Heritage	The potential for impacts on unrecorded, subsurface archaeology is the same for both locations.
Traffic and Transport	The volume of traffic associated with the construction of the onsite substation will be the same for both locations.

3.6.4.3 Borrow Pit

Fill material required for the construction of access roads and turbine bases will be obtained from one onsite borrow pit and will be located to the east of T5. The use of the borrow pit represents an efficient use of existing onsite resources and eliminates the need to source material from outside the site and transport large volumes of construction materials along the local public road network to the Site. The location for the borrow pit was identified following detailed geotechnical site investigations and site-specific constraints outlined in **Section 3.8.1,** namely 65 m buffer of watercourses, 100 m buffer from archaeological sites or monuments and the avoidance of environmental constraints identified from desk studies. The borrow pit will provide up to 50,276 m^3 of site won general fill. The proposed borrow pit shall also be reinstated with excavated soil material which will avoid the need to export excess spoil to off-site facilities.

An alternative to using onsite borrow pits was the option of sourcing all stone and hardcore materials from locally licensed quarries. The transport of such material to Site would result in a significant increase in construction traffic and heavy loads and was therefore considered the least preferable option.

A comparison of the potential environmental effects of using an onsite borrow pit in comparison to using an offsite quarry is presented in **Table 3.6**.

Table 3.6: Environmental effects from utilising local quarries compared to the on-site borrow pit

Criteria	Comment
Population & Human Health (incl. Shadow Flicker)	Potential for increased noise, vehicular and dust emissions from transporting material from offsite quarry locations to the site which could have adverse health effects. Increased HGV disturbance will lead to increased environmental nuisance.
Terrestrial Ecology	Neutral – potential for a small area of vegetation to be removed to access the borrow pit and the quarry. No significant impacts to terrestrial ecology.
Aquatic Ecology	Neutral – potential for silt or sediment laden run-off to impact surface water bodies and the aquatic ecology they support from the borrow pit and the quarry.
Ornithology	Neutral – no potential impact to ornithology.
Soils & Geology	Effect on local quarry resource.
Hydrology & Hydrogeology	Neutral – potential for silt or sediment laden run-off to impact surface water bodies and the aquatic ecology they support from the borrow pit and the quarry.
Air & Climate	Potential increase in dust emissions and vehicle emissions associated with off-site vehicle movements.

Criteria	Comment
Noise	Whilst there would be less noise generated from the Site as a result of using an offsite source, there will be an increase in noise emissions from the transport of material from offsite quarry locations on public roads. This will impact on dwellings and facilities situated along these roads.
Material Assets	Effect on local quarry resource.
Landscape & Visual	Neutral - no potential landscape and visual impact.
Cultural Heritage	Neutral - The potential for impacts on unrecorded, subsurface archaeology is the same for both locations.
Traffic and Transport	Additional HGV trips required for importation of fill.

3.7 ALTERNATIVE DESIGN PHILOSOPHY AND SPECIFICATIONS

Consideration was given to an appropriate limited range of turbine dimensions that would allow suitable flexibility at procurement stage. This is necessary because of the rate of change in technology and the length of time required to progress a project from early planning stage to turbine purchase. Different models that are currently available may not be available in a number of years and models that are not available now are likely to become available. The Developer undertook a review of currently available technology and chose a range of dimensions that ensures the best chance of a competitive procurement process for the proposed limited range of dimensions.

The result was the proposed limited range of dimensions as set out below:

- A tip height range of 177 m to 185 m;
- A hub height range of 102.5 m to 110.5 m, and
- A rotor diameter range of 149 m to 155 m.

The range of dimensions are shown on **Figure 1.4**.

3.7.1 Turbine Type

This output may vary as a result of the final turbine type, power output modelling and turbine development over the period leading up to construction. For the purposes of this EIAR, a minimum rated output of 5.6 MW and a maximum rated output of 6.6 MW has been used to calculate the power output of the proposed wind farm, which will result in an estimated installed capacity of between 28 MW to 33 MW. A wind farm with the same potential power output could also be achieved on the Site by using smaller turbines (for example 3.5 MW machines). However, this would necessitate the installation of up to 11 turbines to achieve a similar output. Furthermore, the use of smaller turbines would not make efficient use of the wind resource available having regard to the nature of the Site. Taller wind turbines with larger rotor diameters allow wind turbines to sweep more area, capture more wind, and produce more electricity.

3.7.2 Number of Turbines

A larger number of smaller turbines would result in the wind farm occupying a greater footprint within the Site, with a larger amount of supporting infrastructure being required (i.e., roads etc) and increasing the potential for environmental impacts to occur.

The proposed number of turbines takes account of all site constraints and the distances to be maintained between turbines and features such as roads and houses, while maximising the wind energy potential of the Site. The 5 No. turbine layout selected for the Site has the smallest development footprint, while still achieving the optimum output.

3.7.3 Height of Turbines

The turbine model to be installed on the Site will be the subject of a competitive tendering process and will be within the following dimensions. The height of the turbines that will be selected for construction on the Site will have an overall ground to blade tip height ranging from 177 m to 185 m, a rotor diameter ranging from 149 m to 155 m and a hub height ranging from 102.5 m to 110.5 m. The use of alternative smaller turbines at this Site would fail to make the most efficient use of the wind resource passing over the Site.

Following the establishment of the developable area of the Site, as part the design alternative process, specific turbine models with different heights (177 m, 180 m and 185 m) were considered before settling on the tip height range of 177 m to 185 m now proposed.

The relationship between the turbine height and density (number of turbines) required to achieve a particular output was a key design consideration. From research carried out by Betakova *et al*. (2015) people have highlighted that when given an option, they tend to prefer a scenario of fewer larger turbines:

"People prefer reducing the number of turbines by replacing smaller turbines with larger ones even though larger ones might be visible from a larger number of residences"

One such study commissioned by Fáilte Ireland in 2008 found that:

"In terms of the size and composition of wind farms, tourists tended to prefer farms containing fewer turbines. If both produced the same amount of electricity, tourists also preferred wind farms containing a small group of large turbines (55%) to a large group of smaller turbines (18%)."[5]

On the basis of these factors and through design stage analysis, consideration was given to the approach that the slightly increased sense of visual dominance imparted by taller turbines is preferable to the reduced level of permeability and increased visual array associated with a greater number of shorter turbines required to achieve the same output. Moreover, the perceived visual dominance of taller turbines is further offset by increased setback distances from residential receptors.

The consideration to provide fewer, larger turbines with greater power output is in line with industry trends. This option increases energy efficiency, improving the energy output to the national grid per turbine, thus reducing the cost of energy for the consumer. The use of less turbines also reduces the impact on the receiving environment with less land-take required to accommodate the wind farm, with less associated construction works as detailed above. Recent permitted wind farm applications in Ireland tend towards larger/taller turbines (i.e., the larger turbine tip heights that are available on the market in Ireland). Examples of recent consented wind farms which include larger/taller turbines are the Carrownagowan Wind Farm, Co. Clare (ABP ref. PA03.308799) which consists of 19 No. wind turbines at 169 m tip height, Castlebanny Wind Farm, Co. Kilkenny (ABP ref PA10.309306) which consist of 21 No. wind turbines at 185 m tip height, Ardderroo Wind Farm, Co. Galway (ABP ref. PL07 .303086) which consists of 25 No. wind turbines at 178.5 m tip height. Coole Wind Farm, Co. Westmeath (ABP ref. PL25M.300686) which consists of 13 No. wind turbines of 175 m tip height, and Derrinlough Wind Farm (ABP ref. PA19.306706) which consists of 21 No. wind turbines of 185 m tip height.

A comparison of the potential environmental effects of the installation of a larger number of smaller wind turbines when compared against the chosen option of installing a smaller number of larger wind turbines are presented in **Table 3.7**.

[5]https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/4_Visitor_Insights/Visitor-Attitudes-on-the-Environment.pdf?ext=.pdf [Accessed 25/10/2022]

Table 3.7: Environmental effects from a large number of smaller wind turbines compared to the Development

Criteria	Comment
Population & Human Health (incl. Shadow Flicker)	Greater potential for shadow flicker impact on nearby sensitive receptors.
Biodiversity	Larger development footprint would result in greater habitat loss.
Ornithology	The presence of more turbines would increase the potential effects on birds.
Soils & Geology	Larger development footprint would result in greater volumes of peat and spoil to be excavated.
Hydrology & Hydrogeology	The larger development footprint would increase the potential for silty runoff to enter receiving watercourses.
Air & Climate	Neutral – Potential air and climate impacts would be similar.
Noise	Potential for increased noise impacts on nearby sensitive receptors.
Material Assets	Neutral – Potential material assets impacts would be similar.
Landscape & Visual	A larger number of smaller turbines would have a greater visual impact.
Cultural Heritage	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.
Traffic and Transport	Potential for greater traffic volumes during construction phase due to larger development footprint and requirement for more construction materials and turbine components.

3.8 ALTERNATIVE GRID CONNECTION

3.8.1 Grid Connection Technology and Routes

A key consideration in determining the Grid Connection technology for a proposed wind energy development is whether the cabling is undergrounded or run as an overhead line. While overhead lines are less expensive and allow for easier repairs when required, underground lines will have no visual impact. A comparison of the potential environmental effects of constructing overhead lines when compared against constructing underground lines is presented in **Table 3.8**.

Table 3.8: Environmental effects from overhead lines compared to underground lines

Criteria	Comment
Population & Human Health (incl. Shadow Flicker)	Potential to impact property prices due to visual impact.
Biodiversity	Where underground lines are unable to be placed in the road there is greater potential for impact to biodiversity as the footprint of cable trenches will be greater than that of wooden poles.
Ornithology	Neutral – No potential impact to ornithology.
Soils & Geology	Cable trenches have a larger footprint than OHL pole and will have a greater potential to impact soils and geology as the excavation volumes will be greater.
Hydrology & Hydrogeology	There is greater potential for water impacts due to sediment release for cable trenches as there will be a greater volume of material excavation than with OHL poles.
Air & Climate	Slightly less dust emissions associated with OHL installation due to the smaller excavation footprint.
Noise	Potential for noise impacts similar for OHL and cable trench installation during the construction and decommissioning phases. Potential for greater operational noise from OHL.
Material Assets	Neutral – Potential impacts to material assets similar for OHL and cable trench installation.
Landscape & Visual	Potential for greater visual impact due to overground poles and cables.
Cultural Heritage	Potential for impacts on unrecorded, subsurface archaeology is greater for underground lines as they will be placed on land/off-road and will cover a greater surface area than OHL poles.
Traffic and Transport	Potential for a slight impact to traffic using the forest track running from the Site entrance to the N22 during the cable trench installation, however the majority of the proposed grid connection route is offroad. No traffic impacts associated with OHL as it would be all offroad.

3.8.2 Grid Connection Routes

Potential grid connectivity and constraints were also considered during the strategic site selection process as detailed in the strategic screening exercise as discussed in **Section 3.5.2.1**. Ballyvouskill 220 kV GIS substation was selected because it had capacity available when compared to Clonkeen and because of its closer proximity to the Site (i.e., within 13 km as the crow flies).

Four underground cabling route options from Inchamore to Ballyvouskill were initially considered and assessed as part of a civil and structural due diligence to determine which route would be brought forward. . The four routes, Route A, B, C and D are shown on **Figure 3.7**. Route D has three route options for connection to Ballyvouskill. The initial grid route assessment found a combination of Route B and C combined with Route D Option 2 or Option 3 was the most favourable as the majority of the route is within Coillte lands and there are less bridge crossings.

On review, a combination of Route B (excluding the section running towards the Sullane), Route C and Route D Option 3 was chosen as the grid route. This route was selected as it avoided utilising the alternative Route A. The risks associated with the constructability of Route A were the Macroom to Millstreet bypass, crossing a protected bridge, and existing services in the road. The selected grid route has less bridges and the majority of it is located within Coillte lands, reducing the requirement to access further third party owned property. A comparison of the potential environmental effects of constructing Route A compared against the chosen option (combined Routes B, C and D) is presented in **Table 3.9**.

Table 3.9: Environmental effects of grid Route A compared against the chosen option (combined Routes B, C and D)

Criteria	Route A	Route Option (combined options B, C, D,)
Population & Human Health (incl. Shadow Flicker)	Neutral as the temporary works will avoid Ballyvourney.	Neutral as the temporary works will avoid Ballyvourney.
Terrestrial Ecology	Route A travels along public roads within St Gobnets Wood SAC and Mullaghanish to Musheramore Mountains SPA with some off-road sections proposed where lands are hydrologically connected to St Gobnets Wood SAC and Mullaghanish to Musheramore Mountains SPA.	The chosen route (combined options B, C and D travels through an area which is hydrologically connected to Killarney National Park, Macgillycuddy Reeks and Caragh River Catchment, is ecologically connected to Mullaghanish to Musheramore Mountains SPA and there is a potential ecological connection to Killarney National Park SPA.
Aquatic Ecology	Route A drains to Sullane and Foherish catchments with 14	Route B and C drains to the River Flesk (which is hydrologically

Criteria	Route A	Route Option (combined options B, C, D,)
	stream crossings along the route. Annex II Freshwater Pearl Mussel (*Margaritifera margaritifera*) and Atlantic Salmon (*Salmo salar*) are present within both river systems.	connected To Killarney National Park, Macgillycuddy Reeks and Caragh River Catchment SAC), and Foherish River. Route D drains to the Garrane stream, a tributary of the Foherish River. Route B drains to the Sullane River. There are Annex II Freshwater Pearl Mussel ((*Margaritifera margaritifera*) and Atlantic Salmon (*Salmo salar*) present within the above mentioned river systems.
Ornithology	Route A runs through St. Gobnet's Wood SPA and Mullaghanish to Musheramore Mountains SPA.	Route D is ecologically connected to Mullaghanish to Musheramore Mountains SPA and is potentially connected to Killarney National Park SPA.
Soils & Geology	Route A is typically adjacent to farmland, with rushes frequently present which suggests a soft peaty soil underlies the area, although areas with till, weathered rock and rock outcrops were also observed.	The Grid Connection Route is approximately 19.9 km of which 1.3 km is within the Site. The remaining 18.6 km is located off-road and in third-party lands. The potential impacts associated with the Grid Connection Route in relation to soils and geology in general are considered slight.
Hydrology & Hydrogeology	Route A has five bridge crossings which would increase the potential for silty runoff and hydrocarbons to enter receiving watercourses.	There are three bridge crossings and therefore less potential for silty runoff and hydrocarbons to enter receiving watercourses.
Air & Climate	Temporary dust and exhaust emissions from construction vehicles	Temporary dust and exhaust emissions from construction vehicles
Noise	Temporary noise impacts during the construction phase.	Temporary noise impacts during the construction phase.
Material Assets	Neutral – No impact to material assets.	Neutral - No impact to material assets.
Landscape & Visual	Neutral – No visual impact.	Neutral – No visual impact.

Criteria	Route A	Route Option (combined options B, C, D,)
Cultural Heritage	Neutral – route located in existing roads and tracks.	Neutral – route located in existing roads and tracks.
Traffic and Transport	Neutral as some temporary road closures will be necessary of narrow roads to facilitate the installation of cables.	Neutral as some temporary road closures will be necessary on narrow roads to facilitate the installation of cables.

3.9 ALTERNATIVE RENEWABLE ENERGY TECHNOLOGIES

Forestry and agriculture will continue to be carried out on the Site around the footprint of Development. An alternative source of renewable energy considered for Site following its identification was solar energy. Commercial solar energy production is the harnessing and conversion of sunlight into electricity using photovoltaic arrays (panels). The capacity factor of solar energy is significantly lower than that of onshore wind energy, requiring approximately three times the capacity of the Development (i.e. X (3) x Y (33 MW) = Z (99 MW)) to produce the same amount of energy. Solar farms require 1 hectare per MW, the land area required to generate the equivalent amount of MW would be in the region of 40 ha. This compares to a footprint of 14.86 ha for the five proposed turbines. **Table 3.10** outlines the potential impact from the development of a solar photovoltaic array when compared to a wind farm energy development. The selected wind farm energy development is the most efficient method of energy production with the lesser potential for significant, adverse environmental effects.

Table 3.10: Environmental effects from a solar photovoltaic array compared to a wind farm development

Criteria	Comment
Population & Human Health (incl. Shadow Flicker)	No potential for shadow flicker to affect sensitive receptors. Potential for glint and glare impacts on local road users and at dwellings.
Biodiversity	Larger development footprint would result in greater habitat loss.
Ornithology	Potential for mimicry of sensory cues i.e., glint and glare similar to water leading to bird fatalities caused by collision. This can be mitigated.
Soils & Geology	Although Solar PV has a larger development footprint the volume of peat and spoil to be excavated is less

Criteria	Comment
	than that required for a wind farm due to the shallow excavation works required during construction.
Hydrology & Hydrogeology	A solar PV array development would require a larger development footprint therefore increasing the potential for silty laden runoff to enter receiving watercourses.
Air & Climate	Reduced capacity factor of solar PV array technology would result in a longer carbon payback period.
Noise	The potential noise impacts from a solar PV are less than that of a wind energy development due to the smaller scale construction and there is no noise associated with the solar panels.
Material Assets	The larger development footprint would have a greater impact on the land use (Forestry and Agriculture) of the Site.
Landscape & Visual	Potentially less visible from surrounding area due to screening from existing forestry and topography. More of a local low level visual impact due to the increased land take and slope of the land.
Cultural Heritage	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.
Traffic & Transport	Potential for greater traffic volumes during construction phase due to the number of solar panels required to achieve the same output. However, due to the smaller size of the solar panels there may be less work required along the TDR route to accommodate their delivery.

3.10 ALTERNATIVE TURBINE HAUL ROUTE

Alternative ports of entry and transport routes to the Site were considered, the latter in relation to turbine component delivery as well as general construction-related traffic.

3.10.1 Port of Entry

The alternatives considered for the port of entry of wind turbines into Ireland for the Development include Ringaskiddy Port, Co. Cork and the Foynes Port, Co. Limerick. Both Ports offer a roll-on-roll-off procedure to facilitate import of wind turbines. Ringaskiddy Port was selected as the port of entry for this Project because it is located closer to the Site and a number of the existing wind farms in the locality have successfully utilised this port. This reduces the work required on the Turbine Delivery Route.

3.10.2 Turbine Component Delivery to Site

Turbine component delivery routes from Ringaskiddy Port included the N40 and the N22. This route has proven suitable for the transport of turbine components for other wind farm developments in the area. The transport analysis (as presented in **Chapter 15: Traffic and Transportation**) shows that only minor additional accommodation works will be required to accommodate the proposed turbines.

3.10.2.1 Civil Construction Haul Route

The local road network in the vicinity of the Site and the supplier locations were assessed for the Civil Construction Haul Route. A number of the local roads were not suitable as they were too narrow or they would have required upgrade works.

The proposed Civil Construction Haul Routes are shown on **Figure 15.3**.

Specific grades of rock fill will be required as fill under turbine foundations while sub-base and base course materials for the access track and turbine hardstand construction will be sourced on site from borrow pits. Concrete, crushed stone and concrete blocks for construction of the Development will come from licenced quarries in the locality such as:

- McGroup Keim Quarry;
- Coppeen Concrete, Enniskeane;
- Mid-Cork Quarries, Gortnadiha;
- McSweeney Bros, Kilmichael;
- Keohane Readymix, Ballygurteen, and
- Murray Bros Tarmacadam Ltd, Ardcahan.

These quarries will also be the source of crushed stone and road surfacing for widening works to the turbine haul route (existing Coillte track) and for grid connection works.

From Keim, trucks will follow the R582 in a southern direction and then travel in a westerly direction along the L-5226-0, the L-7418-55, the L-7418-25 and the L-7418-0 to Ballyvourney and will then follow the N22 to the site entrance.

For the quarries to the south (all bar Mc Group Keim), trucks will use the R587, then the R584 to the new Macroom By-Pass (N22) and then follow the old N22 to the site.

For the Grid Connection Route, general material excavated from trenches in public roads will be disposed of to a licenced facility while excavated road surfacing material will be recycled. Excavated road surfacing materials will be recycled and used for temporary reinstatement of trenches. General soil waste will be transported to one or more of the following licensed facilities:

- Tomas Mullins, Scrahanagown, Coolea, Co. Cork;
- Richard & Dennis Carroll Plant Ltd., Clonfadda, Macroom, Co. Cork;
- Ciaran Ryan Plant Hire Ltd., Ballymacorcoran, Clondrohid, Co. Cork, and
- Séan Ó Luasa, Na Foithrí (Fuhirees), Cúil Aodha, Maighchromth, Co. Chorcaí.

Soil and stone spoil from road widening on the Turbine Haul Route will be disposed of to the same facilities.

Bitumen and supplementary road surfacing for trench reinstatement can be sourced from Lehane Tarmacadam, Kilbarry, Macroom, Co. Cork or McSweeney Bros, Kilmichael or Murray Bros Tarmacadam Ltd., Ardcahan and will use the routes as shown on **Figure 15.3**.

Grid construction traffic will use the grid route and link with the N22 at Cummeenavrick or will be serviced from the wind farm site.

3.11 ALTERNATIVE MITIGATION MEASURES

Mitigation by avoidance has been central to the Project's evolution. By avoiding the sensitive areas of the Site using the constraints led approach described in **Section 3.6.1** the potential for environmental effects is limited. As noted above, the site layout aims to avoid any environmentally sensitive areas through the application of site-specific constraints. Where loss of habitat occurs at the Site, this has been mitigated with the proposal of enhancement lands.

The alternative to this approach is to encroach on the environmentally sensitive areas of the site and accept the potential environmental effects associated with this. The best practice design and mitigation measures set out in this EIAR will contribute to reducing any risks and have been designed to break the pathway between the Site and any identified sensitive receptors.

3.12 CONCLUSION

A description of the reasonable alternatives in terms of wind farm design and layout, design philosophy and specifications, grid connection, renewable energy technologies, turbine haul route and mitigation measures, studied by the Developer, which are relevant to the proposed project and its specific characteristics (maximum 33 MW output, five turbines with a tip height range of 177 m to 185 m, a hub height range of 102.5 m to 110.5 m and a rotor diameter range of 149 m to 155 m – large scale wind farm), and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects has been provided.

4 POPULATION AND HUMAN HEALTH

4.1 INTRODUCTION

4.1.1 Background and Objectives

This Chapter of the EIAR assesses the impacts of the Project (**Figure 1.2**) on population and human health, including the proposed grid connection and turbine delivery routes assessed as part of this EIAR. (**Chapter 2: Project Description**). Where negative effects are predicted, the chapter identifies appropriate mitigation strategies. The assessment considers the potential effects during the following phases of the Development:

- Construction of the Project;
- Operation of the Project, and
- Decommissioning of the Project.

This Chapter of the EIAR is supported by Figures in **Volume III** and the following Appendix document provided in **Volume IV**:

- **Appendix 4.1a to d: Shadow Flicker Assessment**

4.1.2 Statement of Authority

This chapter has been prepared by Jennings O'Donovan & Partners Limited. It was prepared by Mr. David Kiely and Ms. Sarah Moore, with the assistance of Ms. Shirley Bradley.

Mr. David Kiely has undertaken EISs/ EIARs for wind farms throughout Ireland. He has 39 years' experience in the civil engineering and environmental sector and has obtained a Bachelor of Engineering Degree in Civil Engineering and a Master of Science degree in Environmental Protection. David has overseen the development of over 50 wind farms from feasibility, planning and environmental assessment through to construction, including the preparation of population and human health chapters for other wind farms.

Ms. Sarah Moore is a Senior Environmental Consultant and holds a Bachelor (Hons.) Degree in Environmental Science from University of Limerick and a MSc (Dist.) in Environmental Engineering from Queen's University, Belfast. She has worked in environmental consultancy for over fourteen years and has prepared AA Screenings, Environmental Reports and EIARs for other wind farms including shadow flicker assessments.

Ms. Shirley Bradley is a Graduate Environmental Scientist with a First-Class Honours Degree (BSc. Hons) in Environmental Science from the Institute of Technology, Sligo. She was also awarded with the Governing Body award for a BSc in Environmental Protection. Shirley's key capabilities are in report writing, assisting Senior Consultants and GIS.

4.1.3 Relevant Legislation and Guidance

The population and human health section of this EIAR is carried out in accordance with legislation and guidance contained in **Chapter 1: Introduction** and the **Planning Statement**. Fáilte Ireland's "EIAR Guidelines for the Consideration of Tourism and Tourism Related Projects" was also adhered to in the preparation of this chapter. The design and construction of the Project including the installation of associated equipment such as switchgear and substations is governed by the 2005 Safety, Health and Welfare at Work Act, The Safety, Health and Welfare at Work (General Application) Regulations 2021 and also by S.I. 291 The Safety, Health and Welfare at Work (Construction) Regulations, 2013 as amended.

The Revised EIA Directive Consultation (revised EIA Directive 2014/52/EU) (Section 1.2.2) states that:

"*It is intended that the consideration of the effects on populations and on human health should focus on health issues and environmental hazards arising from the other environmental factors, for example water contamination, air pollution, noise, accidents, disasters, and not requiring a wider consideration of human health effects which do not relate to the factors identified in the Directive*".

4.1.4 Assessment Structure

In line with the EIA Directive as amended and current EPA guidelines the structure of this chapter is as follows:

- Assessment Methodology and Significance Criteria **–** a description of the methods used in desktop surveys and in the assessment of the significance of effects;
- Baseline Description **–** a description of the socio-economic profile of the local area of the Development, i.e., of local electoral areas and of County Cork and based on a desk-based study using Central Statistics Office (CSO) data;
- Assessment of Potential Effects **–** including the "Do Nothing" scenario and identifying the ways in which the population and human health of the area could be affected by the Development during the construction, operational and decommissioning stages;
- Mitigation Measures and Residual Effects **–** a description of measures recommended to avoid, prevent, reduce or, if necessary, offset any potential significant adverse effects and a summary of the significance of any residual effects of the Development after mitigation measures have been implemented;
- Cumulative Effects **–** identifying the potential for effects of the Development to combine with those from other existing, permitted and/or proposed projects as listed in **Chapter 2: Project Description** of this EIAR, to affect the population and human health;
- Summary of Significant Effects, and

- Statement of Significance.

With respect to the EIA Directive as amended, Section 1.2.2 (outlined in Section 4.1.3), amalgamates the findings of other assessments undertaken as part of the EIA process. Limited interactions with Human Health are possible and consideration has been given to the findings of the following assessments:

- Chapter 8: Soils and Geology
- Chapter 9: Hydrology and Hydrogeology
- Chapter 10: Air and Climate
- Chapter 11: Noise and Vibration
- Chapter 15: Traffic and Transportation
- Chapter 16: Major Accidents and Natural Disasters

Where appropriate, mitigation measures have been proposed to avoid, prevent, reduce or, if necessary, offset any identified significant adverse effects.

All activities carried out by the appointed Contractor of the Development will be in accordance with the requirements of the Safety, Health and Welfare at Work Act 2005 as amended and Regulations made under this Act.

4.1.5 Scope of the Assessment

The effect of a development on population and human health includes the following broad areas of investigation:

- Population and Settlement Patterns;
- Economic Activity;
- Tourism;
- Employment;
- Topography and Land Use;
- Health Impacts of Wind Farms including Electromagnetic Fields;
- Property Value / Residential Amenity, and
- Natural Disaster and Major Accidents.

Where a significant negative impact can be foreseen, it is prevented, reduced, avoided or, if necessary, offset by way of practical mitigation measures.

This assessment considers the following criteria:

- Sensitive receptors in the area;

- Existing land use in the area;
- General amenities in the area, and
- Potential effects from water, noise, shadow flicker, air quality and traffic.
- Effects on the linguistic and cultural heritage of the Gaeltacht including the promotion of Irish as the community language

4.2 ASSESSMENT METHODOLOGY

In line with the EIA Directive as amended and current EPA guidelines, this Chapter includes the following elements:

- Details of Methodologies utilised in the context of legal and planning frameworks;
- Baseline Descriptions;
- Assessment of Potential Effects (do-nothing, construction, operational and decommissioning stages);
- Detailed Mitigation Measures;
- Assessment of Cumulative Impacts, and
- Summary of Significant Effects and Statement of Significance.

A desk study was undertaken using the Central Statistics Office (CSO) data along with a review of the Cork County Development Plan 2022-2028. Consideration was also given to the 2015[1] report produced by the EPA entitled 'Investigation into the Assessment of Health Impacts within National Environmental Regulation Processes' that outlines how human health impacts are dealt with, throughout the European Union (EU) by environmental regulators with an emphasis on the role at the planning / environment interface.

4.2.1 Definition of Study Areas

Three geographical Study Areas have been outlined for this assessment. While the greater geographical areas Study Area 2 and Study Area (3) provide a baseline of statistical data for this chapter, it is not considered for local impacts of this assessment. Note: Study Area 1 lies within Study Area 2 and information outlined for Study Area 2 incorporates data for Study Area 1. The three Study Areas as shown in **Figures 4.1, 4.2** and **4.3** are outlined below:

Study Area 1: The Site and Environs – District Electoral Division (DED) An Sliabh Riabhach (47.36 km^2).

In order to make inferences about the population and other statistics in the vicinity of the Site, DEDs were analysed. The wind farm entire Site comes under one Municipal Division (MD),

[1] Golder Associates (2015) *Investigation into the Assessment of Health Impacts within National Environmental Regulation Processes*. Available online at: http://www.epa.ie/pubs/reports/research/health/assessmentofhealthimpactsreport.html, [Accessed on 20/04/21]

Macroom, and electoral division (ED) An Sliabh Riabhach, that can be separated into distinct townlands; Inchamore, Milleeny, Derreenaling, Derrynasaggart, Slievereagh, Coomnaclohy, Coomnagire, Cappagh West, Cappagh East, Killeen, and Flats.

Study Area 2: **Cork County** (7,316 km^2) The Development and 5.99 km of the grid connection are located in Study Area 2.

Study Area 3: **Kerry County** (4,807 km^2) A section of the grid connection (13.89 km) and 1.047 km of the forest track from the site entrance to the N22 are located in Study Area 3.

Descriptive terminology for impact assessment follows the systematic method of description of the EPA Guidelines (2022), as outlined in **Chapter 1: Introduction**, **Table 1.4**.

4.2.2 Consultation

Consultation with relevant organisations was initiated during the initial stage of the EIA to identify any effects that could be initiated by the Development. A summary of the findings is detailed in **Table 4.1**.

Table 4.1: Summary of Consultation response on Human Health

Consultation response on Human Health		
Health Service Executive	Letter in Response to Scoping Report received on 10th December 2020	**Opportunity for Health Gain**: "The proposed development should be assessed with a view to the potential to include opportunities for health gain within the site of the proposed wind farm by including greenways, cycle-paths or walking trails within the development site." **Shadow Flicker**: It is recommended that a shadow flicker assessment is undertaken to identify any dwellings and sensitive receptors which may be impacted by shadow flicker. The assessment must include all proposed mitigation measures. Dwellings should include all occupied properties and any existing or proposed properties for which planning consent has been granted for construction or refurbishment. It is recommended that turbine selection will be based on the most advanced available technology that permits shut down during times when residents are exposed to shadow flicker. As a result, no dwelling should be exposed to shadow flicker.

Consultation response on Human Health		
Fáilte Ireland		• Baseline assessments should identify any tourism sensitivities in the zone of influence of a development. This zone of influence of a development is highly dependent on its **Context, Character, Significance**, and **Sensitivity**, as outlined in the Draft Guidelines. These characteristics apply to both the development and the environment. • Impact assessment should contain the likely significant effects of a development arising from both construction and operation of a development. Advice on describing the effects is contained within the Draft Guidelines and includes the quality, significance, extent, probability, type and duration of the effect, with particular descriptors for each. • Impact assessment should be carried out as per EPA guidelines and the best practice for that prescribed topic. It may be considered appropriate to consider impact on tourism assets under the 'material assets' topic below. • The impact upon tourism can be considered within this section through the sensitivities of Hospitality, Safety and Pace of Life. Changes in population can impact the perception of pace of life or safety in a particular location. Impacts upon these issues in areas which rely heavily on tourism or have a particular sensitive tourism generator should be considered in this section. • A link between tourism and this prescribed environmental factor, beyond the normal development impacts, is rare, however the impact upon tourism of issues of noise and vibration can be significant. Construction for example should consider the sensitivity of the development and ensure mitigation is in place. • The construction programme of developments should work to avoid peak tourism periods in tourism areas and should consider planned or anticipated tourism events and festivals. • Cultural heritage should be strongly considered in non-tourism developments and the impact upon tourism considered as a potential impact. • Waste and Waste disposal issues can also impact the perception of an unspoiled environment, effecting tourism, which should be considered. • Tourism could be considered a material asset as its impact upon the economy and the infrastructure in place to

Consultation response on Human Health		
		support it is a material consideration in assessing economic impact. • The visual impact of a tourism development, especially in locations which are visually sensitive or renowned for their scenic or landscape beauty, should be considered carefully. A development intended to utilise or enjoy a particular vista or environment should minimise impact upon that environment.

4.3 BASELINE DESCRIPTION

4.3.1 Population and Settlement Patterns

Study Area 1: The Site and Environs (DEDs An Sliabh Riabhach, Clydagh and Coomlogane)

The extent of Study Area 1 can be seen in **Figure 4.1**. There are no defined community settlements with a population greater than 2,500 within Study Area 1. Macroom, which has a population of 3,765 persons is approximately 22 km distant east of the Project. The nearest centres of population to the Site are Killarney, Co. Kerry, 20 km distant to the north-west which has a population of 14,504 residents and Cork City, 50 km distant east which has a population of 208,669 persons. The surrounding area is largely rural, with a mixture of agricultural grassland, commercial forestry plantations, private roads and public roads. Isolated residences and farmsteads are also scattered throughout the area.

Nearby settlements to the Project located within Study Area 1 include the villages of Coolea 3.2 km southeast and Ballyvourney 5 km east. The Site and a section (1.03 km) of the grid connection are located in the Múscraí Gaeltacht. This Gaeltacht is made up of four native Irish speaking communities Ballyvourney, Ballingeary, Coolea and Clear Island. It covers an area of 626 km.

Over the last five years, Cork County Council and Kerry County Council have granted planning permissions in Study Area 1 which include housing, alterations to existing dwelling houses, development of new housing, agricultural buildings, and commercial developments including a solar farm[2]. The 2016 Census statistics note 348 occupied residences and a total population of 942 in Study Area 1. There were 485 number Males and 457 number Females. The population density of Study Area 1 is 6 persons per square kilometre.

[2] Cork County Council. *Planning Map Search* Available online at: https://www.corkcoco.ie/en/planning/planning-enquiry-online-submissions [Accessed 10th February 2023]

All inhabited dwellings are located at a distance of over 740 m from the proposed turbines. There are 39 properties within 2 km of the turbines as shown on **Figure 1.3**. The Site and its wider environs are classified as a 'Transitional Rural Area' in the Cork County Development Plan 2022-2028[3]. Although population concentrations are lower in these areas, there is a more stable population base and less evidence of population decline than other parts of the County. These ED areas also exhibit characteristics of a weaker economic structure and have higher levels of environmental sensitivity.

Study Area 2: Cork County

Preliminary data from Census 2022 shows the population of County Cork has increased by 7.1% to 581,231[4].The total population in the 2016 CSO for County Cork was 542,868, of which Males numbered 268,675 and Females were 274,193. There has been a 4.4% increase in the population since 2011. The population density is 256 persons per km^2. The total number of households was 146,442 in 2016, a 2.7% increase since 2011. Average size of households (in persons) has generally remained the same at 2.8-2.9 persons per household over the past three census reports.

Cork is the largest county in Ireland with a land mass of 7,500 km^2 including Cork City. The economic performance of Cork is strong and plays a critical role in both our regional and national economies. Cork contributes 19% to the national GDP.

The extent of County Cork can be seen in **Figure 4.2**. There are a number of medium sized towns and villages geographically spread throughout County Cork. These settlements number 102 and provide essential services for the local communities and the rural hinterlands. The different settlement tiers perform differing roles with the result that no area in the county is significantly peripheral or isolated.

The increase in rural population over a 5-year period from 2011 to 2016 in Cork County was 6,946. The towns of Carrigaline (15,770), Cobh (12,800), Midleton (12,496) and Mallow (12,459) are the most populated within the County.

Carrigaline, the largest town in County Cork, is significant for health, social and cultural activities. According to the Census 2016 there are 6,971 people residing in the Carrigaline settlement area who are classed as being 'At Work'. It has the largest number of workers (3,369) commuting into Cork city and suburbs. Carrigaline is 60 km distant from the Site to the south-east.

[3] Cork County Development Plan 2022-2028 Available online: https://www.corkcoco.ie/en/cork-county-development-plan-2022-2028 [Accessed 28th August 2022]

[4] Census 2022, https://data.cso.ie/, accessed 26/10/2022

Study Area 3: Kerry County

The extent of County Kerry can be seen in **Figure 4.3**. The total population in the 2016 CSO for County Kerry was 147,707, of which Males numbered 73,055 and Females were 74,652. There has been a 1.5% increase in the population since 2011. The population density is 31 persons per km^2. The total number of households was 54,493 in 2016, a 2.2% increase since 2011. Average size of households (in persons) has decreased over the period 2011 to 2016 from 2.8 to 2.6 persons. Preliminary data from Census 2022 shows the population of County Kerry has increased by 5.1% to 155,258.

There are a number of large and medium sized towns and villages geographically spread throughout County Kerry. These are broken down into Key Town, Regional Town, District Town, Village, and Small Village Settlements. The key element of the County Kerry Core & Settlement Strategy is to deliver 30% of all new homes in the Key Towns of Tralee and Killarney within the existing built-up footprint of the settlements. The overall aim for rural towns and villages is the strengthening of their social and economic structure by supporting the re-use of existing buildings and the regeneration of under-utilised buildings and lands[5].

The towns of Tralee and Killarney are considered Key Towns. These are key destinations, along transportation corridors and are economically active in the surrounding area. According to the Census 2016 the population of Tralee is 23,691 persons and Killarney is 14,504 persons. Tralee is 59 km distant from the Site to the north-west. Killarney is 28 km distant from the Site to the north-west.

4.3.2 Economic Activity

4.3.2.1 Primary Sectors

Study Area 1: The Site and Environs (DED An Sliabh Riabhach)

The main sectors in this Study Area are Professional services. This ED also exhibits characteristics of a stronger economic structure and have higher levels of environmental sensitivity.

Study Area 2: Cork County

The economy of County Cork is broadly based and diverse with strengths in the areas of agriculture/agri -tech, marine, food production, tourism, services, energy and in technology-based manufacturing in sectors such as electronics and life sciences. The Cork Region has the largest life sciences sector in employment terms in the country with almost 10,000

[5] Kerry County Development Plan 2022 -2028, http://docstore.kerrycoco.ie/KCCWebsite/planning/devplan/vol1updated.pdf , accessed 12/09/2022

permanent full-time jobs in the sector in 2016. Seven of the top ten global pharmaceutical companies have a presence in the county.

Cork also has a very significant agriculture and food sector. It has the most people employed in agriculture in the state. In 2010, the recorded numbers on farms in Cork was 14,222. This was 5.5% higher than the next highest at 13,445 in Galway[6]. with a number of indigenous enterprises having a significant international presence including Dairygold and Midleton Distillery. Danone and Kerry Foods are also present in Cork and together produce approximately 8% of the world infant milk formula[7].

4.3.3 Employment

4.3.3.1 Study Area 1: The Site and Environs (DED An Sliabh Riabhach)

Although population concentrations are lower in these areas, there is a more stable population base and less evidence of population decline than other parts of the County. Detailed information on employment for such a small area is unavailable. It is assumed that the majority of those residing within this area travel outside of it for employment. Please see Section 4.3.3.2 for more information on employment within the county.

4.3.3.2 Study Area 2: Cork County

According to the CSO 2016 there were 198,177 persons over 15 years of age in the labour force in Cork County and 91% were in employment. The Professional Services, the Manufacturing Industry and Commerce and Trade industries employ 110,842 persons. Of the 123,443 persons aged 15 years and over who were outside the labour force, 29% were students, 23% were looking after the home/family and 37% were retired. **Table 4.2** sets out employment by Industry in Cork County in 2016.

The live register figures show Cork County has seen a 42% decrease in registered unemployment since 2016. Between 2019 and 2020, numbers on the live register have risen, likely due to the economic downturn associated with the COVID-19 pandemic and Cork County has experienced a 4.3% rise in unemployment during that time.

[6] Life in 1916 Ireland: Stories from statistics https://www.cso.ie/en/releasesandpublications/ep/p-1916/1916irl/economy/ag/ [Accessed online 24/01/2022]

[7] County Development Plan Review, Economy and Employment, Background Document No.6, Planning Policy Unit, Cork County Council (2019), https://www.corkcoco.ie/sites/default/files/2019-12/Background%20Document%20no%206%20Economy%20and%20Employment.pdf, [Accessed online 12/05/2021]

Table 4.2: Cork County Employment by Industry (2016)

Principal Economic Status	No. Persons
At work	179,890
Looking for first regular job	1,827
Unemployed having lost or given up previous job	16,460
Student	35,933
Looking after home/family	27,965
Retired	45,612
Unable to work due to permanent sickness or disability	12,926
Other	1,007
Total	**321,620**

4.3.3.3 Study Area 3: Kerry County

CSO 2016 recorded 69,923 persons over 15 years of age in the labour force in County Kerry and 88% were in employment. The Professional Services, Commerce and Trade and Other industries employ 40,515 persons. Of the 48,993 persons aged 15 years and over who were outside the labour force, 24% were students, 20% were looking after the home/family and 45% were retired. **Table 4.3** sets out employment by Industry in County Kerry in 2016.

The live register figures show County Kerry has seen a 34% decrease in registered unemployment between 2011 and 2016. Between 2019 and 2020, numbers on the live register have risen slightly, likely due to the economic downturn associated with the COVID-19 pandemic. Based on the figures for January 2021 to May 2021, the live registers have fallen below the 2019 figure.

Table 4.3: Kerry County Employment by Industry (2016)

Principal Economic Status	No. Persons
At work	61,222
Looking for first regular job	835
Unemployed having lost or given up previous job	7,866
Student	11,849
Looking after home/family	9,585
Retired	21,855

Principal Economic Status	No. Persons
Unable to work due to permanent sickness or disability	5,238
Other	466
Total	**118,916**

4.3.4 Land Use

4.3.4.1 Study Area 1: The Site and Environs (DED An Sliabh Riabhach)

Study Area 1 is located in County Cork and County Kerry.

The Site is located within the electoral area of An Sliabh Riabhach, which supports 54 farm holdings, with an average holding size of 53 ha. The main livestock farmed are sheep and cattle[8].

ArcGIS Pro was used to calculate an area 796 ha forestry within Study Area 1. The majority of the forestry within Study Area 1 was classed as 'Coniferous Forest' according to CORINE Land Cover (Copernicus)[9].

4.3.5 Tourism

4.3.5.1 Tourist Attractions

Study Area 1: Development Site and Environs (10 km)

Tourist attractions (receptors) were collated using the suggested information sources outlined in the Fáilte Ireland EIAR Guidance document and using an internet search engine.

The Beara to Breifne Way, Ireland's longest national waymarked walking/cycling trail runs through part of the Study Area, it is not located within the Site (6 km at the closet point), however 640 m of the Grid Connection Route is along the Beara to Breifne Way see **Figure 4.4**. The Way runs almost the length of the country and takes the walker and cyclist to some of its most beautiful and least explored areas; along the coast of the Beara Peninsula, across six mountain ranges, along the banks of the River Shannon and through the lake regions of Roscommon and Leitrim.

There are two scenic routes located within Study Area 1. Scenic route S23 (road between Macroom and Derrynasaggart Mountains) is 149 m from the red-line boundary and 860 m from the Site. Scenic route S22 (road from Ballyvourney to Mullaghanish to Caherdowney) is located 5.6 km from the Site and 730 m from the grid connection at the closest point as shown on **Figure 4.4**.

[8] Census of Agriculture 2020, CSO, agri@cso.ie, Accessed 14/05/2021.
[9] Environmental Protection Agency Maps https://gis.epa.ie/EPAMaps/ [Accessed Online_22/06/2022]

Comeenatrush Lake and Waterfall walk are located 1.4 km north of the grid connection at the closest point and 12 km north-east of the Site.

St Gobnait's monastic site is located 5.6 km south-east of the Site. On the feast day of St Gobnait (11th February) pilgrims travel to Ballyvourney to visit St Gobnait's statue to bring them good health and good fortune.

Gougane Barra located 13 km south-west of the Site is a popular tourist village famous for its small 11th century St Finbarrr's Oratory built on a peninsula. The area around Gougane Barra is part of the Múscraí Gaeltacht. The village is set in a spectacular landscape known for its tranquillity, the beauty of the Gougane Lake and its numerous walking trails. Coillte Forest Park at Gougane Barra offers numerous walks for all ability levels, among the Sitka Spruce, beside the winding River Lee or past waterfalls tucked into the mountainside[10].

The are no existing walking tracks or trails within the Site, there are numerous forest tracks currently used by walkers for recreation purposes throughout the Study area.

Taking into account the availability of existing walking tracks, it is considered that the main tourism and recreation in Study Area 1 is trail walking, hiking and cycling or mountain biking.

Study Area 2: Cork County

Tourism in County Cork is an important industry based on its rich natural and built heritage. Many areas that are important to the tourist industry of County Cork owe their attraction to the exceptional quality of the landscape or particular features of the built environment[11]. There are a number of policies in the Cork County Development Plan 2022 which seek to promote tourism in the county. Policy TO 1-2: Promotion of Sustainable Tourism in County Cork is '(a) *Promote a sustainable approach to the development of the tourism sector within Cork County* ….." and Policy TO 7-1: Walking/Cycling and Greenways is "*Promote the development of walking and cycling routes throughout the County as an activity for both international visitors and local tourists…*"

Study Area 3: Kerry County

Kerry attracts 13% of all overseas visitors to Ireland. Kerry is more dependent on tourism than any other county with over 20% of its workforce employed in tourism-related enterprises. There are over 9,000 people directly employed in the accommodation and hospitality sectors in Kerry. It has the greatest concentration of tourist accommodation outside of Dublin – up to 50,000 beds in the approved and unapproved sectors.

[10] Failte Ireland, West Cork Digital Brochure (2021), Accessed 11/08/2021.
[11] County Development Plan 2022, Section 10, https://www.corkcoco.ie/sites/default/files/2022-06/volume-1-main-policy-material.pdf, [Accessed Online_27/06/2022]

Kerry County Council published a tourism strategy in 2016 for the period 2016 to 2022. The plan has a number of objectives including "*Increase the number of visitors to the county, their length of stay and their spend, and to do so in a manner that is sustainable*." The strategy will be achieved by the implementation of 273 individual actions.[12]

Some of the most popular tourist attractions in County Kerry include the Ring of Kerry, the lakes of Killarney, Skellig Michael, Dingle, Killarney National Park. Killarney National Park was voted number eight in the top ten paid tourist attractions in 2018 in Ireland and the Lakes of Killarney are the closest tourist attractions to the Project, located 17 km north-west and 11 km north-west of the Project at the nearest point respectively.

4.3.5.2 Tourism: Numbers and Revenue

Study Area 1: Development Site and Environs (10 km)

Tourist numbers and revenue data is only available for larger towns or at county level. Although the data is unavailable for Study Area 1 tourist sites such as Goungane Barra welcomes over 60,000 visitors each year[13].

Study Area 2: Cork County

The South-West Region which includes the Counties of Cork and Kerry has consistently been the most popular region in Ireland outside Dublin for overseas tourist and domestic visitors. Regional Tourism performance figures for 2018 for the South-West Region show overseas tourist numbers for the South-West Region totalled 2,335,000 in 2019 and tourist revenue accounted for €970,000,000 from overseas tourists. Domestic visitors from Ireland and Northern Ireland accounted for 2,354,000 visits to the region in 2019, with €536,000,000 in revenue generated from domestic and Northern Ireland visitors[14].

County Cork is home to a number of nationally renowned visitor attractions including Blarney Castle and Blarney Stone, Ballycotton Cliff Walk, Cobh, Doneraile Park and Spike Island. Doneraile Park was one of the top free of charge attractions visited in 2019 with 490,000 visitors. Blarney Castle and Stone was one of the top fee charging attractions with 460,000 visitors.

Cork is also included in 'Wild Atlantic Way" which is one of the longest defined coastal routes in the world (located 33 km south-west of the Project). It was devised as a new 'experience'

[12] County Kerry Tourism and Action Plan 2016 – 2022, Kerry County Council & Destination Tourism Forum, 2016,
[13] Fáilte Ireland (2012) Visitors to Tourist Attractions 2007 -2011
[14] Key Tourism Facts 2019, Failte Ireland, March 2021, http://docstore.kerrycoco.ie/KCCWebsite/Tourism/TourismStrategy.pdf, accessed 12/05/2021https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/Key-Tourism-Facts-2018.pdf?ext=.pdf, accessed 12/05/2021

and 'destination' by Fáilte Ireland to present the West Coast of Ireland as a compelling international tourism product. It is an over-arching brand which individual destinations and businesses can trade collectively with much greater potential visibility and clarity of message in the international marketplace[15].

Study Area 3: Kerry County

As previously stated, the South-West Region which includes the County Kerry has consistently been the most popular region in Ireland outside Dublin for overseas tourist and domestic visitors. Some of the top visitor attractions in Ireland are located in Kerry including Muckross House, Dingle, The Ring of Kerry, Carrauntoohil, Ross Castle as well as Blasket Island and Skellig Michael. In 2018 Muckross House was one of the top visited fee charging attractions with 550,649 visitors.

4.3.5.3 Visitors Attitudes to Wind Farms

The first wind farm in Ireland was completed in 1992 at Bellacorrick, Co. Mayo and since then wind farms have elicited a range of reactions from Irish people (Failte Ireland, 2012). In 2002, Sustainable Energy Ireland (SEI) now the Sustainable Energy Authority of Ireland (SEAI) commissioned a survey aimed at identifying public attitudes to renewable energy, including wind energy in Ireland[16]. The 2002 survey found that, in general, Irish people are positively disposed towards the development of wind farms. However, the survey also indicated that people will not accept wind farms everywhere and that special care should be taken so that wind farms respond to contextual landscape characteristics.

Ireland's scenery has been a cornerstone of international tourism marketing campaigns for decades. In 2012, 91% of overseas holidaymakers to Ireland rated scenery as an important part of a destination with natural/unspoilt environment also rated highly at 91%. The future sustainability of Ireland's tourism industry is therefore inextricably linked to the maintenance of the character and scenic qualities of the Irish landscape.

Fáilte Ireland, in association with the Northern Ireland Tourist Board (NITB), decided in 2007 (67 wind farms established) to survey both domestic and overseas holidaymakers to Ireland to determine their attitudes to wind farms. The survey drew on many aspects of the original SEI survey including the photomontages of wind farms, and in particular, the landscape types that were used to elicit a reaction from respondents. The purpose of the survey was to assess

[15] Wild Atlantic Way1 Operational Programme 2015-2019, Failte Ireland, August 2015, https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/2_Develop_Your_Business/Key%20Projects/Wild-Atlantic-Way-Operational-Programme_1.pdf, accessed 12/05/2021

[16] Sustainable Energy Ireland (2003), Attitudes towards the Development of Wind Farms in Ireland, Dublin

whether or not the development of wind farms would impact on the visitors' enjoyment of Irish scenery. In 2012, this research was updated by Millward Browne Landsdowne on behalf of Fáilte Ireland to determine if there was any change in visitor attitudes during this period.

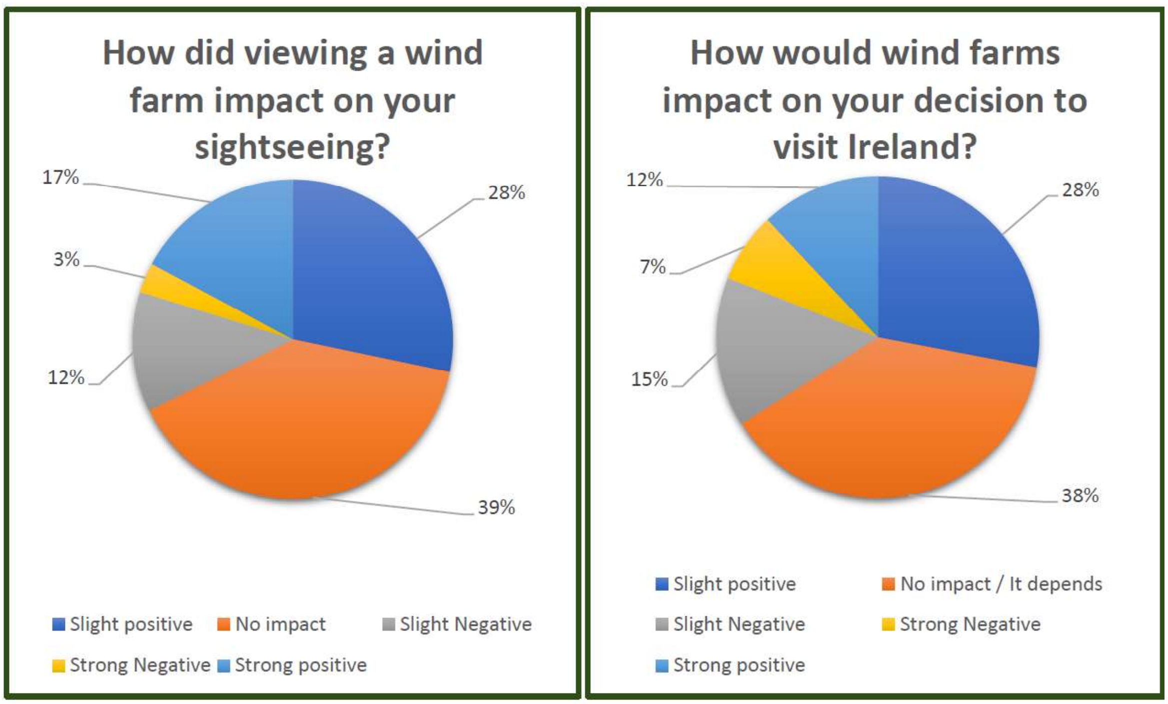
The 2012 research indicated that 47% of visitors felt an increased positive impact on landscape, compared to 32% in 2007. Negative responses also increased, showing 30% in 2012 against 17% in 2007. However, 49% of visitors felt that wind farms had no impact on the landscape in 2007 in comparison to 23% in 2012. It was notable that those interviewed who did not see a wind farm during their trip held more negative perceptions and opinions on wind farms to those that did. Of the wind farms viewed, the majority (59%) contained less than ten turbines in 2012, which was quite similar to 2007 (63%).

Despite the fact that there has been an increase in the number of visitors who have seen at least one wind farm on their holiday, there was also a slight increase (from 45% in 2007 to 48%) in the number of visitors who felt that this had no impact on their sight-seeing experience. Importantly, and as has been seen in the previous research, the type of landscape in which a wind farm is sited can have a significant impact on attitudes. Although 21% feel that wind farms have a fairly or very negative impact on sight-seeing, this figure increases substantially for wind farms in coastal areas (36%).

Visitors were again asked to rate the beauty of five different yet typical Irish landscapes: coastal, mountain, farmland, bogland and urban industrial land, and then rate the scenic beauty of each landscape and the potential impact of siting a wind farm in each landscape. As in 2012, the results indicate that each potential wind farm and site must be assessed on its own merits, due to the scenic value placed on certain landscapes by the visitor and the preferred scale/ number of wind turbines within a wind farm. Looking across all landscapes, wind farms are seen to have an enhancing effect on the landscapes. They are seen as less beautiful, particularly urban/ industrial and bogland.

Coastal areas (91%) followed by mountain moorland (83%) and fertile farmland (81%) continue to be rated as the most scenic, and unsurprisingly resistance is greatest to wind farms in these areas. For instance, there was a greater relative negativity expressed about potential wind farms on coastal landscapes (40%), followed by fertile farmland (37%) and mountain moorland (35%). On the other hand, less than one in four were negatively disposed to the construction on bogland (24%) or urban industrial land (21%). The majority of visitors also still favour large turbines (47%) over small turbines (28%), and in smaller numbers, with the option of five turbines proving the most popular, followed by two clusters of ten and finally wind farms of 25 turbines.

Seven out of ten (or 71%) visitors claim that potentially greater numbers of wind farms in Ireland over the next few years would have either no impact or a positive impact on their likelihood to visit Ireland (**Graph 4.1**). Of those who feel that the potentially greater number of wind farms would impact positively on future visits, the key driver is support for renewable energy, followed by potential decreased carbon emissions. Given the scenario where more wind farms will be built in Ireland in the future, the most widely held view is that this will not impact their likelihood to visit the area again, with a slightly greater majority saying that this would have a positive rather than a negative impact.



Graph 4.1: Visitors Attitudes on the Environment – Wind Farms. Source: Fáilte Ireland (2008)

Fáilte Ireland carried out research on Overseas Holidaymakers Attitudes to Ireland in 2018. It noted holiday makers choice is based largely on *beautiful scenery* (93%), followed closely by *plenty to do and see* (91%) and *friendly people* and *natural attractions* (88%). BiGGAR Economics carried out research in Scotland on 28 wind farms and tourism trends (2017)[17]. No pattern emerged that would suggest that onshore wind farm development has had a detrimental impact on the tourism sector, even at a very local level. No relationship was identified between the development of onshore wind farms and tourism employment at the level of the Scottish economy, at local authority level nor in the areas immediately surrounding wind farm development.

[17] BiGGAR (2017) Wind Farms and Tourism Trends in Scotland. Available online at: https://www.lyrewindfarm.com/web/cms/mediablob/en/3949334/data/3878350/2/windfarm-lyre/Wind-farms-and-tourism-trends-in-Scotland.pdf [Accessed on 13/11/2019]

4.3.6 Human Health

Common concerns around wind farms in terms of human health are generally associated with electromagnetic fields, shadow flicker and noise. These topics are considered in this assessment in addition to air quality, water contamination and traffic.

4.3.6.1 General Health of Population

Human health of communities can vary greatly owing to a number of factors including susceptibility to disease, location, income inequality, access to health care etc. In 2019 the Department of Health published "Health in Ireland – Key Trends 2019" which shows population health at the national level presents a picture of decreasing mortality rates and high self-perceived health over the past ten years. Ireland has the highest self-perceived health status in the EU, with 82.9% of people rating their health as good or very good.

The 2016 census data for the general health of the population as shown in **Table 4.4** indicates the health status across all four study areas is "Very Good" to "Good". The health status of the Site and Environs is very similar to that of County Cork. Both these areas are above the national average. The "Very Good" health status for County Kerry at 56% is slightly below the national average of 59%.

Table 4.4: Population by General Health (2016)

General Health	The Site & Environs (10 km)	County Cork	County Kerry	Ireland
	Percentage (%)			
Very good	64	63	56	59
Good	26	26	30	28
Fair	7	7	9	8
Bad	1	1	1	1
Very bad	0	0	0	0
Not stated	2	2	4	3

4.3.6.2 Electromagnetic Interference

Electromagnetic fields ("EMF") are invisible lines of force that surround electrical equipment, power cords, wires that carry electricity and outdoor power lines. Electric and magnetic fields can occur together or separately and are a function of voltage and current. When an electrical appliance is plugged into the wall, an electric field is present (there is voltage but no current); when that appliance is turned on, electric and magnetic fields are present (there is both voltage and current). Both electric and magnetic fields decrease with distance. Electric fields are also dissipated by objects such as building materials. On a daily basis, people are exposed to extremely low frequency ("ELF") EMF as a result of using electricity.

National and international health and scientific agencies have reviewed more than 35 years of research including thousands of studies. None of these agencies has concluded that exposure to ELF-EMF from power lines or other electrical sources is a cause of any long-term adverse effects on human, plant, or animal health. The International Commission on Non-Ionising Radiation Protection (ICNIRP) Guidelines give a limit of 100 μT for sources of AC magnetic fields. This compares to 0.13 μT that arises from a 110 kV underground cable when directly above it; 1.29 μT that arises from a 220 kV underground cable when directly above it and 11.4 μT that arises from a 400 kV AC underground cable that is one metre deep and measured directly above it. This is detailed in information booklet published by ESB in 2017 called "EMF & You" which provides information about Electric & Magnetic Fields and the electricity network in Ireland[18].

In 2014 a study was undertaken in Canada[19], measuring electromagnetic fields around wind farms and the impact on human health. The study found that:
"there is nothing unique to wind farms with respect to EMF exposure; in fact, magnetic field levels in the vicinity of wind turbines were lower than those produced by many common household electrical devices and were well below any existing regulatory guidelines with respect to human health".

From the limit of 100 μT for sources of AC magnetic fields given by the ICNIRP, a comparison of between 0.02 μT and 0.41 μT arises when turbines operate under "high wind" scenarios.

4.3.6.3 Shadow Flicker

The Department of Energy and Climate Change for England stated in its report Update of UK Shadow Flicker Evidence Base (2011) that it is considered that the frequency of the flickering caused by the wind turbine rotation is such that it should not cause a significant risk to health.

Section 4.6 provides the full assessment of shadow flicker for this EIAR.

[18] EMF & You, ESB, 2017 - https://esb.ie/docs/default-source/default-document-library/emf-public-information_booklet_v9.pdf?sfvrsn=0, accessed 14/05/2021
[19] Lindsay C McCallum, *et al*. (2014) *Measuring electromagnetic fields (EMF) around wind turbines in Canada: is there a human health concern?*

4.3.6.4 Noise

A study by the EPA in South Australia on low frequency noise near wind farms and in other environments found that *'Overall, the study demonstrates that low frequency noise levels near the wind farms in the study are no greater than levels in urban areas at comparable rural residences away from wind farms'.*

The turbine rotor blades will be fitted with a serrated extension of the trailing edge which will reduce noise emissions by design by effectively breaking up turbulence. Baseline noise measurements were carried out from 11th October to 9th November 2020. A number of predictions were prepared for the layout of the five turbine Development. Based on layout, potential noise-sensitive receptors including occupied and un-occupied were identified from maps. Receptor locations were verified through visits to the area. **Chapter 11: Noise** provides an assessment of noise in relation to the Development.

4.3.6.5 Air Quality

Environmental Protection Agency (EPA, 2016), EU and World Health Organisation (WHO, 2014) reports estimate that poor air quality accounted for premature deaths of approximately 600,000 people in Europe in 2012, with 1,200 Irish deaths attributable to fine particulate matter ($PM_{2.5}$) and 30 Irish deaths attributable to Ozone (O_3)[20 21]. These emissions, along with others including nitrogen oxides (NO_x) and sulphur oxides (SO_x) are produced during the burning of fossil fuels for energy generation, transport or home heating. There are no such emissions associated with the operation of wind turbines.

Traffic disruption to the public during the construction and decommissioning phases of the Development is likely. Transport accounts for a significant portion of pollutants in the atmosphere. Potential impacts are discussed in Section 4.4.6.

Chapter 10: Air and Climate provides an assessment of air quality in relation to the Development.

4.3.6.6 Water Contamination

Contaminants such as sediments arising from the Development have the potential to contaminate water bodies designated for drinking water purposes and may cause ecological damage as well. Mitigations as set out in **Chapter 9: Hydrology and Hydrogeology** will prevent and reduce risk of contamination of waterbodies. The drainage design and surface

[20] *www.euro.who.int/en/health-topics/environment-and-health/air-quality/news/news/2014/03/almost-600-000-deaths-due-to-air-pollution-in-europe- new-who-global-report,* accessed 10th May 2021
[21] Irelands Environment 2016 – An Assessment', EPA, 2016, accessed 10th May 2021

water network are considered in terms of assimilative capacity, that is to dilute contaminants in receiving waterbodies as a ‘last line of defence’. Any contaminants will be treated when water is abstracted for drinking water purposes.

A review of the GSI well database indicates there are no mapped wells within the Site boundary. Governing industry guidelines stipulate a buffer zone of 250 m is required from boreholes used for drinking water abstraction. The closest mapped wells are more than 1 km from the boundary of the Site. All houses including wells are over 740 m from the Site and can be considered outside the 250 m buffer.

Chapter 9: Hydrology and Hydrogeology provides an assessment of the hydrological impacts in relation to the Development, including the potential for water contamination.

4.3.6.7 Traffic

It is proposed that the turbine nacelles, tower hubs and rotor blades will be landed at Ringaskiddy Port, County Cork and will be transported on the N22 to the site entrance.

Receptors considered as having ‘high’ sensitivity are primarily business premises which are directly on the N28 and N22 which have significant potential to generate traffic.

The sensitive receptors are assessed in **Chapter 15: Traffic and Transportation**.

4.3.6.8 Health Impact Studies

While there are anecdotal reports of negative health effects on people who live near operational wind farms there is no peer reviewed scientific research in support of these views. In contrast, several peer reviewed scientific research publications outlined below conclude that wind turbines are not related to adverse impacts on human health.

Frontiers in Public Health published a study[22] in 2014 on wind turbines and human health. This review summarised and analysed the science in relation to this issue specifically in terms of noise (including audible noise, low-frequency noise, and infrasound), EMF, and shadow flicker. The study noted that:

“*Based on the findings and scientific merit of the research conducted to date, it is our opinion that the weight of evidence suggests that when sited properly, wind turbines are not related to adverse health effects. This claim is supported (and made) by findings from a number of government health and medical agencies and legal decisions*”.

[22] L. D. Knopper, *et al*. (2014) *Wind turbines and human health*.

The National Health and Medical Research Council, Australia’s leading medical research body, concluded that there is no reliable or consistent evidence that wind farms directly cause human health problems as part of their Systematic Review of the Human Health Effects of Wind Farms published in December 2013. The review was commissioned to determine whether there is a direct association between exposure to wind farms and negative effects on human health or whether the association is casual, by chance or bias.

Objectors to wind farms often refer to wind turbine syndrome as a condition that can be caused by living in close proximity to wind farms. The symptoms allegedly include sleep deprivation, anxiety, nausea and vertigo. It has been rejected by the wind industry as there is no scientific backing to these claims. This Systematic Review of the Human Health Effects of Wind Farms began in late 2012 and included a literature and background review of all available evidence on the exposure to the physical emissions produced by wind turbines. These emissions were noise, shadow flicker and electromagnetic radiation produced by wind turbines. The review concludes that the evidence considered does not support any direct association between wind farms and human health problems and that confounding bias could be possible explanations for any reported association.

In general, there are no specific health considerations in relation to the operation of a wind turbine. The area surrounding the turbine base will still be available for use. Noise and Shadow Flicker are operational Health and Safety issues, which have been addressed in **Chapter 11: Noise** and **Section 4.6 below**.

4.3.6.9 Turbine Safety

Turbines pose no threat to the health and safety of the general public. The Department of the Environment, Heritage and Local Government (DoEHLG)’s ‘*Wind Energy Development Guidelines for Planning Authorities 2006’* state that there are no specific safety considerations in relation to the operation of wind turbines. Fencing or other restrictions are not necessary for safety considerations. People or animals can safely walk up to the base of the turbines. The DoEHLG Guidelines state that there is a very remote possibility of injury to people from flying fragments of ice or material from a damaged blade. However, most blades are composite structures with no bolts or separate components and the danger is therefore minimised. The build-up of ice on turbines is unlikely to present problems. The wind turbines will be fitted with anti-vibration sensors, which will detect any imbalance caused by icing of the blades. The sensors will prevent the turbine from operating until the blades have been de-iced.

Turbine blades are made of fibre-reinforced polymer or unsaturated polyester, a non-conducting material which will prevent lightning strikes. Lightning protection conduits will be integral to the construction of the turbines. Lightning conduction cables, encased in protection conduits, will follow the electrical cable, from the nacelle to the base of the turbine. The conduction cables will be earthed adjacent to the turbine base. In extremely high wind speed conditions, (usually at Beaufort Storm Force 10 or greater) the turbines will shut down to prevent excessive wear and tear, and to avoid any potential damage to the turbine components.

4.3.7 Property Value

There are currently no Irish studies undertaken to assess the impact of wind farms on property prices. However, a number of studies have been undertaken in the UK, with findings set out in **Table 4.5**.

A study on 'the effect of wind farms on house prices' was undertaken in 2014 by the Centre of Economic Research. The study found that house prices were driven by the property market and not the presence or absence of wind farms[23]. Another study on 'Valuing the Visual Impacts of Wind turbines through House Prices' was undertaken in 2014 by the London School of Economics and it found the presence of wind farms negatively impacted property values within 2 km of very large wind farms[24]. However, in 2016, following on from the contrasting results of the two 2014 studies, ClimateXChange carried out their own research in Scotland. The ClimateXChange study found no significant effect on the change in price of properties within 2 km or 3 km, and found the effect to be positive[25]. This study also found that some wind farms can provide economic and amenity benefits to an area. The Development will include for the upgraded tracks that can be used by walkers within the Coillte owned areas of the Site and will provide a significant community benefit fund for the local area.

[23] https://cdn.ymaws.com/www.renewableuk.com/resource/resmgr/publications/reports/ruk-cebr-study.pdf [Accessed 27/01/2022]
[24] http://eprints.lse.ac.uk/58422/1/__lse.ac.uk_storage_LIBRARY_Secondary_libfile_shared_repository_Content_SERC%20discussion%20papers_2014_sercdp0159.pdf [Accessed 27/01/2022]
[25] Heblich, D. S., Olner, D. D., Pryce, P. G. & Timmins, P. C., 2016. *Impact of wind turbines on house prices in Scotland,* Scotland: ClimateXChange. [Accessed 27/01/2022]

Table 4.5: Summary of Research findings between Wind Farms and Property Values

Year	Country	Research Group	Finding
2014	UK	Centre of Economic Research	In summary the analysis found that country-wide property market drives local house prices, not the presence or absence of wind farms; and The econometric analysis established that construction of wind farms at the sites examined across England and Wales has not had a detectable negative impact on house price growth within a 5 km radius of the sites.
2014	UK	London School of Economics	There was an average reduction in the value of houses (based on 125,000 house sales between 2000 and 2012) of between 5% and 6% within 2 km of very large wind farms.
2016	UK (Scotland)	ClimateXChange	Following a wide range of analyses, including results that replicate and improve on the approach used in the 2014 study by London School of Economics, the study did not find a consistent negative effect of wind turbines or wind farms when averaging across the entire sample of Scottish wind turbines and their surrounding houses. Most results either show no significant effect on the change in price of properties within 2 km or 3 km or find the effect to be positive. Some wind farms provide economic or leisure benefits (e.g. community funds or increasing access to rural landscapes through providing tracks for cycling, walking or horse riding)

4.3.8 Natural Disasters and Major Accidents

A wind farm is not a recognised source of chemical pollution. Should a major accident or natural disaster occur, the potential sources of pollution onsite during both the construction and operational phases are limited. Sources of chemical pollution with the potential to cause significant environmental pollution and associated negative effects on health include bulk storage of hydrocarbons or chemicals and storage of wastes. Spills and leaks can occur if they are not mitigated against which may cause negative effects to human health, if contamination of food or water occurs. The occurrence of such spills and leaks is unlikely as bunding and safe storage practices will be complied with. **Chapter 16: Major Accidents and Natural Disasters** and **Appendix 2.1: Construction Environmental Management Plan** discusses this in more detail. The Site is not regulated under the Control of Major Accident Hazards Involving Dangerous Substances Regulations i.e., SEVESO sites and so there is no potential effect from this source. All SEVESO sites are located 30 km or more from the Development.

There is limited potential for significant natural disasters to occur at the Site. Ireland is a geologically stable country with a mild temperate climate. The potential natural disasters that may occur are therefore limited to peat-slide, flooding, fire and their increased risk due to climate change.

With reference to **Chapter 8: Soils and Geology, Section 8.3.3.** The proposed infrastructure will be located on Devonian sandstone, namely Gun Point Formation which is comprised of Green-grey sandstone & Purple siltstone. Sandstone is usually within the range of Weak (5-25 Mega Pascals) to Medium Strong (25-50 MPa) and Siltstone is usually within the range of Very Weak (1-5 MPa) to Weak (5-25 MPa).

Geological features and destructive fault lines associated with the above-mentioned Formations give rise to the character of the topography at the Site. This has resulted in areas with steep slopes and/or complex topography densely populated with bedrock outcrops. Bedrock proximal to these fault lines will likely be fractured and/or weathered.

The Peat Stability Assessment Risk Ranking ranged from *'Very Low'* to *'Moderate'*. The risk of peat-slide is further addressed in **Chapter 8: Soils and Geology**. A Peat and Spoil Management Plan has been prepared in **Appendix 2.1**.

There are no recorded localised flood events within the immediate area of the Site. A Surface Water Management Plan has been put in place and can be found in **Appendix 2.1**. The risk of flooding is addressed in **Appendix 9.1: Flood Risk Assessment**.

A 2020 article in Wind Power Engineering Magazine estimated that 1 in 2,000 wind turbines catch fire each year[26]. Overall, the data shows that wind turbine fires are relatively rare[27]. It is therefore considered that the risk of significant fire occurring, affecting the wind farm and causing the wind farm to have significant environmental effects is negligible.

As described earlier, there are no significant sources of pollution in the wind farm with the potential to cause environmental or health effects. Also, the spacing of the turbines and distance of turbines from any properties limits the potential for impacts on human health. The issue of turbine safety is addressed in **Section 4.3.6.9**.

4.4 ASSESSMENT OF POTENTIAL IMPACTS

4.4.1 'Do-Nothing' Scenario

If the Project was not to proceed, the existing uses of the site for agriculture and commercial forestry would continue. The opportunity to capture a renewable green energy supply would be lost, as would the opportunity to contribute to Ireland's 2050 target of net-zero emissions. The opportunity to generate local employment and tourism would also be lost.

4.4.2 Population and Settlement Patterns (including Irish Language and Residential Amenity)

The Development does not contain a housing or services element and is not considered to have any direct, long term, positive or negative impact on the local or regional population levels. However, construction workers (25 workers at the peak of the construction phase) who are not based locally may temporarily relocate to the region for the project duration of 21 months, this is more likely for the initial construction and decommissioning phase than for the operational phase. The overall impact is considered to be imperceptible in terms of population.

The predicted effect on the immediate settlement patterns and social patterns is also slight to non-existent. There is, however, the benefit which will accrue to the region in terms of the ability to provide electricity to industry and business via a high-quality supply. This will lead to the region becoming more attractive to business with the subsequent benefit of increased employment opportunities in the region. A renewable, green energy supply will be attractive for companies looking to develop in County Cork.

[26] https://www.windpowerengineering.com/is-rope-based-descent-emergency-evacuation-at-the-end-of-its-tether/ [Accessed 27/01/2022]
[27] https://www.firetrace.com/fire-protection-blog/wind-turbine-fire-statistics [Accessed 27/01/2022]

During the construction phase there is the potential for limited impacts on the residential amenity of the local population. These will be short-term impacts relating primarily to an increase in construction traffic causing noise, dust, and an increase in traffic volume. The impacts of each on nearby properties have been found to be slight negative in the construction and decommissioning phases and imperceptible in the operational phase (see **Chapter 10: Air and Climate**, Sections 10.2.7; **Chapter 11: Noise and Vibration**, Section 11.4; and **Chapter 15: Traffic and Transportation**, Section 15.5.

The Project will see 25 persons working on the Project during the peak of the construction phase, two during the operation phase and 10 persons during the decommissioning phase. While the Project is not likely to result in a marked increase in settlement in the area, or a change in social patterns in the area, it will provide a renewable energy source which will prove attractive to certain types of industry depending on national and global economic conditions.

The Project is located within the Múscraí Gaeltacht area. While the construction phase will see the arrival of construction workers to the area, this will be a short-term occurrence and will not result in permanent settlement of the area by non-Irish speakers. The Project is, therefore, predicted to result in a negligible, indirect, not significant impact on the Irish language and cultural heritage of the Gaeltacht during the construction phase. Please see **Chapter 14: Cultural Heritage** for more details.

The overall impact of the construction and decommissioning phases on population and settlement patterns is predicted to be slight positive and short-term in nature should construction workers relocate to the area for the duration of these phases. The overall impact during the operational phase is predicted to be slight positive at the local level in terms of settlement patterns where increased business is attracted to the region.

4.4.3 Economic Activity

During the construction phase, there will be economic effects resulting from the expenditure on items such as Site preparation, Site Access Roads, purchase and delivery of materials, plant, equipment and components. Information provided by the Developer based on experience at other wind farms and various reports outlined in Section 4.4.4 indicates that there is expected to be a peak onsite workforce of maximum 25-workers. Some of these workers will be sourced from the local labour market where possible in Study Area 2 and Study Area 3, but professional and skilled personnel may be required to be sourced from areas across Ireland or further afield.

During the initial decommissioning and construction phase, jobs are likely to be created. Local employment will be provided, as well as employment on local, national and international levels both directly and indirectly. International employment will involve the manufacturing of wind turbines and the shipment of these components to Ireland. Throughout the project lifetime, employment will be both created and maintained on local, regional, national and international levels.

It is envisaged that labour and materials will be sourced from the local area during construction where possible (See **Chapter 15: Traffic and Transportation**). Ready-mix concrete will also be sourced from local suppliers (See **Chapter 15: Traffic and Transportation),** again subject to authorisation, and to quality and quantity being available.

Employees involved in the construction of the Development will most likely use local shops, restaurants and hotels/accommodation. Therefore, overall, there will be a slight, positive impact on employment in the locality. Employees also involved in the subsequent operation and decommissioning of the Development will use local shops, restaurants and hotels/accommodation.

BVG Associates carried out extensive assessments on the economic benefits from eight onshore wind farms in Southwest Scotland[28]. Each contract value was assigned to one or more relevant elements of a supply chain. Capital expenditure (CAPEX) was found to relate to turbine, civil works and electrical works supply chains, whereas the operational expenditure (OPEX) relates to transmission operations, maintenance and service (OMS) supply chain, the wind farm OMS and also the decommissioning supply chain.

Based on this research and the 28 to 33 MW range of capacity proposed for this project, the CAPEX for the Development is estimated to be approximately €65 to €75 million. This expenditure will result in economic benefit at a national, regional and local level. The OPEX in nominal terms is estimated to be €75 to €90 million. The BVG report found, for the eight projects studied, that 66% of the total project spend (CAPEX & OPEX) was retained within the National economy, 17% of the total was retained in the local region hosting the project.

Cork County Council will benefit from payments under both the Development Contribution Scheme and from annual rate payments. The Applicant is also committed to a 'Community Benefit' package. This package will be advertised annually and managed by the local community or an independent body on behalf of the local community. The purpose of the

[28] Economic Benefits from onshore wind farms, September 2017, BVG Associates, accessed 18/05/21

community fund is to enable the local community to share in the benefits of the Development. FuturEnergy Ireland and SSE's community benefits funds typically support local projects, with funds allocated to projects from all aspects of the community.

The overall impact on economic activity is predicted to be a moderate, positive, short-term impact during the construction phase of the Development and moderate, positive and long-term during the operational phase. There will be similar effects to the construction phase during decommissioning.

4.4.4 Employment

The employment effects that are attributable to the Development can be outlined as direct, indirect and induced.

Direct: Employment and other economic outputs that are directly attributable to the delivery of the Development. These include any new jobs that are created to manage and supervise the construction phase, operational and decommissioning phases of the Development and that are filled by employees of the Developer or the appointed Contractor (or sub-contracted employees).

Indirect: Employment and other outputs created in other companies and organisations that provide services to the Development, (i.e. procurement and other supply chain effects). Most manufactured materials like towers, blades and subcomponents are assumed to be imported (import intensity of 66%) with major infrastructure delivery through Ringaskiddy Port; fewer indirect manufacturing jobs will be generated domestically in Ireland.

Induced: Additional jobs and other economic outputs that are created in the wider economy, as a result of the spreading of employee incomes and other ripple effects that occur as a result of the direct and indirect effects of the Development.

Sustainable Energy Authority of Ireland (SEAI) researched the flow of investment and sales revenue from onshore wind and the transmission grid through the different industrial sectors in the supply chain required for input–output macro-analysis (**Table 4.6**).

Table 4.6: Capital Investment breakdown for onshore wind supply (Source SEAI, 2015 [29])

	Industrial Sectors
€192 million average annual capital investment to reach 2020 NREAP/NEEAP targets	Manufacturing (70%): turbines, blades, towers, gearbox, generator, electrical equipment, transformer etc.
	Construction (12%)
	Electricity Supply Services (10%)
	Transport (2.5%)
	Finance (2.5%)
	Professional Services (3%)

In terms of its capacity to capture capital investment domestically, Ireland has strong indigenous feasibility, planning, foundations and engineering expertise, with the skills and knowledge base to potentially supply niche markets in controls and instrumentation, albeit the bulk of heavy manufacturing (blades, towers) is imported. Similarly, the Irish supply chain is very well positioned in all of the preliminary design and operational aspects of the electricity grid, providing a significant boost to national employment. However, some manufactured materials such as cables, underground pipes, insulators and conductors are sourced from abroad.

According to SEAI, there are 0.34 new long-term jobs per MW, which falls in line with European Wind Energy Association (EWEA) estimates for direct employment in Europe. In the case of the Development, this translates to 9-11 new long-term jobs for a 28 – 33 MW powered installation.

According to Institute for Sustainable Futures document (2015)[30], 3.2 jobs are created per MW of wind energy development during the construction and installation phase, the report assumes a 2-year construction period. Based on this employment estimate and a twenty-one-month construction phase, between 78 and 92 jobs could be created during the construction phase (for an installed capacity of between 28 – 33 MW).

[29] A Macroeconomic Analysis of Onshore Wind Deployment to 2020 An analysis using the Sustainable Energy Economy Model, SEAI, 2015. [Accessed Online 29/06/2022] Available at: https://www.seai.ie/publications/A-Macroeconomic-Analysis-of-Onshore-Wind-Deployment-to-2020.pdf

[30] Institute for Sustainable Futures, Calculating Global Energy Sector Jobs – 2015 Methodology Update, 2015. [Accessed Online_27/06/2022] Available:https://opus.lib.uts.edu.au/bitstream/10453/43718/1/Rutovitzetal2015Calculatingglobalenergysectorjobsmethodology.pdf

According to the European Wind Energy Association's (EWEA) Report 'Wind at Work' (2009)[31], 1.2 jobs per MW are created during installation of wind energy projects based on 1 year construction period. Using this figure, a projection of between 59 and 69 jobs could be created as a result of the construction of the Development (for an installed capacity of between 28 – 33 MW and a construction period of 1 year).

The Sustainable Energy Authority of Ireland' 2015 report 'A Macroeconomic Analysis of Onshore Wind Deployment to 2020'[32] puts direct construction jobs from wind farm developments at 1.07 jobs per MW based on 1 year of construction. Using this figure, a projection of between 52 and 62 jobs could be created as a result of the construction of the Development (for an installed capacity between 28 – 33 MW and a construction period of twenty-one months). Therefore, considering the minimum and maximum figures, it is estimated that between 52 and 92 direct and indirect jobs could be created during the construction phase of the proposed project. It is not expected that all of these jobs will be based at the wind farm Site, however, the employment of tradespeople, labourers, and specialised contractors for the construction phase will have a direct, short-term significant, positive impact on employment in the study area.

An estimated breakdown of the potential construction employment is as follows:

Table 4.7: Estimated Employment breakdown during the construction phase of the Development

Occupation/Task	No. of People	Employment Period
Foundation team	eight	20 weeks
Roads (truck drivers)	four	40 weeks
Plant drivers	two	48 weeks
Foreman	one	84weeks
Senior Engineer	one	84 weeks
Junior Engineer	one	15 weeks
Substation Civils	five	24 weeks
Substation electrical	seven	16 weeks
Foreman	one	15 weeks
General operatives	one	84 weeks

[31] European Wind Energy Association (EWEA) (2009), Wind at Work, - Wind Energy and Job Creation in the EU [Accessed Online: 27/06/2022] available at: http://www.ewea.org/fileadmin/files/library/publications/reports/Wind_at_work.pdf

[32] Sustainable Energy Authority Ireland (SEAI) (2015), A Macroeconomic Analysis of Onshore Wind Deployment to 2020. [Accessed Online: 27/06/2022]. Available at: https://www.seai.ie/publications/A-Macroeconomic-Analysis-of-Onshore-Wind-Deployment-to-2020.pdf

A total of 25 persons will be employed on site during the peak of the construction phase of civil engineering of access Roads, crane hardstand, turbine foundation, and substation construction. These numbers will be somewhat less for the turbine delivery, assembly and commissioning activities. A mixture of skills will be required, including unskilled/semi-skilled/skilled manual (construction labour and machine operators), non-manual (administration roles), managerial and technical (civil, electrical, mechanical technical and engineering) and professional roles (scientific, engineering, legal, business and accounting). The manual roles will be Site-based with the other roles being predominately office-based, with Site visits as and when required. During construction, personnel will be at the Site over a number of months and during these times will likely use local accommodation and restaurants and other facilities.

There will be 10 workers required for the decommissioning phase including engineer/ supervisor, crane drivers, plant drivers, banksman, HGV drivers, safety officer, wind turbine technician and general operatives.

Anecdotal evidence received by the Developer on other wind farm construction projects shows that local businesses such as accommodation providers welcome the enhanced level of occupancy that is achieved due to the construction contractors using their accommodation on a year-round basis, including periods of the year that are traditionally considered 'low season'. This is supported by the Edf-re.uk study which found the local benefits from wind farm construction projects included:
"*using local contractors, developing businesses to build wind farm technology, and supporting the workforce with food, accommodation and amenities*"[33]

The benefits of increased business, although temporary, can allow businesses to invest in improvements that would not otherwise be affordable, leading to a long-term enhancement.

Whilst assessment of potential effects on the tourism economy are considered in **Section 4.4.5** to be negligible and not significant, the benefits to individual businesses will be substantial and significantly positive.

The Project will create two full-time jobs during the operational phase. In addition to these jobs, various personnel will be required for the successful and continued operation of the wind farm. During the operation phase of the wind farm, the operation and reliability,

[33] Edf-re.uk [accessed 29/06/2022] available at: https://www.edf-re.uk/local-community/community-benefits#economy

maintenance (turbines, civil works and electrical infrastructure) finance, ongoing compliance with permissions and permits, safety, security, community relations and benefits and land-owner agreements must be continually managed. These requirements are widely distributed over various employment sectors and are an integral part of the ongoing operation of the Project and will provide continuous employment for the lifetime of the wind farm. A general outline of the employment associated with the operational phase of the wind farm is outlined in **Table 4.8.**

Table 4.8: Parties involved during the operational phase[34]

Maintenance Contracts	Financial and Services Contracts	Other Stakeholders
Project Manager	Lenders	Local Community
Asset Management	PPA Provider	Local Authority (incl. rates payments)
Turbine Contractor • Transport Companies • Crane Hire • Plant and Vehicle Hire • Site Facilities	Landowner Agreements	Construction and Maintenance material suppliers: • Local shops • Food providers • Accommodation providers
	Insurance	Plant Hire companies
	Accountancy	Telecom provider
	Safety Consultants	
	Community Liaison Officer	
Electrical Works Contractor	Environmental Monitoring • Noise • Ornithology • Habitat Management	
Civil Works Contractor		
Utility		

The persons fulfilling these roles may live and work anywhere in Ireland, visiting the Site as and when required, to operate and maintain the plant and equipment. During major service operations, personnel may be at the Site over several days and during these times may use local accommodation and restaurants.

Overall, there will be a slight positive short-term impact on employment in the area during construction and decommissioning and a long-term positive impact on employment in the area during the operation phase.

[34] Irish Wind Energy Association (2019) *Life-cycle of an Onshore Wind Farm*. Ionic Consulting. Available online at: https://www.iwea.com/images/files/iwea-onshore-wind-farm-report.pdf [Accessed 13/11/2019]

4.4.4.1 Embedded measures

The Developer has a long track record of developing wind farms in Ireland and experience from previous wind farm construction projects is that expenditure in local goods and services is widely spread and makes a difference to existing businesses. A study by KPMG on behalf of Wind Energy Ireland in 2021 confirms this[35]. The Developer is committed to employing good practice measures with regard to maximising local procurement and will adopt measures such as those set out in the Renewable UK Good Practice Guide, 2014: 'Local Supply Chain Opportunities in Onshore Wind' (Renewable UK, 2014).

The Developer will work with a variety of contractors who will be actively encouraged to develop local supply chains throughout the local area, and work with subcontractors to invest in training and skills development.

At this stage in the development process, it is not possible however, to quantify economic benefits in respect of individual supply chain companies, as contracts would not be offered until consent is granted. However, it is evident from the Developer's recent experience that local and regional suppliers of a wide range of goods and services will benefit from such a Development (in this case, Cork, Kerry and Ireland as a whole).

4.4.5 Land Use

Prior to the grid connection installation works within public roads, it is proposed that all access points (domestic, business, farm) are considered when finalising the temporary road closures and diversions to maintain local access as much as possible and avoid impacts on various land uses.

With reference to **Chapter 8: Soils and Geology,** peat depth across the site is generally very shallow to shallow with the exception of isolated pockets of moderately deep pnorth-west of the site. There was no very deep peat observed at the site. There is a relatively extensive area of deep peat north of proposed location for T1 and the associated access track. The footprint of the proposed development avoids this area. The Risk Ranking at peat probe locations is generally Very Low to Low with the exception of Moderate or High-risk point locations associated with deeper peat and/or steeper inclines and/or close proximity to sensitive receptors. Similarly, the Risk Ranking for Subsoil Stability at trial pit locations is generally Very Low to Low. An Emergency Response Plan has been included in **Appendix 2.1: Construction Environmental Management Plan**.

[35] Economic impact of onshore wind in Ireland, KPMG for Wind Energy Ireland, 2021. [Accessed Online: 29/06/2022] Available at: https://windenergyireland.com/images/files/economic-impact-of-onshore-wind-in-ireland.pdf

4.4.6 Tourism

The impact upon tourism was considered within this section through the sensitivities of Hospitality, Safety and Pace of Life

Fáilte Ireland published guidelines in 2011 for the treatment of tourism in an EIS, which describes the effects of wind farm projects on tourism. Many of the issues covered in the report are similar to those covered in this EIAR, for example, scenery is assessed in **Chapter 12: Landscape and Visual Amenity**.

Fáilte Ireland published a study on 'Visitor Attitudes on the Environment' in 2012[36] to assess the perceived impacts of wind farms on potential future visits to an area. The study found that 12% of those surveyed, responded that wind farms would have 'a strong positive impact' on their decision to visit Ireland, with 27% responding it would have a 'slight positive impact', whilst 38% said it would have 'no impact'. 7% of respondents stated it would have a 'strong negative impact' and 15% stated it would have a 'slight negative impact'. The survey also found that wind farms were noted as more favourable than other forms of development such as housing, mobile phone masts or electricity pylons.

Based on historical examples and findings of the BiGGAR Economics report (mentioned in **Section 4.3.5.3**) there is not expected to be any direct relationship between the tourism sector growth and this Project.

A small section of the grid route (640 m) is located along the Beara to Breifne Way. Works along this section will take up to seven days to complete. Pedestrian access will be maintained during the construction and decommissioning phases and works will be completed outside peak tourist season where possible. Due to the small-scale and temporary nature of the works there will be a short-term, slight, negative impact on tourism during the construction and decommissioning phases.

It is also proposed that waymarking and public information signage will be installed to facilitate the public use of routes in and around the Site once works are complete. The upgrading of existing roads and the development of new roads will allow access to the area for walkers/mountain bikers within the parts of the wind farm site located on Coillte lands. Coillte's Open Forest policy also means walkers will have full access to the forestry and tracks once construction work is complete.

[36] Fáilte Ireland (2012) Visitors Attitudes on the Environment – Wind Farms - https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/4_Visitor_Insights/WindFarm-VAS-(FINAL)-(2).pdf?ext=.pdf [Accessed on 13/11/2019]

Based on the findings of the assessment of tourism in the area and the potential impacts, it was considered that the Project will not give rise to any significant effects on tourism. The overall effects of the Project with regards to tourism for both construction and decommissioning are considered short-term, slight, negative. There will be a long-term, slight positive impact during operation due to the provision of new tracks, information boards and waymarking.

4.4.7 Human Health

4.4.7.1 Electromagnetic fields

Electromagnetic fields from wind farm infrastructure, including the grid connection and substation, are very localised and are considered to be an imperceptible, long-term impact.

4.4.7.2 Shadow flicker

Section 4.6 provides an impact assessment of shadow flicker from the Project.

4.4.7.3 Noise

The construction process associated with wind farms is not considered intensive and is temporary works, most of which is carried out a considerable distance from receptors. The main noise sources will be associated with the construction of the turbine foundations, turbine hardstands, grid connection, extraction and processing in the borrow pit location, with lesser sources being site access roads, construction of a 38 kV substation and compound and works at turbine delivery nodes. Accessing stone material from the borrow pit will significantly reduce road traffic flow on local roads. The main construction traffic to Site will be due to a very short period where trucks will deliver stone around the Site and ready-mix trucks deliver concrete for the turbine bases. The delivery of turbines by large trucks travelling at very low speed will generate very low levels of noise.

The effects of noise and vibration from onsite construction activities are not considered significant. The effects for Decommissioning will be similar to construction but of shorter duration (See Chapter 11, Section 11.4.1).

Predicted operational noise limits from the Project are within the noise limits set out in the Wind Energy Development Guidelines 2006 and are imperceptible. (see **Chapter 11: Noise and Vibration**, Section 11.4.3).

Noise effects during decommissioning of the Project are likely to be of a similar nature to that during construction but of shorter duration. Existing roadways and turbine bases (excluding plinths) will be left in place and naturally vegetated over. Any legislation, guidance or best practice relevant at the time of decommissioning will be complied with.

4.4.7.4 Air Quality

Chapter 10: Air and Climate provides an assessment of air quality in relation to the Project. The impact assessment concludes that:

The effect of the Project on air quality will be imperceptible over the short-term period in which there will be an increase in traffic movements during construction and decommissioning. There will be slight, long term, positive effects on air quality because of the wind farm during operation.

Overall, the air quality impacts of the Project on Human Health will be a long term, positive effect on human health.

4.4.7.5 Water Contamination

Chapter 9: Hydrology and Hydrogeology provides an assessment of the hydrological impacts of the Project, including the potential for water contamination.

Water contamination could potentially occur during the construction and the decommissioning phases from the release of suspended solids, accidental spillages of cement, hydrocarbons or HDD fluid. Once mitigation measures are implemented the risk of water contamination will be significantly reduced. However, there remains a level of risk and therefore both precautionary measures and emergency response protocols have been established and specified in Management Plans 1 and 3 of the CEMP, **Appendix 2.1**.

4.4.7.6 Traffic

Chapter 15: Traffic and Transportation provides an assessment of the traffic impacts in relation to the Project.

The assessment concludes that: the Project has generally been assessed as having the potential to result in a negative, slight/moderate, direct, short-term, high probability effect during the construction and decommissioning phases and, imperceptible during the operational phase. After mitigation, the residual effects have been assessed as minor to negligible, negative and short-term in nature during the construction phase, imperceptible during the operational stage and slight, negative, direct, high probability and short-term in nature during the decommissioning phase.

It is possible that a blade (or set of blades) could require replacement if damaged by lightning on one of the surrounding operational or planned Wind Farms. Should this coincide with the construction period for the Development, then there is the potential for cumulative transport affects. However, these are considered as being of low probability, slight impact and of short duration.

4.4.8 Property Value

Based on the available published studies the operation of a wind farm at the Site will not significantly impact on property values in the area as discussed in Section 4.3.7. The Project will have a long-term imperceptible impact on property values.

4.4.9 Natural disaster and major accidents

Chapter 16: Major Accidents & Natural Disasters provides an assessment of the vulnerability of the Project to major accidents and natural disasters. Possible risks associated with the Project during the construction, operation and decommissioning phases are outlined and assessed. The consequence ratings assigned to each potential risk assumes that all proposed mitigation measures and safety procedures have failed to prevent the major accident and/or disaster. All scenarios when assessed were considered "low risk".

4.5 MITIGATION MEASURES AND RESIDUAL EFFECTS

Although no negative potential impact of significance has been established, there are a number of measures, which will be implemented for the safety of workers and the public during the construction, operational and decommissioning phases.

4.5.1 Embedded Mitigation

The Project, as described in **Chapter 2: Project Description**, incorporates good practice measures for limiting adverse effects of the construction works. The principal potential effects on human health arising from works tend to relate to construction traffic affecting the use of National roads, local primary roads and access roads by the general public and drainage. Measures are set out in **Chapter 15: Traffic and Transportation** relating to how delivery of goods and services will be managed during works to minimise impacts and details of mitigations and the use of Sustainable Drainage Systems can be found in **Chapter 9: Hydrology and Hydrogeology**. The proposed mitigation measures have been further developed in the **Construction and Environmental Management Plan (CEMP)** (**Appendix 2.1**).

4.5.2 Population and Settlement Patterns

Given that no negative impacts have been identified, no mitigation measures are proposed.

4.5.3 Economic Activity

Allowing for the implementation of embedded mitigation (section 4.4.3.1 above), no significant effects have been identified in respect of socio-economic receptors arising from the construction of the Project and therefore no mitigation measures are required to reduce or remedy any adverse effect.

4.5.4 Employment

Given that potential impacts of the Project at construction, operation and decommissioning phases are predominantly positive in respect of socio-economics, employment and economic activity, no mitigation measures are considered necessary.

4.5.5 Land Use

Mitigation measures for land use have been incorporated into the preliminary design stage. This has allowed for the prevention of unnecessary or inappropriate ground works or land use alterations to occur.

In this regard, the construction and operational footprint of the Project has been kept to the minimum necessary to avoid impact on existing land uses. Furthermore, existing forestry tracks have been incorporated into the design to minimise the construction of new Site Access Roads and minimise the removal of forested areas. New Site Access Roads have been sensitively designed to minimise impact on forestry. Electricity cables will be installed underground in or alongside Site Access Roads to avoid and minimise negative impact. The construction and decommissioning works will be planned and controlled by a Construction and Environmental Management Plan (CEMP). This provides details on day to day works and methodologies. As part of these works, the public and other stakeholders will be provided with updates on construction activities which will affect access to lands. This will be communicated to members of the public through a community liaison officer employed for the duration of the construction period.

Chapter 15: Traffic and Transportation will be referred to for all proposed works and deliveries along the turbine delivery route to avoid undue impact to adjacent land uses.

4.5.6 Tourism

Mitigation measures for recreation, amenity and tourism are primarily related to the preliminary design stage of the Project, which has allowed for the prevention of unnecessary or inappropriate development to occur that will significantly affect any recreational or tourist amenity. In designing the Project, careful consideration was given to the potential impact on landscape amenity and setback distances from sensitive receptors.

There are no existing walkways or trails located on Site. A section of the grid route (640 m) is located along the Beara to Breifne Way. Pedestrian access will be maintained during the construction and decommissioning phases and works will be completed outside peak tourist season where possible. In providing for public safety, appropriate signage and safety measures will be put in place during construction and decommissioning activities.

4.5.7 Human Health and Safety

4.5.7.1 *Construction and Decommissioning*

To maintain safety and avoid health impacts on construction workers and the general public, best practice site safety and environmental management will be maintained. The Development will be designed, constructed, operated and decommissioned in accordance with the following:

- Safety, Health & Welfare at Work (Construction) Regulations 2013 as amended
- Safety, Health & Welfare at Work Act 2005, and
- Safety, Health & Welfare at Work (General Applications) Regulations 2007 as amended

All construction staff will be adequately trained in health and safety and will be informed and aware of potential hazards.

All hazards will be identified, and risks assessed. Where elimination of the risk is not feasible, appropriate mitigation and/or control measures will be followed. The contractor will be obliged under the construction contract and current health and safety legislation to adequately provide for all hazards and risks associated with the construction phase of the project.

Safe Pass registration cards are required for all construction, delivery and security staff. Construction operatives will hold a valid Construction Skills Certificate Scheme card where required. The Developer is required to ensure a competent contractor is appointed to carry out the construction works. The Contractor will be responsible for the implementation of procedures outlined in the Safety & Health Management Plan.

In relation to COVID-19, up to date Health Service Executive guidance will be consulted regularly in line with Health and Safety Authority recommendations and all reasonable on-site precautions will be taken to reduce the spread of COVID-19 on construction sites, should the virus be prevalent at the time of construction.

Once mitigation measures and health and safety measures are followed, the potential for impact on human health on the construction site during construction and decommissioning is expected to be not significant and temporary to short-term.

Public safety will be addressed by restricting access to the public in the vicinity of the site works during the construction and decommissioning stage. The construction site will be temporarily closed in sections to the public for the twenty-one-month construction period as well as the decommissioning period. This measure aims to avoid potential injury to members of the public as a result of construction activities.

Appropriate warning signage will be posted at the construction site entrance, directing all visitors to the site manager. Appropriate signage will be provided on public roads approaching site entrances and along haul routes.

In relation to the turbine delivery route, extra safety measures will be employed when large loads are being transported, for instance, Garda escort will be requested for turbine delivery and a comprehensive turbine delivery plan will be utilised to avoid potential impact to human safety for road users and pedestrians.

Once mitigation measures and health and safety measures are implemented and followed, the potential for impact on human health for members of the public during construction and decommissioning of the proposed project is expected to be not significant and temporary to short-term.

4.5.7.2 Operation

For operation and maintenance staff working at the proposed wind farm, appropriate site safety measures will be utilised during the operational phase by all permitted employees. All personnel undertaking works in or around the turbines will be fully trained and will use appropriate Personal Protective Equipment (PPE) to prevent injury.

Equipment within high voltage substations presents a potential hazard to health and safety. The proposed substation will be enclosed by palisade fencing and equipped with intruder and fire alarms in line with ESB and EirGrid standards.

All electrical elements of the Project are designed to ensure compliance with electro-magnetic fields (EMF) standards for human safety.

All on-site electrical connections are carried by underground cable and will be marked out above ground where they extend beyond the track or hardstanding surface. Details of cables installed in the public road will be available from ESBN.

Lightning conductors will be installed on each turbine as all structures standing tall in the sky require this protection. Turbines specifically require this to prevent power surges to electrical components. Turbines will be fitted with ice detection systems which will stop the turbine from rotating if ice is forming on a turbine blade. This aims to prevent ice throw.

Rigorous statutory and engineering safety checks imposed on the turbines during design, construction, commissioning and operation will ensure the risk posed to humans is negligible. 24-hour remote monitoring and fault notifications are included as standard in the Turbine Operations and Maintenance Contracts. A Supervisory Control and Data Acquisition ("SCADA") system will monitor the Development's performance. If a fault occurs, then a message is automatically sent to the operations personnel preventing emergency situations. In addition to scheduled maintenance, the maintenance contracts will allow for call out of local engineers to resolve any issues as soon as they are picked up on the remote monitoring system.

Access to the turbines inner structure will be locked at all times and only accessed by licenced employees for maintenance.

In line with the Health Service Executive's Emergency Planning recommendations, any incident which may occur at the site which requires emergency services, incident information will be provided in the 'ETHANE' format:

- Exact location;
- Type of incident;
- Hazards Access and egress;
- Number of casualties (if any) and condition, and
- Emergency services present and required

4.5.8 Major Accidents and Natural Disasters

The design of the Project has considered the susceptibility to natural disasters. The proposed site drainage will mitigate against any potential flooding risk due to run off with the use of Sustainable Drainage Systems (SuDS). Construction drainage will be left in-situ for the lifespan of the project through to decommissioning.

The Contractor's fire plans are reviewed and updated on a regular basis. A nominated competent person shall carry out checks and routine maintenance work to ensure the reliability and safe operation of firefighting equipment and installed systems such as fire alarms and emergency lighting. A record of the work carried out on such equipment and systems will be kept on site at all times.

Shadow flicker detection systems will be installed on all turbines to manage occurrence of shadow flicker on nearby receptors.

4.5.9 Property Value

Given that potential impacts of the Project at construction, operation and decommissioning phases are a long-term imperceptible impact in respect of property value no mitigation measures are considered necessary.

4.5.10 Residual Risk

Once the above mitigations are taken into account, the residual risk on population and human health is assessed to be an imperceptible, long-term effect.

4.6 CUMULATIVE EFFECTS

For the assessment of cumulative impacts, any other existing, permitted or proposed developments (wind energy or otherwise) have been considered where they have the potential to generate a significant incombination or cumulative impact with the construction and operational phases of this Project. Further information on projects considered as part of the cumulative assessment are given **Chapter 2 Appendix 2.4**. The impacts with the potential to have cumulative impacts on population and human health, in particular noise, air and climate, traffic, material assets and visual impacts are addressed in their relevant chapters of this EIAR.

4.7 SUMMARY OF SIGNIFICANT EFFECTS

The assessment has not identified any likely significant effects from the Project on its own or in combination with other projects on population and human health.

4.8 STATEMENT OF SIGNIFICANCE

This chapter has assessed the significance of potential effects of the Project on population and human health. The Project has been assessed as having the potential to result in effects of a slight positive, long-term impact overall. Through the implementation of mitigation measures, the cumulative effects associated with the Project are predicted to be not significant.

4.9 SHADOW FLICKER

This section comprehensively assesses the potential shadow flicker effects of all scenarios within the Turbine Range. The potential impacts that could arise from the Project during the construction, operation and decommissioning phases relate to potential shadow flicker impacts during operation. No shadow flicker will occur during the construction or decommissioning phases.

A shadow flicker computer model was used to calculate the occurrence of shadow flicker at all relevant receptors to the Project. The output from the calculations is analysed to identify and assess potential shadow flicker impacts. This is further detailed in **Appendix 4.1a** to **d**. Where negative effects are predicted, this section identifies appropriate mitigation strategies.

The 2018 Review of the 2006 Wind Energy Development Guidelines confirms that:
"Shadow Flicker occurs when the sun is low in the sky and the rotating blades of a wind turbine casts a moving shadow which, if it passes over a window in a nearby house or other property results in a rapid change or flicker in the incoming sunlight. The time period in which a neighbouring property may be affected by shadow flicker is completely predictable."

Shadow flicker lasts only for a short period and happens only in certain specific combined circumstances. The circumstances require that:

- the sun is shining;
- the turbine is directly between the sun and the affected property, and
- there is enough wind energy to ensure that the turbine blades are moving.

If any one of these conditions is absent, shadow flicker cannot occur.

The 2019 Draft Revision of the Wind Energy Development Guidelines (WEDG) also added the following circumstance required for shadow flicker occurrence:

- *"there is sufficient direct sunlight to cause shadows (cloud, mist, fog or air pollution could limit solar energy levels)"*

The 2019 Draft Guidelines also note:

"Generally only properties within 130 degrees either side of north, relative to the turbines, can be affected at these latitudes in the UK and Ireland – turbines do not cast long shadows on their southern side".

Shadow flicker may have the potential to cause disturbance and annoyance to residents if it affects occupied rooms of a house. Careful site selection, design and planning, and good use of relevant software to control turbine operation can help reduce the possibility of shadow flicker. Modern wind turbines have the facility to measure sunlight levels and to reduce or stop turbine rotation if the conditions that would lead to excess shadow flicker at any neighbouring property arise.

The distance and direction between the turbine and property is of significance because:

- The duration of the shadow will be shorter, the greater the distance (i.e., it will pass by quicker)
- The shadow flicker cast by rotating wind turbine blades will be reduced, the further a dwelling is from an operating turbine

The path of the sun varies over the seasons resulting in a changing potential for a shadow to be cast throughout the year. Similarly, the sun's position in the sky over the course of a day is changing such that the shadow cast by a turbine is constantly changing. Shadow flicker is more likely to occur on sunny winter days, when the sun is lower in the sky and shadows can cast a greater distance from the turbine. Shadow flicker is more likely to occur to the west or south-west of the wind turbines with some occurrences also predicted to the north or north-east and south-east. This can be seen in **Appendix 4.1 a** to **d**.

Persons with photosensitive epilepsy can be sensitive to flickering light between 3 and 60 Hertz (Hz)[37]. This is supported by research in recent years asserting that flicker from turbines must interrupt or reflect sunlight at frequencies greater than 3 Hz to pose a potential risk of inducing photosensitive seizures. The frequencies of flicker caused by modern wind turbines are less than 1 Hz[38], and are well below the frequencies known to trigger effects in these individuals. Therefore, any potential shadow flicker effect from the wind turbines is considered an effect on residential amenity, rather than having the potential to affect the health of residents.

[37] Epilepsy Action (2012) *Other Possible Triggers of Photosensitive Epilepsy*. Available online at: http://www.epilepsy.org.uk/info/photosensitive-epilepsy [Accessed on 27 November 2019]
[38] Harding, G., Harding, P., & Wilkins, A. (2008). *Wind turbines, flicker, and photosensitive epilepsy*. *Epilepsia* (49) 6, pp. 1095-1098.

4.9.1.1 Relevant Guidance

The relevant Irish guidance for shadow flicker is derived from the 'Wind Energy Development Guidelines for Planning Authorities' (Department of the Environment, Heritage and Local Government (DoEHLG), 2006) and the 'Best Practice Guidelines for the Irish Wind Energy Industry' (Irish Wind Energy Association, 2012).

The Department of Environment, Community and Local Government in its Wind Energy Development Guidelines (2006) (the 2006 Guidelines) considers that:
"*At distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low. Where shadow flicker could be a problem, developers should provide calculations to quantify the effect and where appropriate take measures to prevent or ameliorate the potential effect, such as by turning off a particular turbine at certain times".*

The 2006 Guidelines also 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".

A significant minimum separation distance from all occupied dwellings of 740 m has been achieved with the Project design. There are 7 No. occupied dwellings within 1 km of any proposed wind turbine location.

Although the DoEHLG thresholds apply to dwellings located within 500 metres of a proposed turbine location, for the purposes of this assessment, the guideline thresholds of 30 hours per year or 30 minutes per day have been applied to all properties located within ten rotor diameters (i.e., assumed at 1,550 metres as the widest potential rotor diameter within the range (155 m) and 2,000 metres for completeness) of the proposed turbines (as per IWEA guidelines, 2012). The DoEHLG Guidelines state that at distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low.

The adopted 2006 DoEHLG guidelines are currently under review. The DoHPLG released the 'Draft Revised Wind Energy Development Guidelines' in December 2019. The revised draft of Wind Energy Development Guidelines 2019 provides for zero shadow flicker.

The Draft 2019 Guidelines are based on the recommendations set out in the 'Proposed Revisions to Wind Energy Development Guidelines 2006 – Targeted Review' (December 2013) and the 'Review of the Wind Energy Development Guidelines 2006 – Preferred Draft Approach' (June 2017).

The assessment herein is based on compliance with the current DoEHLG Guidelines limit (30 hours per year or 30 minutes per day). However, it should also be noted that the Project can be brought in line with the requirements of the 2019 draft guidelines to ensure no shadow flicker occurs at residential dwellings within the vicinity of the wind farm. Should the 2019 draft guidelines be adopted while this application is in the planning system, the Project will fully comply with their requirements through the implementation of the mitigation measures outlined herein and subject to a time allowance for the turbine to safely stop rotating.

4.9.1.2 Shadow Flicker Modelling

An industry standard wind farm assessment software package, WindPRO from EMD International Version 3.6 was used to prepare a model of the proposed wind turbines. The programme facilitates the analysis of a wind farm for possible shadow flicker occurrence at nearby houses. It allows for the production of maps, and shadow flicker prediction. The data output from the programme has been analysed and the receptors potentially vulnerable to shadow flicker were identified. The significance of shadow flicker effects was then assessed.

Generic windows of 2 m width, 2 m height and 0.5 m from bottom line above ground are applied in the model to each side of the house. The model assumes the receptor will not face any particular direction, but instead will face all directions. These windows represent an approximation of the existing windows on the houses facing north, south, east and west and provide an estimate of potential shadow flicker to a window on each side of the house. The software determines the times of day/year when the sun will be in line with the rotational components of the turbine and the house/receptor, thereby having the potential to cause shadow flicker. The software outputs details of potential shadow flicker, in this case by mean and maximum duration of the shadow flicker events, days per year and times of occurrence and maximum hours per year and maximum minutes per day of shadow flicker.

The following data inputs were required and used to produce an estimate of the effect of shadow flicker from the wind farm:

- Digital elevation model of the Study Area (10 m resolution – OS X, Y, and Z data points);
- Turbine locations;
- Turbine dimensions (rotor diameter and hub height);
- Receptor locations (i.e., property locations);
- Bottom line height above ground 'window' (0.5 m above ground level),and
- Wind speed and direction for the site to determine the period that the wind turbines will be in operation from the different wind directions during the year.

The software creates a mathematical model of the proposed wind turbines and their surroundings and uses this information to calculate specific theoretical times and durations of flicker effects for the identified properties. The following 'worst-case' assumptions were initially incorporated into the shadow flicker modelling:

- there are no clouds and sunlight is always bright and direct;
- the turbines are always rotating whereas this might not be the case due to maintenance works or break downs;
- there is no intervening structures or vegetation (other than topography) that may restrict the visibility of a turbine, preventing or reducing the effect,
- a limit to human perception of shadow flicker is not considered by the model.

The model operates by simulating the path of the sun during the year. The results of the model provide a calculation of theoretical specific times and durations of flicker effects for the identified properties. As previously stated, given the assumptions incorporated into the model, the calculations overestimate the duration of effects. The worst-case assumption is considered to be sufficient for the purposes of this assessment as it assumes the sky is always clear, the turbines are always aligned face-on to each window and that there is a clear and undisturbed line of sight between the windows of the receptors and the turbines (except where this is prevented due to topography). In reality, this will not occur; the turbines will not always be orientated as described, clouds will obscure the sun and line of sight may also be obscured (for example, from leaves on trees). The flicker effects will be substantially less than this and will not meet the results of the worst-case assumption.

The model also outputs a more realistic scenario, or "expected values". In this scenario, the only change in assumptions is that the statistically likely monthly sunshine frequency and wind direction frequency data is assessed. This assessment only changes the annual hours per year metric and is not applied to the daily data. The data used in the model was the:

- Long-term sunshine probability data from the Met Éireann synoptic station in Valentia
- Long-term wind rose data for the onsite met mast

4.9.1.3 Baseline Description

The study area is defined as ten times the widest potential rotor diameter within the range (10 x 155 m = 1,550 m). A range of turbine parameters were assessed; however, a maximum rotor diameter of 155 m was used to calculate this distance which was then rounded up to 2 km. This dimension gives the most significant outcome as smaller rotor diameters will cast less shadow. A study area of 2,000 m is used for completeness.

In determining potential shadow flicker effects, it is the swept path of the blade that dictates the shadow. The longer the blade the greater the swept path and corresponding shadow, the shorter the blade the smaller the swept path and shadow. A specimen turbine and three alternative scenarios were included in the assessment in order to fully assess the range of turbine parameters discussed in **Chapter 2: Project Description**. A specimen turbine was selected to model a base case scenario using the maximum possible rotor diameter and tip height. To ensure the full extent of the moving shadow which would be created by the Turbine Range was assessed the following scenarios were modelled.

- Specimen Turbine – 107. 5 m hub, 155 m rotor diameter (longest rotor), 185 m tip height
- Alternative Scenario 1 – 102.5 m hub (lowest hub), 155 m rotor diameter (longest rotor), 180 m tip height
- Alternative Scenario 2 – 110.5 m hub (tallest hub), 149 m rotor diameter (shortest rotor), 185 m tip height
- Alternative Scenario 3 – 102.5 m hub (lowest hub), 149 m rotor diameter (shortest rotor), 177 m tip height

A shadow flicker computer model was used to calculate the occurrence of shadow flicker at relevant receptors (houses located within 1,550 m of the proposed turbines). The output from the calculations is analysed to identify and assess potential shadow flicker impacts. Wind turbines, like other tall structures, can cast long shadows when the sun is low in the sky.

The properties were identified using a combination of Ordnance Survey of Ireland (OSI) Maps, AutoCAD drawings and from internet mapping resources including *Eircode Finder, Google Street View*, *Google Earth*, *Bing Maps,* a planning permission search using the Cork and Kerry County Council web resources and from a number of visits to the Study Area. There are 39 properties within the shadow flicker study area radius. The majority of houses are located to the east, north and south of the Development. The coordinates of each dwelling and its distance to the closest proposed turbine are listed in **Table 4.9** and are shown in **Figure 1.3**.

Table 4.9: Properties within the shadow flicker study area

House ID	Easting ITM	Northing ITM	Elevation (AOD m)	Closest Turbine	Distance to Closest Turbine (m)
H1	512160	578211	346.3	T2	755
H2	513445	578031	285.9	T2	764
H3	513072	579801	338.1	T3	767

House ID	Easting ITM	Northing ITM	Elevation (AOD m)	Closest Turbine	Distance to Closest Turbine (m)
H4	514329	579384	289.3	T4	790
H5	514339	577982	318.8	T5	808
H6	514756	578856	262.2	T5	825
H7	513435	577744	264.0	T2	965
H8	512511	577570	263.5	T2	1004
H9	513762	577696	259.3	T5	1010
H10	513449	577603	249.4	T2	1089
H11	513566	577655	253.1	T5	1102
H12	514700	579510	276.8	T5	1114
H13	513505	577609	248.6	T2	1116
H14	513565	577612	248.9	T5	1143
H15	512009	577691	278.3	T2	1178
H16	513794	577514	246.6	T5	1185
H17	511756	577894	314.3	T1	1206
H18	511689	577885	311.8	T1	1249
H19	513838	580300	300.4	T4	1270
H20	513548	577431	232.8	T2	1287
H21	514950	577873	283.9	T5	1292
H22	515053	579406	282.1	T5	1318
H23	513747	577308	221.7	T5	1395
H24	514759	577513	272.4	T5	1429
H25	513572	577269	216.5	T2	1438
H26	513974	577197	219.1	T5	1493
H27	515322	579275	275	T5	1494
H28	513631	577179	207.2	T5	1543
H29	515488	579130	260.2	T5	1602
H30	514568	577209	245.3	T5	1605
H31	514413	577149	233.8	T5	1608
H32	511831	577246	253.3	T2	1628
H33	515603	579094	254.1	T5	1704
H34	512444	580689	261.7	T3	1731
H35	515614	578103	249.3	T5	1767
H36	515672	578122	245.8	T5	1815
H37	515646	578046	243.3	T5	1816
H38	515525	579630	278.7	T5	1837
H39	515332	577403	242.0	T5	1890

4.9.1.4 Assessment of Potential Effects

This assessment considers the potential shadow flicker impact of the Development on the remaining surrounding properties in terms of:

- Predicting and assessing the extent of shadow flicker experienced by all properties within the shadow flicker study area
- Specifying mitigation measures, where deemed necessary

A detailed assessment of each of the following scenarios is included in **Appendix 4.1a**, **4.1b**, **4.1c** and **4.1d**:

- Specimen Turbine **–** 107.5 m hub, 155 m rotor diameter, 185 m tip height
- Alternative Scenario 1 **–** 102.5 m hub, 155 m rotor diameter, 180 m tip height
- Alternative Scenario 2 **–** 110.5 m hub, 149 m rotor diameter, 185 m tip height
- Alternative Scenario 3 **–** 102.5 m hub (lowest hub), 149 m rotor, 177 m tip height

Table 4.10: Summary Shadow Flicker Listing for All Properties

Receptor ID	Specimen Turbine			Alternative Scenario 1			Alternative Scenario 2			Alternative Scenario 3		
	Worst Case Shadow [h/year]	Expected Shadow [h/year]	Max Shadow [h/day]	Worst Case Shadow [h/year]	Expected Shadow [h/year]	Max Shadow [h/day]	Worst Case Shadow [h/year]	Expected Shadow [h/year]	Max Shadow [h/day]	Worst Case Shadow [h/year]	Expected Shadow [h/year]	Max Shadow [h/day]
H1	93:18:00	18:06	01:13	94:17:00	18:19	01:12	88:32:00	17:08	01:12	90:23:00	17:32	01:11
H2	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00
H3	121:06:00	11:51	01:42	118:24:00	11:31	01:42	114:36:00	11:14	01:37	110:08:00	10:43	01:35
H4	98:51:00	11:24	00:48	98:24:00	11:18	00:48	92:49:00	10:42	00:46	92:31:00	10:35	00:46
H5	21:15	04:41	00:24	11:50	02:38	00:24	19:54	04:24	00:23	19:23	04:17	00:23
H6	49:31:00	09:56	00:42	49:40:00	09:56	00:42	45:52:00	09:13	00:41	45:44:00	09:07	00:41
H7	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00
H8	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00
H9	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00
H10	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00
H11	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00
H12	52:06:00	06:28	00:50	52:10:00	06:22	00:47	47:39:00	05:57	00:48	49:03:00	06:02	00:48
H13	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00
H14	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00
H15	12:33	02:25	00:18	00:00	00:00	00:00	11:39	02:15	00:17	10:57	02:07	00:17
H16	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00
H17	36:13:00	06:50	00:40	25:43:00	04:48	00:31	34:23:00	06:29	00:40	35:23:00	06:40	00:39
H18	40:24:00	07:40	00:41	28:30:00	05:22	00:30	38:32:00	07:18	00:40	39:06:00	07:25	00:39
H19	27:12:00	02:28	00:26	17:20	01:28	00:26	25:43:00	02:19	00:25	24:37:00	02:13	00:24
H20	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00
H21	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00
H22	32:34:00	04:47	00:37	24:26:00	03:30	00:28	30:12:00	04:27	00:36	30:21:00	04:27	00:36
H23	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00
H24	10:35	02:16	00:18	00:00	00:00	00:00	09:51	02:07	00:17	09:33	02:04	00:18
H25	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00
H26	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00
H27	18:54	03:01	00:27	17:24	02:44	00:25	17:43	02:49	00:26	17:40	02:49	00:26
H28	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00
H29	14:29	02:27	00:22	14:31	02:26	00:22	13:26	02:16	00:21	13:26	02:15	00:22
H30	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00
H31	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00
H32	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00
H33	12:46	02:12	00:21	12:52	02:13	00:22	11:55	02:04	00:21	11:58	02:04	00:20
H34	10:36	00:58	00:19	00:00	00:00	00:00	10:14	00:56	00:19	09:11	00:50	00:18
H35	10:28	02:19	00:21	10:22	02:18	00:21	09:45	02:10	00:21	09:30	02:06	00:21
H36	09:24	02:05	00:21	09:21	02:04	00:21	08:47	01:57	00:20	08:38	01:55	00:20
H37	10:31	02:19	00:21	10:24	02:18	00:21	09:53	02:11	00:20	09:36	02:07	00:20
H38	13:21	01:52	00:20	13:23	01:52	00:20	12:16	01:43	00:19	12:28	01:45	00:20
H39	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00

Annual Impacts - Worst-Case Shadow Flicker

The calculated worst-case shadow flicker occurrences in the **Table 4.10** assumes the sun is always shining, that there is no cloud cover and the dwelling is always occupied and orientated towards the sun and has a window orientated towards the proposed turbines. As previously stated, this calculation is based on topography alone and excludes vegetation, buildings and other man-made structures in the intervening distance. It does not account for weather conditions, which have a significant impact upon the amount of shadow flicker that may actually occur.

It can be seen from **Table 4.10**, that in the case of the Specimen Turbine where a hub height of 107.5 m and a rotor diameter of 155 m are used for the proposed turbines, there will be 20 No. out of 39 No. receptors that will experience some degree of shadow flicker and 19 No. receptors that will experience no shadow flicker. There will be eight (8 No.) receptors that exceed the WEDG (2006) 30 hours per year shadow flicker using the worst-case assumptions of the model.

In Alternative Scenario 1, where a hub height of 102.5 m and a rotor diameter of 155 m are proposed, there will be 17 No. out of 39 No. receptors that will experience some degree of shadow flicker and 22 No. receptors that will experience no shadow flicker. There will be five (5 No.) receptors that exceed the WEDG (2006) 30 hours per year shadow flicker using the worst-case assumptions of the model.

In Alternative Scenario 2, where a hub height of 110.5 m and a rotor diameter of 149 m are proposed, there will be 20 No. out of 39 No. receptors that will experience some degree of shadow flicker and 19 No. receptors that will experience no shadow flicker. There will be eight (8 No.) receptors that exceed the WEDG (2006) 30 hours per year shadow flicker using the worst-case assumptions of the model.

In Alternative Scenario 3, where a hub height of 102.5 m and a rotor diameter of 149 m are proposed, there will be 20 No. out of 39 No. receptors that will experience some degree of shadow flicker and 19 No. receptors that will experience no shadow flicker. There will be eight (8 No.) receptors that exceed the WEDG (2006) 30 hours per year shadow flicker using the worst-case assumptions of the model.

It is possible for wind turbines to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more turbine simultaneously. As can be seen in the shadow flicker assessment attached as **Appendix 4.1** all of the proposed turbines give rise to some degree of cumulative shadow flicker, if unmitigated.

No shadow flicker is experienced at 19 No. dwellings in all scenarios assessed (**Table 4.10**). At these locations, the suns angle (or azimuth) relative to the turbines and receptors never reaches the required position for shadow flicker effects to occur in these areas. Therefore, these are ruled out for further assessment.

Annual Impacts – Expected Shadow Flicker

To calculate more realistic and 'real world' occurrences of shadow flicker for the receptors that are identified as potentially vulnerable to shadow flicker (**Table 4.10**), it is necessary to identify the likely meteorological conditions which are expected to be experienced at the Site. To estimate the likely duration of sunshine occurrence at the Site, historical meteorological data from the Met Éireann is automatically uploaded by the software. Data from Valentia Meteorological Observatory was used as this Met Éireann observatory is the closest to the Site. This gives a good representation of data for the Development. This data was utilised to consider the probability of sunshine occurrence, and thus allow the determination of 'projected' values for shadow flicker occurrence.

The worst-case predicted hours for shadow flicker are reduced by the average time the weather is cloudy annually. As discussed above, to estimate the impact of sunshine occurrence, historical meteorological data is utilised to consider the likelihood of sunshine (the sunshine probability) at different times of the year. This allows the determination of 'expected' values for shadow flicker occurrence as can be seen in the 'Expected' columns in **Table 4.10**. This is achieved by applying a reductive factor to the worst-case total hours per year of shadow flicker. **Table 4.10** shows the worst-case and the expected shadow flicker values per year which are likely to be experienced by each receptor. Although the expected duration of shadow flicker is reduced substantially for each dwelling when data from Valentia Meteorological Observatory is incorporated into the assessment, they are not eliminated entirely for all the 39 No. receptors within the shadow flicker study area of the Development.

For the specimen turbine scenario there are no exceedances of the WEDG (2006) shadow flicker 30hrs/year threshold at any receptor using the expected shadow flicker data. H1 has the greatest shadow flicker impact at 18hours and 6minutes per year.

In Alternative Scenario 1 there are no exceedances of the WEDG (2006) shadow flicker 30hrs/year threshold at any receptor using the expected shadow flicker data. H1 has the greatest shadow flicker impact at 18hours and 19minutes per year.

In Alternative Scenario 2 there are no exceedances of the WEDG (2006) shadow flicker 30hrs/year threshold at any receptor using the expected shadow flicker data. H1 has the greatest shadow flicker impact at 17hours and 8minutes per year.

In Alternative Scenario 3 there are no exceedances of the WEDG (2006) shadow flicker 30hrs/year threshold at any receptor using the expected shadow flicker data. H1 has the greatest shadow flicker impact at 17hours and 32minutes per year.

Daily Shadow Flicker Impacts

It is not appropriate to apply the annual average sunshine hours correction to the predicted daily totals as the data is based upon monthly averages, which cannot be applied to daily levels with sufficient accuracy. Furthermore, the infrequency of clear skies is more likely to reduce the overall number of instances of shadow flicker over the year, rather than reduce the length of each individual instance. As such, the assessment of daily impacts considers the maximum theoretical amount of shadow flicker only and is inherently conservative.

It can be seen from **Table 4.10**, that in the case of the Specimen Turbine eight receptors will exceed the WEDG (2006) 30 mins per day shadow flicker threshold.

In Alternative Scenario 1, six receptors will exceed the WEDG (2006) 30 mins per day shadow flicker threshold.

In Alternative Scenario 2, eight receptors will exceed the WEDG (2006) 30 mins per day shadow flicker threshold.

In Alternative Scenario 3, eight. receptors will exceed the WEDG (2006) 30 mins per day shadow flicker threshold.

4.9.1.5 Cumulative Effects

Cumulative shadow flicker impacts arise if dwellings are at risk from potential shadow flicker impacts as a result of more than one wind farm. While separate wind farms are not likely to cause effects simultaneously, they could increase the cumulative total hours where a receptor is impacted. In this instance, there is no project listed in **Chapter 2** which includes proposed, consented or existing wind farms within a 2 km range of the turbines that may cause cumulative effects.

4.9.1.6 Mitigation Measures & Residual Effects

Due to the potential for shadow flicker to affect receptors within the shadow flicker study area, it is proposed that a shadow control system will be installed on each of the wind turbines. The control system will calculate, in real-time:

- Whether shadow flicker has the potential to affect nearby properties, based on pre-programmed co-ordinates for the properties and turbines;
- Wind speed (can affect how fast the turbine will turn and how quickly the flicker will occur);
- Wind direction;
- The intensity of the sunlight, and
- The turbine will automatically shut down safely during periods when shadow flicker exceeds the thresholds as set out in the WEDG (2006); and will restart when the potential for shadow flicker ceases at the affected properties.

The WEDG (2006) recommends a 30 hours per year threshold for shadow flicker. The Draft Revised Wind Energy Development Guidelines, December 2019, recommend that shadow flicker should not impact any dwelling, meaning the relevant turbine or turbines must be shut down on a temporary basis until the potential for shadow flicker ceases.

It is intended that the measures outlined above, subject to safe shut down time of approximately 60 seconds, will ensure the WEDG (2006) shadow flicker thresholds are not exceeded at any of the properties within the study area, this will be the case regardless of which turbine is selected within the turbine range.

The control system can be adjusted to automatically shut-down the turbine when the control systems detects the sunlight is strong enough to cast a shadow thereby complying with the 2019 Draft WEDG if/when they come into effect.

In the event that complaints of shadow flicker are received by the Developer / Site Operator or by Cork County Council during operation, an investigation will take place and the complaints frequency, duration and time of complaints will be considered and specialist modelling software will be used to confirm the occurrence(s). If the effects are confirmed in the modelling, a shadow flicker survey involving the collection of light data will also be carried out at the property in which the complaint was made. Further refinement of the blade shadow control system will be conducted to eliminate the shadow flicker occurrence. This could result in the shutting off turbines at specific times of day.

4.9.1.7 Summary of Significant Effects

This assessment has identified the potential for shadow flicker to affect 20 No. out of 39 No. receptors within the shadow flicker study area for all four scenarios assessed. The expected shadow flicker results show there are no exceedances of the WEDG (2006) 30 hrs/year shadow flicker threshold at these 20 No. receptors. However, the WEDG (2006) 30 mins/day shadow flicker threshold is exceeded at up to eight (8 No.) receptors. A shadow control system will be installed to ensure shadow flicker levels do not exceed the WEDG (2006) thresholds and can be adjusted to eliminate shadow flicker, ensuring compliance with the 2019 Draft WEDG if they come into effect. Such systems are common in many wind farm developments and the technology has been well established.

4.9.1.8 Statement of Significance

This assessment has identified that the Project will comply with the WEDG (2006) shadow flicker guidelines. The assessment also determined that the Project will comply with the 2019 Draft WEDG by installing a blade shadow control system on the proposed turbines. Therefore, the Project will not result in significant impacts in relation to shadow flicker. Given that only effects of significant impact or greater are considered "significant" in terms of the EIA Regulations, the potential effects of the Development as a result of shadow flicker, when mitigated, are considered to be not significant.

5 BIODIVERSITY

5.1 INTRODUCTION

This chapter has been prepared by Biosphere Environmental Services, on behalf of Inchamore Wind DAC, to accompany a planning application for the Development. This EIAR assesses the Project as a whole, including all relevant ancillary and subsidiary elements that are not part of the Development, and all direct and indirect effects, and cumulative impacts and interactions.

This chapter assesses the impacts of Inchamore Wind Farm (the Development) (as shown in **Figure 1.2**) on Terrestrial Ecology (namely habitats, flora, mammals and Kerry Slug). The Development refers to all elements of the application for the construction, operation and decommissioning of the proposed Inchamore Wind Farm (**Chapter 2: Project Description**). Where negative effects are predicted, the chapter identifies appropriate mitigation strategies therein. The assessment considers the potential effects during the following phases of the Project:

- Construction of the Project;
- Operation of the Project, and
- Decommissioning of the Project

Common acronyms used throughout this EIAR can be found in **Appendix 1.2.** This chapter of the EIAR is supported by Figures provided in **Volume III** and by the following Appendix documents provided in **Volume IV** of this EIAR:

- **Appendix 5.1** Total plant species list for habitats encountered within the redline boundary of the Site for the proposed wind farm at Inchamore
- **Appendix 5.2** Plant species list for habitats encountered along forest tracks within the grid connection route
- **Appendix 5.3** Bat Report: proposed wind farm development at Inchamore, Co. Cork. Bat Eco Services, 2023
- **Appendix 5.4** Inchamore Wind Farm: Kerry Slug Survey. Prepared by Wetlands Survey Ireland, September 2021
- **Appendix 5.5** Proposed Wind Farm Development at Inchamore, Co, Cork**:** Habitat Enhancement Plan. Prepared by BioSphere Environmental Services, 2023.
- **Appendix 5.6** Gortyrahilly and Inchamore Wind Farms, Bat Survey 2019/2020 Report. Prepared by Fehily Timoney Consulting Engineers

A Construction and Environmental Management Plan (CEMP) for the Project is appended to the EIAR in **Appendix 2.1**. This document is a key construction contract document, which will ensure that all mitigation measures, which are considered necessary to protect the environment, are implemented. For the purpose of this application, a summary of all the mitigation measures for the proposed wind farm project is included in **Appendix 17.1**.

5.1.1 Details of the Proposed Development

A detailed description of the Project has been included in **Chapter 2: Project Description**.

5.1.2 Purpose of the Report

The purpose of the report is to:

- Establish and evaluate the baseline ecological environment, as relevant to the Project.
- Identify, describe and assess all potentially significant ecological effects associated with the Project
- Set out the mitigation measures required to address any potentially significant ecological effects and ensure compliance with relevant nature conservation legislation.
- Provide an assessment of the significance of any residual ecological effects.
- Identify any appropriate compensation, enhancement or post-construction monitoring requirements.

5.1.3 Project Team

The following personnel have been involved in the terrestrial ecology assessment for the proposed Inchamore Wind Farm project.

Dr Brian Madden BA (Mod.), Ph.D, MCIEEM graduated in Natural Sciences from the University of Dublin in 1984 and earned a Ph.D. degree in 1990 from the National University of Ireland for his research on ecosystem processes in raised bogs. Brian has been operating as a consultant ecologist since the 1990s and has worked on a broad range of projects in all counties on the island of Ireland. Dr Madden is the lead author of this chapter and he also carried out habitat and mammal surveys at the proposed wind farm development site.

Dr John Conaghan BSc., PhD, MCIEEM is an experienced plant ecologist who has worked as a consultant ecologist in Ireland since 1994. He is a specialist in the survey and assessment of wetland vegetation and habitats with bogs and fens his main area of expertise. These surveys and assessments have contributed towards Environmental

Impact Assessments of a range of wind farm, power line, road, and gas pipeline developments. John carried out the habitat and flora surveys for the project.

Dr Patrick Crushell BSc MSc PhD MCIEEM CEcol holds an honours degree in Applied Ecology from UCC, a Masters degree in Environmental Resource Management from UCD and a PhD on peatland ecology from Wageningen University, the Netherlands. Patrick carried out the surveys for Kerry Slug for the project.

Dr Tina Aughney holds a BSc in Environmental Science and a PhD degree from NUI Galway and has been working as a bat specialist since 2000. Tina carried out bat surveys at the proposed Inchamore Wind Farm in 2022 and prepared the bat impact assessment for the project.

Dr Jonathon Dunn (Fehily Timoney Consultants) – conducted bat static detector surveys in 2019/2020, Jonathon is an ecologist with over seven years' experience in the environmental sector and holds a BA (Hons) in Natural Sciences (Zoology) from the University of Cambridge, an MSc in Ecology, Evolution and Conservation from Imperial College London and a PhD in Avian Ecology from Newcastle University.

5.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

5.2.1 Chapter Structure

In line with the EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports (2022), the structure of this Biodiversity chapter is as follows:

- Assessment Methodology and Significance Criteria.
- Description of baseline conditions within the Project area.
- Identification and assessment of impacts on biodiversity associated with the Project, during the construction, operational and decommissioning phases.
- Mitigation measures to avoid or reduce the impacts identified.
- Identification and assessment of residual effects of the Project considering mitigation measures.
- Identification and assessment of cumulative impacts if and where applicable.

5.2.2 Relevant Legislation and Policy

The main pieces of legislation relevant to this chapter are as follows:

- The Wildlife Acts 1976 – 2022 as amended

- The Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora) as amended
- The Birds Directive (Council Directive 2009/147/EC on the conservation of wild birds) as amended
- European Communities (Birds and Natural Habitats) Regulations 2011 - 2021
- Flora (Protection) Order, 2022 (S.I. No. 235 of 2022)

In considering ecological survey and assessment of impacts of the proposed Project, this chapter was prepared in accordance with the following guidance and information documents:

- EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports (2022).
- European Commission (2017) Environmental Impact Assessment of Projects. Guidance on the preparation of the Environmental Impact Assessment Report. (Directive 2011/92/EU as amended.
- NRA (2009). Guidelines for Assessment of Ecological Impacts of National Road Schemes.
- CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, Winchester.
- Fossitt (2000). A Guide to Habitats in Ireland, Heritage Council, Kilkenny.
- Smith *et al*. (2011). Best Practice Guidance for Habitat Survey and Mapping in Ireland.
- Northern Ireland Environment Agency, Natural Environment Division (2021) Guidance on Bat Surveys, Assessment and Mitigation for Onshore Wind Turbine Developments in Northern Ireland. Belfast: Department of Agriculture, Environment and Rural Affairs (Northern Ireland).
- Scottish Natural Heritage (2019). Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation.
- EUROBATS 'Guidelines for consideration of bats in wind farm projects' Revision 2014.
- Bat Conservation Trust 'Bat Survey Good Practice Guidelines' 2012 (BCT Guidelines).
- Bat Conservation Ireland (2012). Wind Turbine/Wind Farm Development Bat Survey Guidelines, Version 2.8 December 2012 Bat Conservation Ireland, www.batconservationireland.org.
- Marnell, F., Kelleher, C. & Mullen, E. (2022). Bat Mitigation Guidelines for Ireland. V2. Irish Wildlife Manuals, No. 134. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage. Dublin, Ireland.

- England, N. (2014). Bats and onshore wind turbines Interim guidance. Rodrigues, L., Bach, L., Dubourg-Savage, M., Karapandža, B., Kovač, D., Kervyn, T., Minderman, J. (2015).

5.2.3 The Study Area

The principal study area for habitats and flora, terrestrial mammals and Kerry Slug was the actual Site for the proposed wind farm at Inchamore (as shown in **Figure 1.1**). This was considered adequate as the site does not adjoin any designated area or habitat of particular conservation value. However, the study area was extended to a distance of approximately 2 km from the wind farm boundary for the checking of potential bat roosts.

The study area also included the route for the underground grid connection (see **Figure 1.2**). This extends for a distance of approximately 19.9 km from the proposed 38 kV substation at Inchamore Wind Farm to the existing 220 kV GIS substation at Ballyvouskill. For the turbine delivery route, an assessment was made of locations where physical works are required to facilitate the passing of the vehicles (see **Figure 2.6**).

For habitats and flora species, the main study area is all land within the Redline boundary. However, consideration is given to the potential for sensitive habitats, such as bogs, fens, springs etc., or protected or rare plant species (including bryophytes), to a distance of up to 1 km of the Project area but more should ecological or hydrological connectivity exist. Such habitats may be part of designated sites at a national or international level (Department of Environment, Heritage and Local Government 2010).

For terrestrial mammal species, badger and otter are identified as the principal species likely to be affected by the construction of the Project For badger, the main study area was a distance of approximately 100 m of the proposed turbine and associated infrastructure locations (after NRA 2006 & NRA 2009b). For otter, the main study area was a distance of at least 150 m upstream and downstream of any proposed crossing points of watercourses considered suitable to support otter (after NRA 2008 & NRA 2009b), including the margins of the watercourse to a distance of 10 m width.
For bats, the desk review study area extended to a distance of 10 km for roost sites and to 4 km for known caves. A habitat assessment for bat potential, including assessment of value of trees as bat roosts, was carried out to a distance of 200 m of the locations for the proposed turbines (following BCI Guidelines Ver. 2.8, 2012, NIEA 2021, NatureScot 2021).

5.2.4 Zone of Influence

The Zone of Influence (ZoI), or distance over which potentially significant effects may occur, will differ across the Key Ecological Receptors (KERs), depending on the potential impact pathway(s). The results of both the desk study and the suite of ecological field surveys undertaken have established the habitats and species present within, and in the vicinity of, the Project. The ZoI was then informed and defined by the sensitivities of each of the KERs present, in conjunction with the nature and potential impacts associated with the Development.

The ZoI in relation to direct impacts on habitats and flora and fauna species as a result of the Project will be confined to the area within the Redline Boundary of the Development, as well as the Grid Connection Route to Ballyvouskill substation and the Turbine Delivery Route.

The ZoI of general construction activities (i.e., risk of spreading/introducing non-native invasive species, dust deposition and disturbance due to increased noise, vibration, human presence and lighting) is not likely to extend more than several hundred metres from the proposed Redline Boundary but could be further for birds and bats.

The ZoI of potential impacts on surface water quality in the receiving environment, and associated aquatic flora and fauna, could extend downstream for up to 15 km (following UK guidance, Scott Wilson *et al.* 2006) but more depending on connectivity.

5.2.5 Baseline Data Collection

5.2.5.1 Desk Study

Habitats, flora and terrestrial mammals

A comprehensive desktop review was carried out to identify features of ecological importance within the study area. This included a review of sites designated for nature conservation (European & National) as shown on NPWS website (see www.npws.ie/protected-sites) and protected species datasets held by the National Biodiversity Data Centre (see http://maps.biodiversityireland.ie).

Bats

The following sources of data on bats were accessed:

Bat Conservation Ireland Database

Bat Conservation Ireland acts as the central depository for bat records for the Republic of Ireland. The bat database is comprised of >60,000 bat records. A 1 km and 10 km radius search was requested for the Irish Grid Reference W1403878722 (central point of wind farm site) in February 2023.

Bat Conservation Ireland Landscape Favourability

Bat Conservation Ireland produced a landscape conservation guide for Irish bat species using their database of species records collated during the 2000 – 2009 survey seasons. An analysis of the habitat and landscape associations of all bat species deemed resident in Ireland was undertaken and reported in Lundy *et al*. 2011. The geographical area suitable for individual species was used to identify the core favourable areas of each species. This was produced as a GIS layer for local authorities and planners in order to provide a guide to the consideration of bat conservation. The island is divided into 5 km squares and the landscape favourability of each 5 km square for each species of bat was modelled. This model was used as part of the desktop study for this report.

Previous Survey Data for Inchamore Site

A full season bat survey was previously completed in 2019 and 2020 by Fehily Timoney. This report was in reference to Inchamore and a second proposed development site at Gortyrahilly, Co. Cork. The full report in included in **Appendix 5.6**.

Kerry Slug

The occurrence of the site for the proposed wind farm within the known range of Kerry Slug (*Geomalacus maculosus*) together with the presence of suitable habitat throughout the site suggested the likely presence of the species.

The Kerry Slug is protected by the Wildlife (Amendment) Act 2000. It is listed under Annex II of the Habitats Directive and seven Special Areas of Conservation (SACs) have been designated for the species with a combined total area of approximately 95,337 hectares. The Kerry Slug is also listed in Annex IV of the Habitats Directive and as such is strictly protected from injury, or disturbance / damage to their breeding or resting place wherever it occurs.

A review of data held by the National Biodiversity Data Centre (September 2021) confirms that the species has previously been reported from the 10 km square that the site intersects

(W17). The proposed wind farm is not located within any site designated for nature conservation. The nearest site designated for the protection of Kerry Slug is the Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC (NPWS Site Code: 0365).

Based on the habitats recorded during the ecological assessment of the proposed wind farm, the following potentially suitable habitats have been identified:

- wet heath / blanket bog and rock outcrop habitat present throughout much of the site.

Marsh Fritillary

Results from the habitat and flora assessment indicate that the site does not support habitat suitable for Marsh Fritillary (an Annex II listed species), i.e. damp meadows with substantial coverage (at least 25%) of *Succissa pratensis.*

5.2.5.2 Consultation

As part of the study, consultation was made with the following relevant ecological parties:

- National Parks and Wildlife Services of the Department of Housing, Local Government and Heritage (response received 27th October 2022 – see **Appendix 1.1** in **Chapter 1**)
- BirdWatch Ireland (no response received)
- An Taisce (no response received)
- Irish Peatland Conservation Council (no response received)

5.2.5.3 Field Surveys

Habitats, vegetation and flora

The site of the proposed wind farm at Inchamore was visited and a walkover survey was conducted over two days, *i.e.,* 7th July 2020 and 10th June 2021. Further survey was carried out on 20th December 2022 to review the locations of turbines in areas of heath and bog. The field survey was mainly concentrated in areas in which it is proposed to site wind farm infrastructure.

The route of the grid connection cable was surveyed in January 2022. This comprised a survey by car, with stops at intervals to review habitats and flora present alongside the roads and tracks. The route passes through open countryside before entering the existing substation at Ballyvouskill – this area was walked to record habitats and flora.

Habitats within the study area were classified after 'A Guide to Habitats in Ireland' (Fossitt, 2000). The dominant plant species present in each habitat type were recorded during the field surveys. This is considered sufficient to allow accurate classification of the habitats present. The extents and details of classified habitats were recorded and input to a GIS and are shown in **Figure 5.1** accompanying this report. Where relevant, linkages with the EU Habitats Directive classification system are given.

During the site survey particular attention was paid to the possible occurrence of plant species listed in either the Flora (Protection) Order, 2022 or the Irish Red Data Book (Curtis and McGough 1988). Vascular plant species nomenclature in this report follows Stace (2010) while that of mosses follows Smith (2004).

The mapping of habitats was assisted by the use of aerial photography (OSI Geohive & BING web-sites).

Terrestrial Mammals

Terrestrial mammal species were detected by direct observations and by search for signs, such as tracks or feeding signs during the multi-disciplinary walkover survey on 10th and 11th June 2021.

The approach to the badger *Meles meles* survey was developed using NRA (2009b) '*Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road* Scheme', Transport Infrastructure Ireland. The extents of the development site was walked and checked for badger signs. Badger signs include setts, latrines, snuffle holes, prints, paths and tree scratching. Within the commercial plantations. search for badger signs was restricted to the margins of the forest stands and any accessible tracks or firebreaks through the plantations. Physical access through the interior of dense closed conifer plantation was not feasible. While conifer plantation on bog or heath provides poor habitat for badger, the areas which could not be surveyed, i.e. interior of closed canopy stands, will be assessed at time of tree felling - should such survey indicate a requirement for protection of badger, mitigation will be provided to comply with all relevant legislation (see **Section 5.6.3**).

Bat Field Surveys

Daytime Inspections

Building & structure inspection

A number of buildings on and surrounding the Site were assessed for potential bat usage. Evidence of bat usage is in the form of actual bats or their signs. Inspections are undertaken visually with the aid of a strong torch beam (LED Lenser P14.2) and endoscope (General DC5660A Wet / Dry Scope). These structures were also assessed to determine their suitability as a bat roost and described using the parameters Negligible, Low, Medium or High suitability according to Collins (2016). Daytime inspections were completed on numerous dates in 2022.

Tree potential bat roost (PBRs) inspection

Deciduous trees located adjacent to buildings within the survey area were inspected (21/12/2022) to determine if they provide a roosting space for bats using the Bat Tree Habitat Key (BTHK, 2018) and the classification system adapted from Collins (2016). The Potential Roost Features (PRFs) listed in BTHK (2018) were used to determine the PBR value of trees. Evidence of bat usage is in the form of actual bats or their signs. A Phase 1 inspection was undertaken visually with the aid of a strong torch beam (LED Lenser P14.2) during the daytime searching for PRFs, if visible.

Bat Detector Surveys

Dusk bat surveys – walking and driving transects

Dusk Surveys were completed from 10 minutes before sunset to 110 minutes post sunset. These dusk surveys were primarily completed by walking transects within the Development area along tracks and conifer plantation edges.

- Dusk Survey on 21/7/2022 from 21:30 hrs to 23:20 hrs;
- Dusk Survey on 28/8/2022 from 21:20 hrs to 23:10 hrs.

Walking transects involved the surveyor(s) walking in survey area along tracks and safe accessible points, noting the time, location and bat species encountered. Mapping of bat encounters was undertaken using QGIS and an excel file produced for mapping purposes (ITM Irish grid reference co-ordinates).

Driving transects were undertaken for large survey areas and were completed along large tracks and local road network in the greater area around the proposed development site (after Aughney et al. 2018).

Walking and Driving transects were undertaken to gather information on local bat populations within and adjacent to the proposed development area. Walking and Driving transects were undertaken on the following dates:

- Driving transect on 21/7/2022 from 22:00hrs to 00:00 hrs;
- Walking transect on 21/7/2022 from 23:20 hrs to 01:30 hrs;
- Walking transect on 29/8/2022 from 21:20 hrs to 02:00 hrs;
- Walking transect on 19/9/2022 from 20:30 hrs to 01:00 hrs.

All bat encounters were noted during surveys.

The following equipment was used: Anabat Walkabout Full Spectrum Bat Detector, Petersson D200 Heterodyne Bat Detector & Bat Logger M2 Full Spectrum Bat Detector and Petersson D200 Heterodyne Bat Detector.

Static bat detector survey

Static bat detectors were deployed at each turbine location to record bat calls (echolocation). The data collected were analysed using Kaleidoscope Pro. Version 2.1.0. These data were prepared for EcoBat Tool analysis.

Static Surveillance was undertaken in 2022. The location of static units was determined by the proposed location of turbines. The following static unit models were deployed during this static bat detector surveys. Additional static units were deployed to survey habitats in September in order to gather additional information as recommended by SNH, 2021 (i.e. paired habitat surveys).

Table 5.1: Static Bat Detectors deployed during Static Bat Detector Surveys.

Static Unit Code	Bat Detector Type	Recording Function	Microphone
SM4 Units 1-8	Wildlife Acoustics SongMeter 4 Bat FS	Full Spectrum	SMM-U2, 4 m cable
SM Mini Bat Units 1-12	Wildlife Acoustics SongMeter Mini Bat	Full Spectrum	SMM-U2

Note: ultrasonic microphone were annually checked to ensure that their sensitivity was accurate for static surveillance.

Summary Statistics, Mapping & Analysis

Summary statistics of data collated from static surveillance, walking and driven transects and dusk and dawn surveys were completed. All data collected was collated into excel files for each bat species in order to produce distribution maps.

In addition, the nightly number of bat passes recorded per species on the statics units were analysed using the website based tool Ecobat (http://www.ecobat.org.uk/).

Bat habitats & Bat activity analysis

All static recording locations sampled are also classed according to their favourability as a bat habitat within 200 m radius of the static location. Four classifications are used:

- Open – for example, open peat bog. Typically, there is little tall vegetation in this category which is generally required for bat species to forage and commute along (exception to this is Leisler's bats). This category would be considered to have a low potential for the majority of bat species.
- Edge – for example, hedgerows, treelines and woodland edge. Bat species such as *Pipistrellus* species have a preference to fly along linear habitat features. This category would be considered to have a high potential for the majority of bat species.
- Closed – for example woodland. Bat species such a brown long-eared bats have a preference to foraging within woodland habitats. This category would be considered to have a high potential for the majority of bat species.
- Water – while an open habitat, due to the insect resource associated with water, these habitat types are often favoured by foraging bats, especially Daubenton's bat.

Habitats deemed by the author, under guidance of Roche *et al.* (2014) and Lundy *et al.* (2011), as "Bat Habitat" are as follows:

- Mixed broad leaved woodland;
- Water bodies;
- Linear habitat;
- Bog Woodland;
- Mosaic;
- Scrub, and
- Conifer plantation.

Additional QGIS layers were created to aid analysis for this report. Each bat encounter was mapped and bat encounters within 1 km of the proposed turbine locations was extracted to represent the bat encounters of the principal proposed development area. As bats echolocation calls can be detected some distance from where the actual bat is flying, a 50 m fly zone was created around each bat encounter to represent the general area that individual bat recorded could be located at that point in time. This was named the ***"Buffered Bat Encounters"*** and represents the potential distance that bat echolocation calls can be detected by an ultrasonic microphone (*i.e.,* bat detector zone).

5.2.5.3.1 Core Sustenance Areas

Bat Conservation Trust (BCT) defines Core Sustenance Zones (CSZs) for different bat species and this is based on an extensive literature review (www.bats.org.uk). A CSZ refers to the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the resilience and conservation status of the colony using the roost. With reference to development, the CSZ could be used to indicate:

- The area surrounding a communal roost within which development work may impact the commuting and foraging habitat of bats using that roost.
- The area within which it may be necessary to ensure no net reduction in the quality and availability of foraging habitat for the colony.

Amphibians and reptiles

Incidental sightings of amphibians, namely the common frog *Rana temporaria* and smooth newt *Lisstriton vulgaris,* were recorded during the survey. Habitats within the study area were evaluated for their potential to support breeding amphibians. Suitable breeding habitat include areas of still freshwater such as pond, drainage ditches and wetlands.

Sightings of reptiles, namely the common lizard *Zootoca vivipara*, were noted during the surveys. Habitats within the study area were evaluated for their potential to support the common lizard. Suitable breeding habitat include bog and heath with exposed rock.

Kerry slug

The approach to surveying Kerry slug at the proposed wind farm was live refuge trapping as recommended for use by McDonnell *et al.* (2013) supplemented by targeted diurnal hand searches during site visits. The live refuge trapping method is favoured over other techniques because it enables quantitative sampling (McDonnell and Gormley 2011a, b). In addition, it removes the requirement of undertaking searches during wet weather (in the case of diurnal searches as the species is usually only active in daytime during damp weather), and the health and safety risks associated with nocturnal searches (when species is most active) in remote locations. The metric trap method involves the following:

- The metric traps (0.25 m^2), manufactured by De Sangosse (Pont du Casse, France), are made up of absorbent material covered with a reflective upper surface and a black perforated plastic on the underside. They are wetted in advance of being laid out and are baited with Carrot. Traps are secured to rock outcrops (outcrop metric traps) or on surface vegetation (in the case of heath) using stones, tent pegs, or nails as appropriate. They can also be wrapped around tree trunks (banded metric traps) when undertaking surveys at wooded sites (not relevant to current survey as the target habitat at the current site is wet heath / blanket bog and rock outcrops). Traps are checked weekly for a period of up to six weeks. If required, traps are re-wetted during site visits using a watering can.

In addition to checking the metric traps, incidental observations of Kerry Slug were recorded during each site visit following hand searches amongst suitable habitat. A summary of the dates, methods, and weather conditions of each site visit undertaken are presented in **Table 5.2**.

Table 5.2: Kerry Slug assessment: Survey effort at Inchamore

Date	Site	Survey	Weather
23/07/2020	Inchamore	Hand searches and set traps	Light rain, wet conditions on site.
30/07/2020	Inchamore	Hand searches and check traps	Light persistent rain. Mild and calm.
13/08/2020	Inchamore	Hand searches and check traps	Light rain. Warm
20/08/2020	Inchamore	Hand searches and remove traps	Heavy showers, bouts of strong wind.

After an initial site walkover, the occurrence of suitable Kerry Slug habitat was identified and seven metric traps (see **Plate 5.1**) were deployed amongst wet heath and outcropping rock. The traps were deployed on the 23rd of July 2020 in areas of suitably identified habitats for Kerry slug and subsequently checked on three separate occasions with at least a weekly interval before being removed four weeks later. The location of each trap is summarised in **Table 5.3** and illustrated in **Figure 5.2** below.

Plate 5.1: Slug trap on rock outcrop.

Table 5.3: Trap locations and habitats at Inchamore

Trap	Location (ITM)	Habitat
Trap 1	512468, 578335	Rock outcrop (ER1) in wet heath (HH3) adjacent to a stone wall.
Trap 2	5124181, 578354	Rock outcrop (ER1) in wet heath (HH3) adjacent to a stone wall.
Trap 3	512460, 578537	Rock outcrop (ER1) in wet heath (HH3)
Trap 4	512405, 578583	Rock outcrop (ER1) in wet heath (HH3)
Trap 5	512406, 578594	Halved on wet heath (HH3) and rock outcrop (ER1)
Trap 6	512331, 578672	Halved on wet heath (HH3) and rock outcrop (ER1)
Trap 7	512482, 578615	Rock outcrop (ER1) in wet heath (HH3)

Figure 5.2: Slug trap locations at Inchamore.

5.3 ASSESSMENT APPROACH

The ecological evaluation and impact assessment approach used in this report is based on "Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA 2009) and "Guidelines on the information to be contained in Environmental Impact Assessment Reports" (EPA May 2022).

5.3.1 Important Ecological Features

Ecological features can be important for a variety of reasons and the rationale used to identify them is explained in the text. Importance may relate, for example, to the quality or extent of the Site or habitats therein; habitat and/ or species rarity; the extent to which such habitats and/ or species are threatened throughout their range, or to their rate of decline.

5.3.1.1 Determining Importance

The importance of an ecological feature is considered within a defined geographical context. The following frame of reference has been used in this case (based on NRA Guidance 2009), relying on known/ published accounts of distribution and rarity where available, and professional experience:

The following frame of reference has been used in this case:

- International and European;
- National (Ireland);
- County (County Cork), and
- Local (lower value / higher value).

The above frame of reference is applied to the ecological features identified during the desk study and surveys to inform this report.
The value of habitats has been measured against published selection criteria where available. Examples of relevant criteria include: descriptions of habitats listed on Annex 1 of the Habitats Directive, etc.

In assigning a level of value to a species, it is necessary to consider its distribution and status, including a consideration of trends based on available historical records. Reference has therefore been made to published lists and criteria where available. Examples of relevant lists and criteria include: species of European conservation importance (as listed on Annexes II, IV and V of the Habitats Directive); Irish Red Lists, *e.g.* Ireland Red List No. 3: Terrestrial Mammals, Marnell *et al.* (2019).

For the purposes of this report ecological features of Local importance or greater, and/or subject to legal protection, have been subject to detailed assessment. Effects on other ecological features are considered unlikely to be significant in legal or policy terms.

5.3.2 Impact Assessment

The impact assessment process involves the following steps:

- identifying and characterising potential impacts;
- incorporating measures to avoid and mitigate (reduce) these impacts;
- assessing the significance of any residual effects after mitigation;
- identifying appropriate compensation measures to offset significant residual effects (if required); and
- identifying opportunities for ecological enhancement.

When describing impacts, reference has been made to the following characteristics, as appropriate:

- Positive or negative;
- Extent;
- Magnitude;
- Duration;
- Timing;
- Frequency; and
- Reversibility.

The impact assessment process considers both direct and indirect impacts: direct ecological impacts are changes that are directly attributable to a defined action, e.g., the physical loss of habitat occupied by a species during the construction process. Indirect ecological impacts are attributable to an action, but which affect ecological resources through effects on an intermediary ecosystem, process or feature, e.g., the creation of roads which cause hydrological changes, which, in the absence of mitigation, could lead to the drying out of wet grassland. Example to be changed to one more specific to the project, if required.

Consideration of conservation status is important for evaluating the effects of impacts on individual habitats and species and assessing their significance:

- Habitats – conservation status is determined by the sum of the influences acting on the habitat that may affect its extent, structure and functions as well as its distribution and its typical species within a given geographical area.

- Species – conservation status is determined by the sum of influences acting on the species concerned that may affect its abundance and distribution within a given geographical area.

5.3.3 Significant Effects

The concept of ecological significance is addressed in paragraphs 5.24 through to 5.28 of CIEEM guidelines. Significance is a concept related to the weight that should be attached to effects when decisions are made. For the purpose of ecological impact assessment, a 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features' or for biodiversity in general. Conservation objectives may be specific (*e.g.*, for a designated site) or broad (*e.g.*, national/local nature conservation policy) or more wide-ranging (enhancement of biodiversity). Effects can be considered significant at a wide range of scales from international to local and the scale of significance of an effect may or may not be the same as the geographic context in which the feature is considered important.

The EPA Guidelines on information to be included in Environmental Impact Assessment Reports (EPA 2022) were adhered to when determining significance and the present assessment is in accordance with those guidelines.

Table 5.4: Criteria for determining the Significance of Effects, based on EPA Guidelines (2022)

Effect Magnitude	Definition
No change	No discernible change in the ecology of the affected feature.
Imperceptible effect	An effect capable of measurement but without noticeable consequences.
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight effect	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate effect	An effect that alters the character of the environment that is consistent with existing and emerging trends.
Significant effect	An effect which, by its character, its 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 effect	An effect which obliterates sensitive characteristics.

5.3.4 Cumulative Effects

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 can occur where a proposed development results in individually insignificant impacts that, when considered in-combination with impacts of other proposed or permitted plans and projects, can result in significant effects.

5.3.5 Avoidance, Mitigation, Compensation and Enhancement

When seeking mitigation or compensation solutions, efforts should be consistent with the geographical scale at which an effect is significant. For example, mitigation and compensation for effects on a species population significant at a county scale should ensure no net loss of the population at a county scale. The relative geographical scale at which the effect is significant will have a bearing on the required outcome which must be achieved.

Where potentially significant effects have been identified, the mitigation hierarchy has been applied, as recommended in the CIEEM Guidelines. The mitigation hierarchy sets out a sequential approach beginning with the avoidance of impacts where possible, the application of mitigation measures to minimise unavoidable impacts and then compensation for any remaining impacts. Once avoidance and mitigation measures have been applied residual effects are then identified along with any necessary compensation measures, and incorporation of opportunities for enhancement.

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

- Avoidance is used where an impact has been avoided, e.g., through changes in scheme design;
- Mitigation is used to refer to measures to reduce or remedy a specific negative impact *in situ*;
- Compensation describes measures taken to offset residual effects, i.e., where mitigation *in situ* is not possible.
- Enhancement is improved management of ecological features or provision of new ecological features, resulting in a net benefit to biodiversity, which may be unrelated to a negative impact or is 'over and above' that required to mitigate/compensate for an impact.

5.4 BASELINE ECOLOGICAL CONDITIONS

5.4.1 Physical and General Ecological Description of Site

The proposed wind farm Development is situated on the border of Counties Cork and Kerry and is approximately 5.9 km west of Ballyvourney. The lands are within the townlands of Inchamore, Mileeny, Derryreag and Derreenaling.

The proposed Development is located within the Derrynasaggart Mountains and situated within a landscape dominated by agricultural land (mainly used for stock grazing), commercial forestry and bog and heath of varying quality. There are a number of established wind farms in the region, including Coomagearlahy Wind Farm (c.2.7 km), Coolknoohil Kilgarvan Wind Farm (4.4 km), Glanlee Wind Farm (4.9 km) and Grousemount Wind Farm (7.5 km) (all southwest of the Site).

The altitude of the site ranges from approximately 300 m to 460 m AOD, with the local peak of Knockbwee at 461 m AOD. The mapped geological formation underlying the site is classified as the Gun Point Formation (DUGNPT), which is comprised of Green-grey sandstone and Purple siltstone (see Chapter 8 for details). The primary soil type across the site is blanket peat, with some outcropping bedrock. Peat depth is generally shallow though localised pockets of deeper peat (> 2 m) occur in places.

The topography of the site varies, ranging from mostly gently to occasional steep inclinations. The site for the proposed Development is located within the Lee, Cork Harbour and Youghal Bay catchment. The site lies entirely within the Inchamore Stream sub-catchment where five tributaries flow into the Bardinch River, which then joins the Sullane River, a tributary of the Lee. All surface water drainage from the Site eventually combine in Carrigdrohid Reservoir, from which waters eventually flow to Cork Harbour. The Site itself is characterised by a relatively extensive network of non-mapped natural and artificial drainage channels. The natural streams within the Site are small 1st order tributaries which have high gradients and do not provide suitable habitat for fish or larger aquatic organisms. The Water Framework Directive status (2013-2018) for the mapped surface water body / river (Sullane_010) directly draining the Site is classified as 'Good'.

The Grid Connection Route runs in an east to north-easterly direction from the Inchamore site to the existing Ballyvouskill 220kV substation. Much of the drainage along the route corridor is to the Clydagh River.

Ecologically, the site for the proposed wind farm can be described as being dominated by conifer plantation (WD4 of Fossitt 2000). The unplanted area of the site is mostly wet heath (HH3), with areas of upland blanket bog (PB2) and cutover bog (PB4). Other habitats represented within the Site are dry siliceous heath (HH1), exposed siliceous rock (ER1) and eroding/upland rivers (FW1). The grid connection route is almost entirely along forest tracks.

5.4.2 Sites Designated for Nature Conservation

The potential for the Development to impact on sites that are designated for nature conservation is considered in this Ecological Impact Assessment.

Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) are designated under the EU Habitats Directive and EU Birds Directive respectively and are collectively known as 'European Sites' or 'Natura 2000' sites. The potential for significant effects on the integrity of European Sites is fully assessed in the AA Screening Report and Natura Impact Statement that accompanies this application. As per EPA Guidance 2022, *"a biodiversity section of an EIAR, for example, should not repeat the detailed assessment of potential effects on European sites contained in documentation prepared as part of the Appropriate Assessment process, but it should refer to the findings of that separate assessment in the context of likely significant effects on the environment, as required by the EIA Directive".*

Natural Heritage Areas (NHAs) are designated under Section 18 the Wildlife (Amendment) Act 2000 and their management and protection is provided for by this legislation and planning policy. The potential for effects on these designated sites is fully considered in this report.

Proposed Natural Heritage Areas (pNHAs) were designated on a non-statutory basis in 1995 but have not since been statutorily proposed or designated. However, the potential for effects on these sites is fully considered in this EcIA.

All Designated Sites that could potentially be affected were identified using a Source-Pathway – Receptor model. To provide context for the assessment, European and National Sites within a distance of 15 km surrounding the development site have been considered and are shown in **Figures 5-3 and 5-4** respectively. The distance of 15 km follows guidance from the Department of Environment, Heritage and Local Government (2010). However, sites that were further away from the proposed development were also considered, especially where ecological and/or hydrological connectivity exists.

Information on the identified sites according to the site-specific conservation objectives is provided in **Tables 5.5** and **5.6.**

No part of the study site is within an area with a nature conservation designation or is adjacent to an area with such a designation.

European designated sites

A total of 13 European sites are identified where consideration is given for the potential of the proposed project to impact on their qualifying interests and/or Special Conservation Interests. These sites are listed in **Table 5.5** along with the reasons for designation, the distance from the proposed wind farm site and whether any linkages or connectivity exist between the two locations. The designated sites are mapped in **Figure 5.3a and b.**

The European sites are considered in detail in the AA Screening Report / NIS which accompanies this application.

National designated sites

A series of three Natural Heritage Area (NHAs) occur within a 15 km radius of the site (see **Figure 5.4** and **Table 5.6**). The nearest designated Natural Heritage Area to the Inchamore wind site is Sillahertane Bog NHA, which is approximately 5.5 km to the southwest.

Proposed designated sites

A series of proposed Natural Heritage Areas (pNHAs) occur within a 15 km radius of the Inchamore site (see **Figure 5.6** and **Table 5.6**).

Table 5.5 Relevant European sites, reasons for designation, distances from Inchamore site and summary of ecological connectivity.

Note that in the following, the use of the term 'Project' includes the grid connection route and turbine delivery route.

European Site	Reasons for designation (information correct as of 23rd January 2023) (*denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
	SPECIAL AREAS OF CONSERVATION	
Killarney National Park, Macgillycuddy's Reeks & Caragh River Catchment SAC (site code 000365)	Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) [3110] Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or *Isoeto-Nanojuncetea* [3130] Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion vegetation* [3260] Northern Atlantic wet heaths with *Erica tetralix* [4010] European dry heaths [4030] Alpine and Boreal heaths [4060] *Juniperus communis* formations on heaths or calcareous grasslands [5130] Calaminarian grasslands of the *Violetalia calaminariae* [6130] Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410] Blanket bogs (* if active bog) [7130] Depressions on peat substrates of the *Rhynchosporion* [7150] Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0] Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0] *Taxus baccata* woods of the British Isles [91J0] *Geomalacus maculosus* (Kerry Slug) [1024] *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029] *Euphydryas aurinia* (Marsh Fritillary) [1065] *Petromyzon marinus* (Sea Lamprey) [1095] *Lampetra planeri* (Brook Lamprey) [1096] *Lampetra fluviatilis* (River Lamprey) [1099]	The Site at Inchamore is approximately 1.4 km south of the Caragh River component of the SAC. The closest point to the Turbine Delivery Route (along the access road from the N22 entrance) is 1.62 km south east of the SAC. The Site entrance/closest point of the TDR is located 1.75 km south east to the SAC. There are no ecological or hydrological linkages between the Project and the SAC. The location of the Development from the SAC is greater than the normal distance that foraging lesser horse-shoe bats would normally fly. McAney (in Lysaght & Marnell 2016) notes that the normal foraging distance is less than 2 km, while Schofield (cited in the NPWS Conservation Objectives for the site) notes that linear features such as hedgerows, treelines and stone walls provide vital connectivity for this species within 2.5 km around each roost. The majority of the grid connection route is located along the route of

European Site	Reasons for designation (information correct as of 23rd January 2023) (*denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
	Salmo salar (Salmon) [1106] *Rhinolophus hipposideros* (Lesser Horseshoe Bat) [1303] *Lutra lutra* (Otter) [1355] *Trichomanes speciosum* (Killarney Fern) [1421] *Najas flexilis* (Slender Naiad) [1833] *Alosa fallax killarnensis* (Killarney Shad) [5046] According to this SAC's site Conservation Objectives document (Version 1.0. Department of Culture, Heritage and the Gaeltacht, 23rd October 2017), for each of the listed QIs, the Conservation Objective is to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected.	an existing forestry road which runs parallel to the Clydagh River. The closest distance between the cable route corridor and the SAC is 41 m. The route crosses three main streams and numerous drains which flow into the Clydagh. **It is concluded that hydrological connectivity exists between the Project (by way of the grid connection) and the SAC and that further assessment is required.**
Mullaghanish Bog SAC (site code: 001890)	Blanket bogs (* if active bog) [7130] According to this SAC's site Conservation Objectives document (Version 1.0. Department of Arts, Heritage Regional, Rural & Gaeltacht Affairs, 16th May 2017) for each of the listed QIs, the Conservation Objective is to maintain the favourable conservation condition of the Annex I habitats and/or the Annex II species for which the SAC has been selected.	The Site is approximately 6.9 km south-southwest of the SAC. The Turbine Delivery Route is 7.1 km at its closest point to the SAC. There are no hydrological links between these areas and the SAC. While a section of the grid connection corridor runs within a forest track 632 m from the SAC, the SAC is on higher ground to the forest track with established forestry and open heath in between. **It is considered that there is no potential for significant effects on this SAC.**
St Gobnet's Wood SAC (site code: 000106)	Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0] According to this SAC's site Conservation Objectives document (Version 1.0. Department of Housing, Local Government and Gaeltacht, NPWS 11th January 2022) for each of the listed QIs, the Conservation Objective is to maintain the favourable conservation	The Site is approximately 5 km west-northwest of the SAC. The Turbine Delivery Route at its nearest point (existing road of the N22) is 185 m northwest of the SAC. However, the

European Site	Reasons for designation (information correct as of 23rd January 2023) (*denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
	condition of the Annex I habitats and/or the Annex II species for which the SAC has been selected.	closest point to proposed works (site entrance) is 6.08 km in distance from the SAC. The closest point along the Grid Connection Route is 5.46 km northwest of the SAC. There are no hydrological links between the TDR and GCR to the SAC. The Site and the SAC are linked hydrologically by the Sullane River (channel length c.8 km). However, the qualifying interest of the SAC, Old Sessile Oak Woods, occurs on ground above the high water mark and could not be affected in any way by potential pollutants from the project site which could be carried in the river water. **It is concluded that while hydrological connectivity exists between the Project area and the SAC, there is no potential for significant effects on the qualifying interest of this SAC.**
Blackwater River (Cork/Waterford) (site code 002170)	Estuaries [1130] Mudflats and sandflats not covered by seawater at low tide [1140] Perennial vegetation of stony banks [1220] Salicornia and other annuals colonising mud and sand [1310] Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330] Mediterranean salt meadows (Juncetalia maritimi) [1410]	The site is approximately 11 km southwest of the SAC; the Grid Connection Route is located 4.1 km south of this SAC; the Turbine Delivery route is located 9.0 km south of this SAC; with no hydrological or ecological linkages between the locations and the SAC.

European Site	Reasons for designation (information correct as of 23rd January 2023) (*denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260] Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0] Alluvial forests with Alnus glutinosa and Fraxinus excelsior (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0] *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029] *Austropotamobius pallipes* (White-clawed Crayfish) [1092] *Petromyzon marinus* (Sea Lamprey) [1095] *Lampetra planeri* (Brook Lamprey) [1096] *Lampetra fluviatilis* (River Lamprey) [1099] *Alosa fallax fallax* (Twaite Shad) [1103] *Salmo salar* (Salmon) [1106] *Lutra lutra* (Otter) [1355] *Trichomanes speciosum* (Killarney Fern) [1421] According to this SAC's site Conservation Objectives document (NPWS 31st July 2012, Conservation objectives for Blackwater River SAC [002170]. Version 1.0. Department of Arts, Heritage and the Gaeltacht) for each of the listed QIs, the Conservation Objective is to maintain the favourable conservation condition of the Annex I habitats and/or the Annex II species for which the SAC has been selected.	**It is considered that there is no potential for significant effects on this SAC.**
Glanlough Woods SAC (site code: 002315)	*Rhinolophus hipposideros* (Lesser Horseshoe Bat) [1303] According to this SAC's site Conservation Objectives document (NPWS 28th September 2018 Conservation objectives for Glanlough Woods SAC [002315]. Version 1.0. Department of Culture, Heritage and the Gaeltacht) for each of the listed QIs, the Conservation Objective is to maintain the favourable conservation condition of the Annex I habitats and/or the Annex II species for which the SAC has been selected.	The Site is approximately 14 km northeast of the SAC. The Turbine Delivery Route is located 16.6 km to the northeast of the SAC. The Grid Connection Route is located to 16.6 km to the northeast of the SAC. There are no hydrological links between these areas and the SAC. The location of the Development from the SAC is greater than the normal distance that foraging lesser horse-

European Site	Reasons for designation (information correct as of 23rd January 2023) (*denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
		shoe bats would normally fly. McAney (in Lysaght & Marnell 2016) notes that the normal foraging distance is less than 2 km, while Schofield (cited in the NPWS Conservation Objectives for the site) notes that linear features such as hedgerows, treelines and stone walls provide vital connectivity for this species within 2.5 km around each roost. **It is considered that there is no potential for significant effects on this SAC.**
Kilgarvan Ice House SAC (site code 000364)	*Rhinolophus hipposideros* (Lesser Horseshoe Bat) [1303] According to this SAC's site Conservation Objectives document (NPWS 6th November 2018, Conservation objectives for Kilgarvan Ice House SAC [00364]. Version 1.0. Department of Culture, Heritage, and the Gaeltacht) for each of the listed QIs, the Conservation Objective is to maintain the favourable conservation condition of the Annex I habitats and/or the Annex II species for which the SAC has been selected.	The Site is approximately 10 km northeast of the SAC. The Turbine Delivery Route is located 12.5 km northeast of the SAC. The Grid Connection Route is located 12.3 km northeast of the SAC. There are no hydrological links between the Project and the SAC. The proposed wind farm site location from the SAC is greater than the normal distance that foraging lesser horse-shoe bats would normally fly. McAney (in Lysaght & Marnell 2016) notes that the normal foraging distance is less than 2 km, while Schofield (cited in the NPWS Conservation Objectives for the site) notes that linear features such as hedgerows, treelines and stone walls provide vital connectivity for this species within 2.5 km around each roost.

European Site	Reasons for designation (information correct as of 23rd January 2023) (*denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
		It is considered that there is no potential for significant effects on this SAC and no further assessment is required.
Old Domestic Building, Curraglass Wood SAC (site code 002041)	*Rhinolophus hipposideros* (Lesser Horseshoe Bat) [1303] According to this SAC's site Conservation Objectives document (NPWS 27th August 2018, Conservation objectives for Old Domestic Building, Curraglass Wood SAC [002041]. Version 1.0. Department of Culture, Heritage, and the Gaeltacht) for each of the listed QIs, the Conservation Objective is to maintain the favourable conservation condition of the Annex I habitats and/or the Annex II species for which the SAC has been selected	The Site is approximately 8.1km east of the SAC. The Grid Connection Route is located 9.8 km east of the SAC. The Turbine Delivery Route is located 9.8 km east of the SAC. There are no hydrological links between the Project and the SAC. The location of the Site from the SAC is greater than the normal distance that foraging lesser horse-shoe bats would normally fly. McAney (in Lysaght & Marnell 2016) notes that the normal foraging distance is less than 2 km, while Schofield (cited in the NPWS Conservation Objectives for the site) notes that linear features such as hedgerows, treelines and stone walls provide vital connectivity for this species within 2.5 km around each roost. **It is considered that there is no potential for significant effects on this SAC.**
The Gearagh SAC (site code 000108)	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260] Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation [3270] Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]	The Site is located 16.8 km northwest of the SAC. The Turbine Delivery Route (where works are proposed) is located 18.3 km northwest of the SAC. The Grid Connection Route (at its nearest point) is located 18.3 km northwest of the SAC.

European Site	Reasons for designation (information correct as of 23rd January 2023) (*denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
	Alluvial forests with Alnus glutinosa and Fraxinus excelsior (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0] *Lutra lutra* (Otter) [1355] According to this SAC's site Conservation Objectives document (Version 1.0. Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, 15th September 2016) for each of the listed QIs, the Conservation Objective is to maintain the favourable conservation condition of the Annex I habitats and/or the Annex II species for which the SAC has been selected.	The Sullane River, which drains the Site for the proposed wind farm, flows in a south and then east direction for a distance of approximately 24 km before it enters the River Lee system at Coolcour, approximately 3 km downstream of the Lee Bridge, which marks the eastern extremity of the Gearagh SAC. Flow continues eastwards towards Cork Harbour. Taking into account (i) that the flow from the area of the proposed wind farm does not mix with water within the SAC, and (ii) the channel distance of over 20 km between the two locations, there is no realistic potential for water from the wind farm area (which could carry contaminants in absence of mitigation) to have effects on the qualifying interests of the SAC. **It is considered that there is no potential for significant effects on this SAC.**
Great Island Channel SAC (site code 001058)	Mudflats and sandflats not covered by seawater at low tide [1140] Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330] According to this SAC's site Conservation Objectives document (Version 1.0. Department of Arts, Heritage and the Gaeltacht, 6th June 2014) for each of the listed QIs, the Conservation Objective is to maintain the favourable conservation condition of the Annex I habitats and/or the Annex II species for which the SAC has been selected.	The Site is located 62.2 km west of the SAC. The nearest point along the Turbine Delivery Route is located 5.9 km from the SAC. The nearest point along the Turbine Delivery Route where works are proposed (site entrance) is a distance of 62.8 km west of the SAC. The closest point along the Grid Connection Route is near the existing

European Site	Reasons for designation (information correct as of 23rd January 2023) (*denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
		220 kV Ballyvouskill Substation at a distance of 51.7 km northwest of the SAC. The Sullane River, which drains the Site for the proposed wind farm, enters the River Lee system at Coolcour, approximately 24 km from the site of the proposed wind farm. The Lee then flows for approximately 40 km before entering Cork Harbour. There is a further 5 km distance across the harbour to the SAC. While there is a total distance of approximately 69 km from the Inchamore site to the SAC, hydrological connectivity does exist. However, in view of the distance between the two locations, it is considered that there is no potential for measurable effects on the qualifying interests of the SAC. Any pollutants or silts entering the drainage network at the site for the proposed wind farm, even in the most extreme scenarios and without mitigation of any form, would be completely attenuated by the dilution, dispersal and settlement that would occur within the river and estuarine system. **It is considered that there is no potential for significant effects on this SAC.**
	SPECIAL PROTECTION AREAS	

European Site	Reasons for designation (information correct as of 23rd January 2023) (*denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
Mullaghanish to Musheramore Mountains SPA (site code: 004162)	Hen Harrier (*Circus cyaneus*) [A082] According to the First Order Site-specific Conservation Objectives Version 1.0 for Mullaghanish to Musheramore Mountains SPA (NPWS 2022, Department of Housing, Local Government and Heritage), for each of the listed SCIs, the Conservation Objective is to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA.	The site of the proposed wind farm at Inchamore is approximately 6 km west of the SPA. Habitats suitable for foraging by hen harrier, including bog, heath, wet grassland and scrub, occur fairly widely between the SPA and the wind farm site. The habitats within the wind farm site have potential to support foraging hen harriers. A section of the grid connection route is located along the route of an existing forestry road which runs north of the SPA. The closest distance between the cable route corridor and the SPA is 170 m. The proposed works on the Turbine Delivery Route are at a distance of 5.6 km west of the SPA. **As the potential for significant effects on this SPA cannot be excluded, further assessment is required.**
Killarney National Park SPA (site code 004038)	Merlin (*Falco columbarius*) [A098] Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395] According to the First Order Site-specific Conservation Objectives Version 1.0 for Killarney National Park SPA (NPWS 2022, Department of Housing, Local Government and Heritage), for each of the listed SCIs, the Conservation Objective is to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA.	The Site is approximately 14.5 km east of the SPA. Habitats suitable for foraging by merlin, including bog, heath, wet grassland and scrub, occur fairly widely between the SPA and the wind farm site. The habitats within the wind farm site have potential to support foraging merlin.

European Site	Reasons for designation (information correct as of 23rd January 2023) (*denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
		From a review of the literature (Cramp 1980, Newton et al. 1978, Orchel 1992, Sale 2016), it can be concluded with certainty that the hunting range of merlins breeding within the Killarney National Park SPA, a nearest distance of 14.5 km from Inchamore, could not extend to the site for the proposed wind farm at Inchamore. Habitats outside of the National Park, or within the vicinity of the Inchamore site, are not suitable for supporting Greenland white-fronted goose (the other SCI for this SPA) and there are no historic or recent records of the species from these areas. The works along the Turbine Delivery Route are located 16.0 km east of the SPA. The Grid Connection Route is located 15.8 km east of the SPA. **It is considered that there is no potential for significant effects on this SPA.**
The Gearagh SPA (site code 0004109)	Wigeon (Anas penelope) [A050] Teal (Anas crecca) [A052] Mallard (Anas platyrhynchos) [A053] Coot (Fulica atra) [A125] Wetland and Waterbirds [A999] According to the First Order Site-specific Conservation Objectives Version 1.0 for The Gearagh SPA (NPWS 2022, Department of Housing, Local Government and Heritage), for each of the listed SCIs, the Conservation Objective is to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA.	The Site is 16.8 km northwest of the SPA. The proposed works along the Turbine Delivery Route are located 18.3 km northwest of the SPA. The Grid Connection Route is 18.5 km northwest of the SPA. The Sullane River, which drains the Site for the proposed wind farm, flows in a south and then east direction for a distance of

European Site	Reasons for designation (information correct as of 23rd January 2023) (*denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
		approximately 24 km before it enters the River Lee system at Coolcour, approximately 4 km downstream of the SPA. Flow continues eastwards towards Cork Harbour. Taking into account (i) that the flow from the area of the proposed wind farm is not likely to mix with water within the SPA, and (ii) the channel distance of approximately 28 km between the two locations, there is no realistic potential for water from the wind farm area (which could carry contaminants in absence of mitigation) to have effects on the Special Conservation Interests of the SPA, The habitats within the proposed wind farm site do not have potential to support any of the SCIs of the SPA. **It is considered that there is no potential for significant effects on this SPA.**
Cork Harbour SPA (site code 0004040)	Little Grebe (*Tachybaptus ruficollis*) [A004] Great Crested Grebe (*Podiceps cristatus*) [A005] Cormorant (*Phalacrocorax carbo*) [A017] Grey Heron (*Ardea cinerea*) [A028] Shelduck (*Tadorna tadorna*) [A048] Wigeon (*Anas penelope*) [A050] Teal (*Anas crecca*) [A052] Pintail (*Anas acuta*) [A054] Shoveler (*Anas clypeata*) [A056] Red-breasted Merganser (*Mergus serrator*) [A069] Oystercatcher (*Haematopus ostralegus*) [A130]	The closest point along the Turbine Delivery Route is 14 m from the SPA where the road is already in existence. However, the proposed works (site entrance) is located 57 km northwest of the SPA. The Grid Connection Route is located 57.1 km from the SPA. The Sullane River, which drains the site for the proposed wind farm,

European Site	Reasons for designation (information correct as of 23rd January 2023) (*denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
	Golden Plover (*Pluvialis apricaria*) [A140] Grey Plover (*Pluvialis squatarola*) [A141] Lapwing (*Vanellus vanellus*) [A142] Dunlin (*Calidris alpina*) [A149] Black-tailed Godwit (*Limosa limosa*) [A156] Bar-tailed Godwit (*Limosa lapponica*) [A157] Curlew (*Numenius arquata*) [A160] Redshank (*Tringa totanus*) [A162] Black-headed Gull (*Chroicocephalus ridibundus*) [A179] Common Gull (*Larus canus*) [A182] Lesser Black-backed Gull (*Larus fuscus*) [A183] Common Tern (*Sterna hirundo*) [A193] Wetland and Waterbirds [A999] According to the First Order Site-specific Conservation Objectives Version 1.0 for Cork Harbour SPA (NPWS 2022, Department of Housing, Local Government and Heritage), for each of the listed SCIs, the Conservation Objective is to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA.	enters the River Lee system at Coolcour, approximately 24 km from the site of the proposed wind farm. The Lee then flows for approximately 40 km before entering Cork Harbour. While there is a total distance of approximately 64 km from the Inchamore site to the SPA, hydrological connectivity does exist. However, in view of the distance between the two locations, it is considered that there is no potential for measurable effects on the SCIS of the SAC. Any pollutants or silts entering the drainage network at the site for the proposed wind farm, even in the most extreme scenarios and without mitigation of any form, would be completely attenuated by the dilution, dispersal and settlement that would occur within the river and estuarine system. **It is considered that there is no potential for significant effects on this SPA.**

Table 5.6: Relevant sites designated under Irish legislation, reasons for designation, distances from subject site and summary of connectivity.

Note that in the following, the use of the term 'Project' includes the grid connection route and turbine delivery route.

Site	Reasons for designation (information correct as of 23rd January 2023)	Distance from proposed Inchamore Wind Farm site and summary of connectivity
	NATURAL HERITAGE AREAS	
Sillahertane Bog NHA (site code: 0001382)	Peatlands (4)	The pNHA site is located approximately 5.5 km to the south-southwest of the site for the proposed wind farm. There are no linkages, ecological or hydrological, between the NHA and the wind farm site.
Slaheny River Bog NHA (site code: 000383)	Peatlands (4)	The NHA site is located approximately 14 km to the southwest of the site for the proposed wind farm. There are no linkages, ecological or hydrological, between the NHA and the wind farm site.
Conigar Bog NHA (site code: 0002386)	Peatlands (4)	The NHA site is located approximately 14.5 km to the southwest of the site for the proposed wind farm. There are no linkages, ecological or hydrological, between the NHA and the wind farm site.
	PROPOSED NATURAL HERITAGE AREAS	
Killarney National Park, Macgillycuddy's Reeks & Caragh River Catchment pNHA (site code 000365)	Not Stated.	The proposed wind farm site at Inchamore is approximately 3 km south of the Caragh River component of the pNHA. There are no linkages, hydrological or otherwise, between the two areas. The majority of the grid connection route is located along the route of an existing forestry road which runs parallel to the Clydagh River. The closest distance between the cable route corridor and the

Site	Reasons for designation (information correct as of 23rd January 2023)	Distance from proposed Inchamore Wind Farm site and summary of connectivity
		pNHA is 41 m. The route crosses three main streams and numerous drains which flow into the Clydagh. It is concluded that hydrological connectivity exists between the Project area and the pNHA.
Mullaghanish Bog pNHA (site code: 001890)	Not stated.	The proposed wind farm site is approximately 7.5 km south-southwest of the pNHA. There are no hydrological links between the two areas. While a section of the grid connection corridor runs within a forest track 632 m from the pNHA, the pNHA is on higher ground to the forest track with established forestry and open heath in between. It is considered that there is no ecological or hydrological connectivity between the Project area and the pNHA
St Gobnet's Wood pNHA (site code: 000106)	Not stated.	The proposed wind farm site is approximately 5 km west-northwest of the SAC. The wind farm and the pNHA are linked hydrologically by the Sullane River (channel length c.8 km). It is concluded that hydrological connectivity exists between the Project area and the pNHA.
Prohus Wood pNHA (site code 001248)	Not stated.	The proposed wind farm site is approximately 13.5 km north-west of the pNHA. There are no ecological or hydrological linkages between the two areas. It is concluded that there is no ecological or hydrological

Site	Reasons for designation (information correct as of 23rd January 2023)	Distance from proposed Inchamore Wind Farm site and summary of connectivity
		connectivity between the Project area and the pNHA.
Lough Allua pNHA (site code: 001065)	Not stated.	The proposed wind farm site is approximately 11 km north-northwest of the pNHA. There are no ecological or hydrological linkages between the two areas. It is concluded that there is no ecological or hydrological connectivity between the Project area and the pNHA
Ballagh Bog pNHA (site code: 001886)	Not stated.	The proposed wind farm site is approximately 11.5 km northeast of the pNHA. There are no ecological or hydrological links between the two areas. It is concluded that there is no ecological or hydrological connectivity between the Project area and the pNHA
Gouganbarra Lake pNHA (site code: 001057)	Not stated.	The proposed wind farm site is approximately 12 km northeast of the pNHA. There are no ecological or hydrological links between the two areas. It is concluded that there is no ecological or hydrological connectivity between the Project area and the pNHA.
Kilgarvan Wood pNHA (site code: 001787)	Not stated.	The proposed wind farm site is approximately 12 km north-east of the pNHA. There are no hydrological links between the two areas. It is concluded that there is no ecological or hydrological

Site	Reasons for designation (information correct as of 23rd January 2023)	Distance from proposed Inchamore Wind Farm site and summary of connectivity
		connectivity between the Project area and the pNHA.
Roughty River pNHA (site code: 001376)	Not stated.	The proposed wind farm site is approximately 7 km northeast of the pNHA. There are no hydrological links between the two areas. It is concluded that there is no ecological or hydrological connectivity between the Project area and the pNHA.
Kilgarvan Ice House pNHA (site code 000364)	Not stated (but expected to include Lesser Horseshoe bat).	The proposed wind farm site is approximately 11 km north-east of the pNHA. There are no hydrological links between the two areas. The proposed wind farm site location is greater than the normal distance (less than 2 km) that foraging bats would normally fly (Lysaght & Marnell 2016). It is concluded that there is no ecological or hydrological connectivity between the Project area and the pNHA.
Old Domestic Building, Lettir pNHA (site code 002040)	Not stated (but expected to include Lesser Horseshoe bat).	The proposed wind farm site is approximately 14 km north-east of the pNHA. There are no hydrological links between the two areas. The proposed wind farm site location is greater than the normal distance (less than 2 km) that foraging bats would normally fly (Lysaght & Marnell 2016). It is concluded that there is no ecological or hydrological connectivity between the Project area and the pNHA.

Site	Reasons for designation (information correct as of 23rd January 2023)	Distance from proposed Inchamore Wind Farm site and summary of connectivity
Old Domestic Building, Curraglass Wood pNHA (site code 002041)	Not stated (but expected to include Lesser Horseshoe bat).	The proposed wind farm site is approximately 7 km west of the pNHA. There are no hydrological links between the two areas. The proposed wind farm site location is greater than the normal distance (less than 2 km) that foraging bats would normally fly (Lysaght & Marnell 2016). It is concluded that there is no ecological or hydrological connectivity between the Project area and the pNHA.
Doo Lough pNHA (site code 00350)	Not stated	The proposed wind farm site is approximately 11 km southeast of the pNHA. There are no ecological or hydrological links between the two areas. It is concluded that there is no ecological or hydrological connectivity between the Project area and the pNHA.

5.4.3 Habitats, Vegetation and Flora

The main habitat within the survey area for the wind farm is conifer plantation (WD4). This occupies all but the north-western sector of the site and has been planted on sloping ground which is covered by relatively shallow peat soils. Other main habitats which occur within the site are wet heath (HH3), upland blanket bog (PB2) and cutover bog (PB4). Habitats which occur over small areas of the site are exposed siliceous rock (ER1), dry siliceous heath (HH1) and eroding/upland stream/river (FW1).

In the following sections the vegetation composition of these habitats is described, and the distribution of the principal habitats on site is shown in Figure 1. A list of plant species recorded in the main habitats is presented in **Appendix 5.1.**

Wet heath (HH3)

Wet heath vegetation occurs in the north-western portion of the survey area (see **Plate 5.2**). The vegetation is mostly dominated by varying proportions of purple moor-grass (*Molinia caerulea*), deer grass (*Tricophorum germanicum*) and the moss *Racomitrium lanuginosum*. The habitat has developed on sloping areas where the peat depth is generally between 10 and 50 cm. The vegetation is relatively species-poor, with ling heather (*Calluna vulgaris*), cross-leaved heath (*Erica tetralix*), many-flowered bog-cotton (*Eriophorum angustifolium*) and tormentil (*Potentilla erecta*) among the more frequent associates. The cover of ericoid shrub species (*Erica tetralix* and *Calluna vulgaris)* is in the range of 10 to 20%. The cover of Sphagnum mosses is generally between 10 and 30%, with *Sphagnum capillifolium* and *Sphagnum papillosum* the main species encountered.

The condition of the heath habitat is good[1] in respect of its representativity (i.e. a typical example) and conservation status (i.e. conservation structure and functionality). This is likely to reflect the low levels of livestock grazing evident in the local area. It is likely, however, that the relatively low cover of woody heath species (namely *Erica tetralix* and *Calluna vulgaris*) is a result of a past burning event and possibly over-grazing in previous decades. Small areas of bare peat do occur however the cover is less than 5%. While wet heath vegetation is a relatively widespread habitat in the upland areas of counties Cork and Kerry, the status at a National Level is given as 'Bad and deteriorating' in the review of EU Protected Habitats and Species in Ireland (Department of Culture, Heritage and the Gaeltacht, 2019).

Equivalent EU Annex 1 Habitat – Northern Atlantic wet heaths with *Erica tetralix* (4010)

1 A rating of 'good' follows a scale of 'Excellent', 'Good' and 'Average or Reduced' – this scale is used within the assessment criteria for Natural Habitats within Natura 2000 sites (see Natura 2000 Network – Standard Data Form, Final Version May 1994)

Plate 5.2: Wet heath on sloping ground in the north-west of the survey area.

Dry siliceous heath (HH1)

Dry heath is a widespread habitat in the unplanted areas of the site though it does not occur over large areas. Typically, the habitat is most commonly found along the edges of sandstone rock outcrops where the peat depth is less than 10 cm. Western gorse (*Ulex gallii*) is the main species in the vegetation with ling heather (*Calluna vulgaris*), bell heather (*Erica cinerea*), tormentil, hard fern (*Blechnum spicant*) and green ribbed sedge (*Carex binervis*) also occurring. The main mosses occurring in the vegetation are *Hypnum jutlandicum, Hylocomium splendens* and *Sphagnum capillifolium*. The habitat grades into adjoining areas of wet heath which occupies the slightly deeper peat soils which are adjacent.

Equivalent EU Annex 1 Habitat – European dry heaths (4030)

Upland blanket bog (PB2)

Upland blanket bog vegetation is confined to areas in the western parts of the site where the slope is relatively flat and the peat depth exceeds 50 cm. In general, the depth of peat within blanket bog habitat at Inchamore is between 1 and 1.5 metres. Purple moor-grass and Deer grass dominate the vegetation, with the cover of these two species generally exceeding 50%. As a result of the dominance of these two species the habitat is often difficult to separate the habitat from *Molinia*-dominated wet heath areas and the two habitats often intergrade with each other. Other frequent vascular plant species include cross-leaved heath, ling heather, bog asphodel (*Narthecium ossifragum*), many-flowered bog-cotton (*Eriophorum angustifolium*) and hare's tail bog-cotton (*Eriophorum vaginatum*). The moss layer is typically well-developed with *Sphagnum capillifolium, Sphagnum papillosum, Sphagnum cuspidatum, Racomitrium lanuginosum* and the liverwort *Pleurozia purpurea* among the most conspicuous species.

Equivalent EU Annex 1 Habitat **–** Blanket bog (7130).

Cutover blanket bog (PB4)

Cutover blanket bog occurs in the south-western portion of the survey area (see **Plate 5.3**), as well as in the area where Turbine no. 3 is located. The vegetation of these areas is characterised by a type of degraded grassy heath vegetation dominated by purple moor-grass, deer grass, mat grass (*Nardus stricta*), heath rush (*Juncus squarrosus*), common bog cotton and the mosses *Racomitrium lanuginosum* and *Campylopus introflexus*.

These cutover bog areas are prone to erosion and overgrazing by livestock. As a result, the cover of bare peat/stone is generally between 10% and 40%.

No Equivalent EU Annex 1 Habitat.

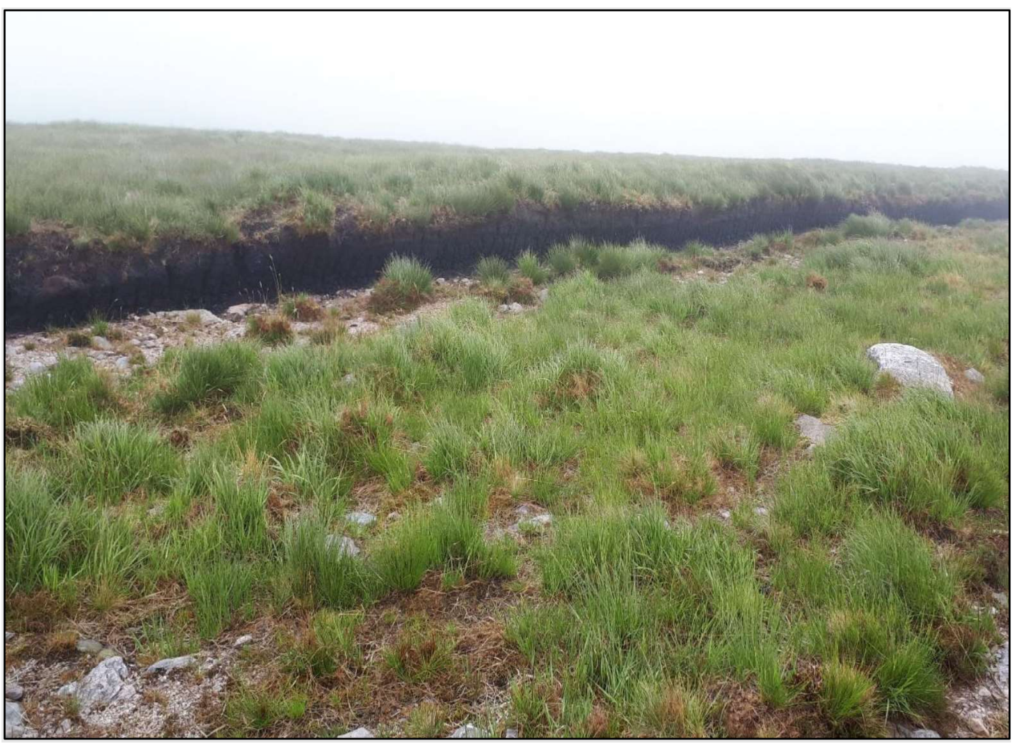


Plate 5.3: **Cutover bog surface dominated by *Molinia caerulea*, with outcropping bedrock visible. Uncut, shallow blanket bog is visible in the background.**

Dry humid acid grassland (GS3)

Small areas of dry humid acid grassland occur on shallow soils close to rock outcrops in the north-west of the survey area. The vegetation is dominated by a range of grass species, especially velvet bent (*Agrostis canina*), sweet vernal grass (*Anthoxanthum odoratum*) and mat grass (*Nardus stricta*). Other frequent species in the low-growing vegetation include heath bedstraw (*Galium saxatile*), tormentil, heath rush and mosses such as *Rhytidiadelphus loreus, Hylocomium splendens* and *Pleurozium schreberi*.

No Equivalent EU annex 1 Habitat.

Wet grassland (GS4)

A few small fields of wet grassland occur in the south of the survey area. These fields are dominated by soft rush (*Juncus effusus*) with frequent creeping buttercup (*Ranunculus repens*), creeping bent (*Agrostis stolonifera*), Yorkshire fog (*Holcus lanatus*) and white clover (*Trifolium repens*). The fields have been utilised for stock grazing until recently and are semi-improved in places.

No Equivalent EU Annex 1 Habitat.

Coniferous woodland (WD4)

Conifer plantation is a widespread habitat within the survey area, covering approximately 128.3 ha. Most of the plantation areas are now between 6 and 10 metres tall, with planting occurring between the mid-1980's to the mid-1990's. Sitka spruce and Lodgepole pine are the main planted tree species, with occasional shrubs of eared willow (*Salix aurita*), downy birch (*Betula pubescens*) and common gorse (*Ulex europaeus*) along the plantation margins.

The ground layer of these woodland areas is mostly heavily shaded, species-poor and dominated by a deep layer of conifer needles. The few plant species which occur are scattered tufts of purple moor-grass and hard fern, along with mosses such as *Hypnum jutlandicum*, *Plagiothecium undulatum* and *Rhytdiadelphus loreus*.

In recent years, areas of coniferous woodland have been established in the south/centre of the survey area. Prior to planting these areas were dominated by a range of grassland habitats including dry humid acid grassland (GS3), Improved grassland (GA1) and Wet grassland (GS4). Planting of these areas took place between 2 and 10 years ago, with Sitka spruce the main species planted.

No Equivalent EU Annex 1 Habitat.

Plate 5.4: Species-poor conifer plantation in the east of the survey area.

Exposed siliceous rock

Exposed sandstone bedrock occurs sparingly within the survey area and is largely confined to the western sector. The vegetation of exposed rock surfaces is typically sparse. In suitable rocky crevices plant species such as hard fern (*Blechnum spicant*), broad buckler fern (*Dryopteris 45rticula*), St. Patrick's cabbage (*Saxifraga spathularis*) and Wilson's filmy fern (*Hymenophyllum wilsonii*) are characteristic.

Equivalent EU Annex 1 Habitat – Siliceous rocky slopes with chasmophytic vegetation (8220).

Eroding/upland stream (FW1)

Short lengths of eroding upland stream (First order tributaries) occur within grassland areas in the south of the survey area. These streams flow through steeply sloping ground and have a stony bed. They support a typical, species-poor vegetation which includes bulbous rush (*Juncus bulbosus*) and lesser spearwort (*Ranunculus flammula*).

No Equivalent EU Annex 1 Habitat.

Plate 5.5: View of typical stream in survey area.

Table 5.7: Summary of the main habitats occurring at turbine and substation and borrow pit locations.

Turbine location	Main habitats occurring within infrastructure footprint
No. 1	Wet heath (HH3) / Blanket bog (PB2)
No. 2	Wet heath (HH3) / Conifer plantation (WD4)
No. 3	Cutover bog (PB4) / Conifer plantation (WD4)
No. 4	Conifer plantation (WD4)
No. 5	Conifer plantation (WD4)
No. 6	Conifer plantation (WD4)
Substation area	Conifer plantation (WD4)
Borrow Pit	Conifer plantation (WD4)

Grid route corridor description

The route is dominated by forest tracks. Habitat descriptions follow, along with a description of the section which traverse open countryside leading towards the Ballyvouskill substation.

Forest tracks (BL3)

Forestry tracks (BL3) dominate the proposed cable route corridor between the site for the proposed Inchamore Wind Farm and the existing substation at Ballyvouskill. The forestry tracks along the survey route are dominated by gravel and generally have a very low cover of vegetation. Any vegetation that does occur is patchy and is located in narrow strips along the track margins which are not subject to vehicular movement. The sparse vegetation of forest tracks is dominated by a mixture of ruderal and grassland species (see **Appendix 5.2**). The main species include *Agrostis stolonifera, Juncus articulatus, Juncus effusus, Cirsium palustre, Plantago major, Ranunculus repens, Prunella vulgaris* and *Trifolium repens*.

A notable plant species which was recorded growing along track margins is *Filago minima* (Least cudweed). The species is considered to be Near Threatened in Ireland (Wyse Jackson *et al*. 2016) and had been listed in the Flora (Protection) Order, 2015 but is not listed in the Flora (Protection) Order, 2022. Approximately 10 flowering heads of the species were noted at two locations in the townland of Derryreagh, where forest track runs through areas of recently felled and replanted coniferous plantation. In the Republic of Ireland, the species has a scattered distribution which includes the Killarney region, areas west of Cork city, Co. Wexford, South Wicklow, Co. Cavan and South Mayo.

Plate 5.6: View of typical forest track through recently felled conifer plantation in Derryreag townland.

Plate 5.7: View of forest track through an area of tall conifer plantation in Glashacormick.

Other habitats traversed by grid route

Between the N22 (chainage 16,200) and the forest road leading to the wind farm location (chainage 16,750), the cable route passes through a strip of grazed wet heath (HH3) alongside the N22 and then through conifer plantation (WD4).

To the north-west of Ballyvouskill substation **(see Figure 5.5)** the cable route passes through a field of improved grassland (GA1). The proposed route then crosses through an area of wet heath (HH3) on sloping ground. This heath vegetation is dominated by *Molinia caerulea* and *Calluna vulgaris,* with frequent *Erica tetralix, Erica cinerea, Potentilla erecta, Tricophorum germanicum, Carex panicea, Juncus squarrosus* and the moss *Sphagnum capillifolium.* The heath has an uneven surface topography which suggests overgrazing/ erosion in the past.

Plate 5.8: View of wet heath vegetation on sloping ground, looking back towards Ballyvouskill substation.

The proposed route then follows an old stony track through wet heath which is dominated by *Juncus effusus, Agrostis capillaris, Juncus articulates, Polytrichum* sp. And *Nardus stricta* which eventually joins with the main forest road further west.

Plate 5.9: View of old track running through wet heath.

Invasive species

During the field surveys, a search for Invasive Alien Species (IAS) listed under the Third Schedule of the European Communities Regulations 2011 (S.I. 477 of 2015) was conducted.

No species listed on this schedule were recorded during the surveys.

5.4.4 Terrestrial Mammals

Irish hare *Lepus timidus hibernicus* was observed on the heath and bog areas within the site and is expected to breed on site. Deer are widespread throughout the site and especially within the afforested areas. Several sightings indicated Sika deer *Cervus nippon* though fallow deer *Dama dama* and sika/red hybrids could also occur as these are widespread in the south-west.

While full search for badger *Meles meles* presence could not be carried out in the afforested areas of the site, no signs were observed in those areas which could be searched (*i.e.* margins of conifer plantations and tracks or firebreaks within the planted areas). It is noted that peat habitats and conifer plantation provide relatively poor habitat for badger as they normally require well drained soils to excavate setts and in Ireland setts are particularly associated with clay banks with hedgerows, native woodland and scrub (Smal 1991).

Pine marten *Martes martes* had been recorded within the local conifer plantations during the 2019/20 bird surveys but there were no signs of its presence during the baseline surveys in 2021. The preferred habitat of pine marten in Ireland is deciduous woodland or scrub with good ground cover, though mixed woodland and coniferous thickets are also used (Hayden and Harrington 2000). Pine martens may nest within larger trees with hollows, rock clefts or outbuildings. Taking into account the low suitability of the habitats within the Site for pine marten, it is considered that the Site is likely to be within a pine marten territory (which can be up to 80 ha) but that breeding on site is not likely.

There is no significant habitat on site to support otter *Lutra lutra*. This reflects the small size of the tributary streams and the absence of fish or larger aquatic organisms. However, otter occurs widely in the main channel of the Sullane River and it is possible that otter might at times travel upstream to the site.

5.4.5 Amphibians

The common frog *Rana temporaria* is widespread on site including within forest drains and in wet bog. Habitat suitable for the smooth newt *Lissotriton vulgaris* is absent within the site.

5.4.6 Reptiles

The common lizard *Zootoco vivipara* was recorded in June 2021 on a rock outcrop within the site and is expected to occur at low densities throughout the heath dominated areas of the site.

5.4.7 Bats

5.4.7.1 Desk review

5.4.7.1.1 Bat Conservation Ireland Database

A 1 km and 10 km radius search was requested from the Bat Conservation Ireland Database for the Irish Grid Reference W1403878722 in February 2023. There were no records on the database for the 1 km search while the records at a 10 km search are presented on the map below (**Figure 5.6**). The nearest BCIreland database recorded is 2.5 km from the boundary of the proposed development site.

Table 5.8: BCIreland Bat Records for 10 km radius search.

Bat Species	Records	Roost Records	Transect Records	Ad Hoc Records
Brown long-eared bat	8	5	0	3
Common pipistrelle	17	0	4	13
Daubenton's bat	6	0	0	6
Leisler's bat	10	0	1	9
Lesser horseshoe bat	7	5	0	2
Nathusius' pipistrelle	0	0	0	0
Natterer's bat	3	1	0	2
Soprano pipistrelle	13	0	1	12
Whiskered bat	4	0	0	4
Pipistrellus species	7	1	0	6

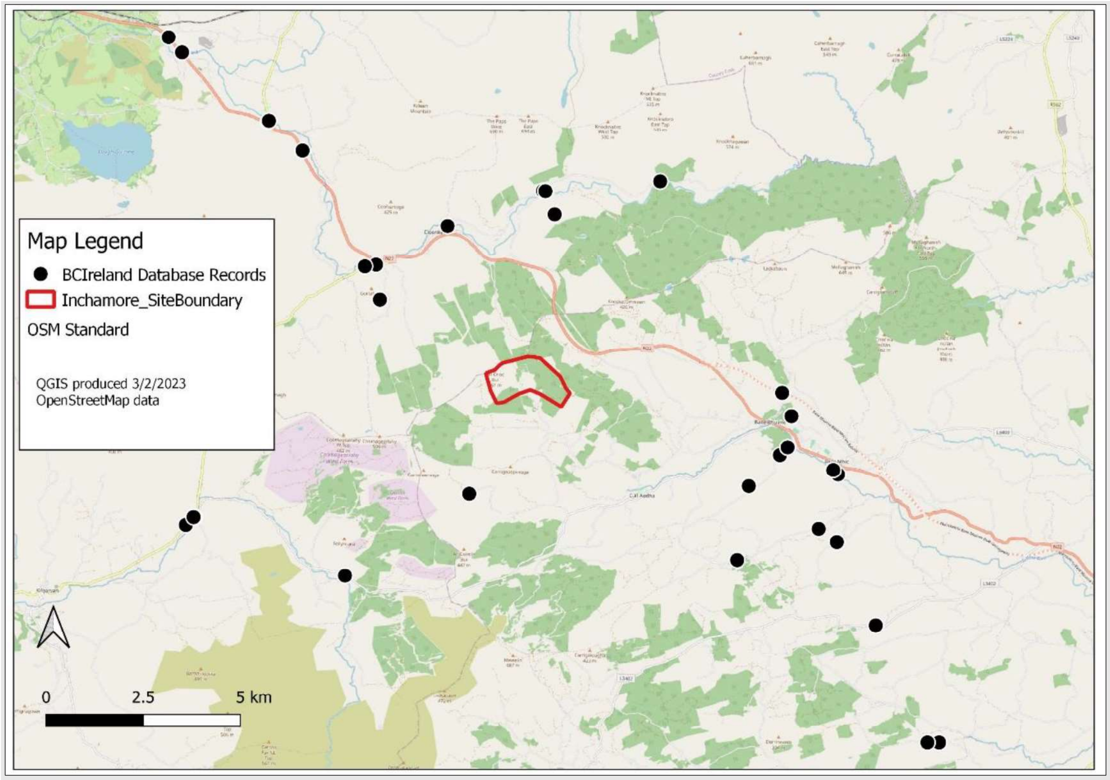


Figure 5.6: Bat Conservation Ireland Database Records (10 km radius).

5.4.7.1.2 Bat Conservation Landscape Favourability

The BCIreland Bat Landscape Favourability Model (Lundy *et al.,* 2011) identified the 5 km square within which the proposed development is located as having a Low to Medium favourability for bats. For the bat species recorded during this bat survey, the 5 km square has a Low or Low to Medium favourability value for eight recorded bat species recorded during the surveys.

Table 5.9: Bat Conservation Ireland Bat Landscape Favourability Model – 5 km Square value.

Bat species	5 km Square
Common pipistrelle	26% Low to Medium)
Soprano pipistrelle	23% (Low to Medium)
Nathusius' pipistrelle	0% (Low)
Leisler's bat	17% (Low)
Brown long-eared bat	13% (Low)
Daubenton's bat	11% (Low)
Natterer's bat	17% (Low to Medium)
Whiskered bat	13% (Low to Medium)
Lesser horseshoe bat	5% (Low to Medium)

5.4.7.1.3 Previous Survey Data

A previous bat survey report includes the proposed development area as part of the survey area (see **Appendix 5.6**): *Fehily Timoney (2020) Gortyrahilly and Inchamore Wind Farms Bat Survey 2019/2020 Report. Unpublished report prepared for SSE Renewables.*

This bat survey completed the following bat survey elements:

- Spring Static Surveillance: 10 static units, 11 nights surveillance;
- Summer Static Surveillance: 10 static units, 10 nights surveillance;
- Autumn Static Surveillance: 10 static units, 26 nights surveillance;
- 1 extra static unit was deployed on 30/7/2019 for 24 nights;
- Daytime assessment of 4 buildings;
- Daytime assessment of trees;
- Dusk bat emergence surveys:
- Walking transects along pre-mapped routes.

This bat survey recorded all nine resident bat species during the surveys. The majority of the bat survey data was recorded by the static surveillance surveys. A total of 22,877 recordings over the 46 nights of surveys were recorded on the static units. The most commonly recorded species was common pipistrelle, followed by soprano pipistrelle, and Nathusius' pipistrelle.

Table 5.10: 2019 Static Surveillance Results (Calculations based on recordings over 46 nights).

Bat Species	No. of Recordings	Percentage	No. of Recordings/ Night
Brown long-eared bat	419	1.84%	9.11
Common pipistrelle	16,180	70.29%	616.09
Daubenton's bat	563	2.55%	22.33
Leisler's bat	872	3.84%	18.96
Lesser horseshoe bat	39	0.17%	0.85
Nathusius' pipistrelle	1,001	4.41%	21.76
Natterer's bat	174	0.89%	4.41
Soprano pipistrelle	3,219	14.17%	69.98
Whiskered bat	381	1.68%	8.28

5.4.7.2 Field surveys

5.4.7.2.1 Daytime Inspections

Building & structure inspection

Four sets of buildings were inspected, one set of buildings is located within the Site, but not in area of proposed infrastructure, while the remaining three are located outside the Site (**Figure 5.6**). Daytime inspections were undertaken on 21/12/2022 and 6/1/2023 of the buildings and the results of these inspections are presented in the table below. In addition, static units were deployed in three of the buildings and left in-situ (recording from sunset to sunrise from 21/12/2022 to 6/1/2023).

Building 2, located within the Site (see **Figure 5.7**), was recorded as a bat roost for three species of bat: lesser horseshoe bat (bat droppings), Natterer's bat (bat droppings and audio files) and brown long-eared bat (audio files). The level of droppings and the number of audio files recorded (4 bat encounters, see **Table 5:11**) indicates that this building is used as a night roost for these three species of bat. Turbine 5 is the closest turbine to Building 2 (423 m).

Table 5:11: Buildings / Structures inspection results.

Building Code	Description	Grid Reference (ITM)	Daytime Inspection	Static Unit Results
Building 1	2-storey dwelling and 5 single storey sheds. Natural stone walls, mixed roofs (slate and corrugated iron). No evidence of bat usage.	514755, 578855	No bat evidence recorded during daytime inspection Suitability: Low to Medium level	No bats recorded on static unit
Building 2	2-storey derelict house, slate roof, timber fascia, small lean-too shed with corrugated roof	513562, 578539	Small number of bat droppings on ground floor room (Lesser horseshoe bat) and in lean-too shed (Myotis spp.). Suitability: Medium to High level	Static Recordings - Main House: Natterer's bat and Brown long-eared bat. Lean-too: Natterer's bat.
Building 3	2-storey derelict dwelling (slate roof in poor	514338, 577982	No bat evidence recorded during daytime inspection	Unknown - permission

Building Code	Description	Grid Reference (ITM)	Daytime Inspection	Static Unit Results
	condition) and numerous stonewall ruins.		Suitability: Low to Medium level	refused to collect static unit
Building 4	Single storey shed.	514703, 578897	No bat evidence recorded during daytime inspection Suitability: Low level	Not applicable

Table 5.12: Static unit results of winter surveillance of Building 2.

Date	Time	Bat Species	Survey Type	Bat Detector Model
21/12/2022	23:52:00	Natterer's bat	Statics in buildings	Mini Bat
27/12/2022	16:57:00	Brown long-eared bat	Statics in buildings	Mini Bat
28/12/2022	20:57:00	Natterer's bat	Statics in buildings	Mini Bat
29/12/2022	19:29:00	Natterer's bat	Statics in buildings	Mini Bat

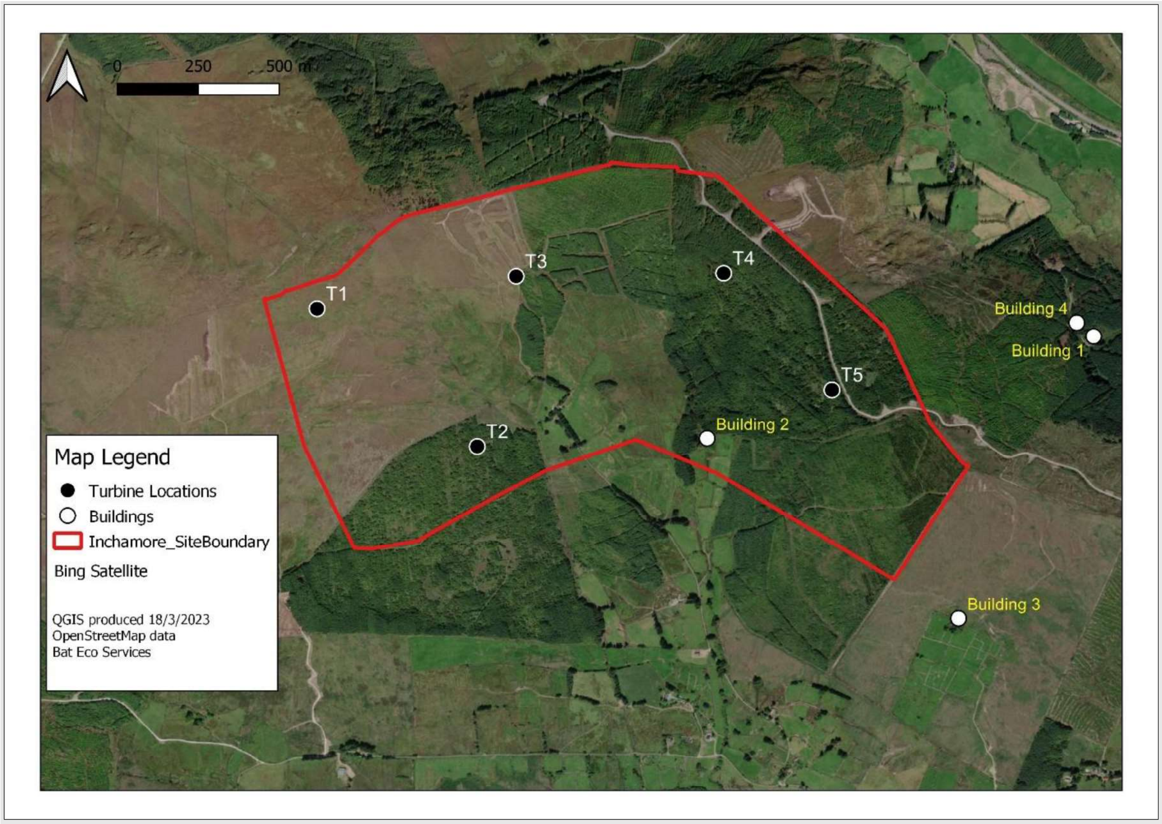


Figure 5.7: Location of buildings surveyed.

5.4.7.2.2 Tree Potential Bat Roost (PBRs) Inspection

There is an area of mature trees surrounding Building 2 within the proposed development area. All of the trees within this located were inspected on 21/12/2022 for features such as tree holes, spilt limbs etc. that can provide roosting features for bats. The majority of trees in this area are conifer trees and therefore do not have a Potential Bat Roost or PBR value for local bat populations.

5.4.7.3 Field Survey Results – Bat Detector Surveys

5.4.7.3.1 Dusk Bat Surveys, Walking & Driving Transects

The bat encounters recorded for these surveys (completed on 21/7/2022, 28/8/2022, 29/8/2022 and 19/9/2022) are reported as part of overall summary maps for each of the bat species. The following bat species were recorded during dusk surveys and the transects: soprano pipistrelle, common pipistrelle, Leisler's bat, Natterer's bat, Daubenton's bat, *Myotis* species and brown long-eared bat. This information provides distribution results for the bat species recorded, which are presented in the full report (**Appendix 5.3**). Full breakdown of the nightly data is provided in the appendices.

5.4.7.3.2 Static Bat Detector Survey

The tables presented in the full bat report (**Appendix 5.3**) summarise the results recorded on the static units deployed over four surveillance periods (see **Figure 5.8**). The information collated by the static surveillance is analysed using the EcoBat Tool (discussed under that section of the report). Figures are provided to show the location of each of the static unit in relation to the proposed turbine locations. The location of static units was determined by the proposed location of turbines. All static units were deployed for a minimum of 10 days and therefore meet the level of surveillance recommended by guidance documents.

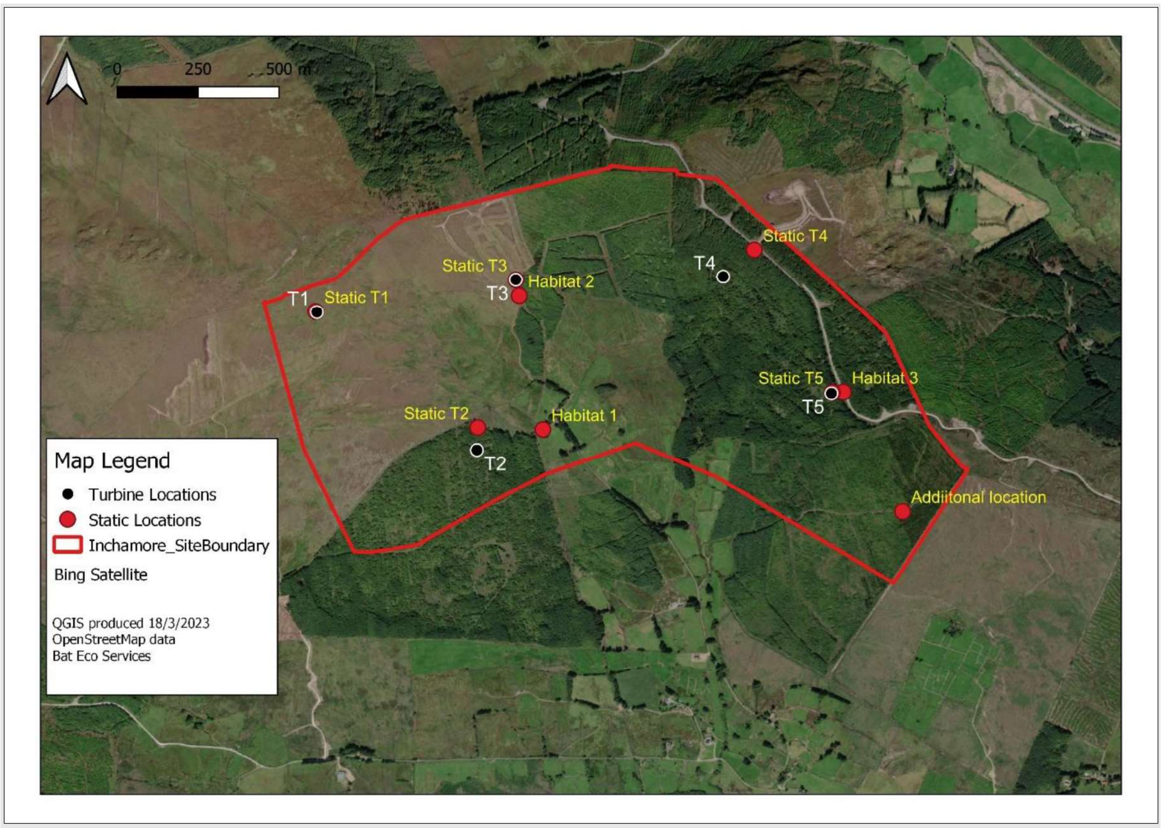


Figure 5.8: Location of static units deployed during static surveillance relative to proposed turbine locations.

The following bat species were recorded during the static surveillance: soprano pipistrelle, common pipistrelle, Leisler's bat, Natterer's bat, whiskered bat, Daubenton's bat, *Myotis* species, lesser horseshoe bat and brown long-eared bat. These records were also used to prepare distribution maps for the individual bat species recorded.

In summary, the total number of common pipistrelles bat passes recorded during all four static surveillance periods was 10,980 while soprano pipistrelles (720 bat passes) and Leisler's bats (650 bat passes) were the second and third most frequently recorded bat species, respectively. However, overall, common pipistrelles accounted for 85% of the recordings.

In relation to distribution across the static unit locations and during all surveillance periods, common pipistrelle was the most frequently recorded bat species, *i.e.* recorded on all static units deployed. The highest level of common pipistrelle bat passes was recorded on the static located in the easternmost part of the site (labelled in Figures as additional location) during the Spring Surveillance. All other bat species were recorded at a lower level of bat passes and less frequently across static surveillance locations. These totals included the three additional static units deployed in the second Autumn Surveillance.

In order to compare with Table 3 in Section 4.2.1 (see full bat report in **Appendix 5.3**), only data from the static units deployed at the proposed turbine locations are used for the following summary table. Apart from the common pipistrelles and Leisler's bats, the level of recordings detected was less in 2022 compared to 2019 for all other bat species noted. No Nathusius' pipistrelles were recorded in the 2022 static surveillance.

Table 5.13: 2022 Static Surveillance Results at proposed turbine locations only (250 nights / 6 static units = mean of 42 nights).

Bat Species	No. of Recordings	Percentage	No. of Recordings/ Night
Brown long-eared bat	86	0.81%	2.05
Common pipistrelle	9,061	84.94%	215.74
Daubenton's bat	75	0.7%	1.79
Leisler's bat	636	5.96%	15.14
Lesser horseshoe bat	1	0.01%	0.02
Natterer's bat	75	0.7%	1.79
Soprano pipistrelle	584	5.47%	13.9
Whiskered bat	47	0.44%	1.12
Myotis species	103	0.97	2.45

Four static surveillance periods were undertaken in 2022. This was a total of 2,688 hours of surveillance. In order to provide an overall visual in relation to the total level of bat activity recorded at the static units a series of graphs were prepared (see **Appendix 5.3**).

The bat species were divided into two groups:

- Common bat species: common pipistrelle, soprano pipistrelle and Leisler's bat;
- Less Common bat species: all remaining Irish bat species.

The principal summary points from the graphs are as follows:

- Common pipistrelles were consistently recorded across the survey site in high bat activity levels during all four static surveillance periods but particularly high levels were recorded during the spring surveillance.
- Common pipistrelle bat activity levels was highest at the additional location (see Figure 5.8).
- During the 2nd Autumn Surveillance, common pipistrelle bat activity levels was higher on the static located adjacent to one of the 'habitat' sites surveyed. This 'habitat' was the road access through the conifer plantations and therefore is indicative of commuting individuals along the open roads through a generally cluttered environment.
- Generally, Leisler's bat activity levels recorded was low and therefore are likely to indicate commuting individuals through the landscape. The highest level of bat activity for this specie was recorded at the additional location during the Spring surveillance.
- Soprano pipistrelle bat activity levels was consistently low during all static surveillance period at all proposed turbine locations.
- T1 was not an important location for the less common bat species and this is primarily a reflection of the habitats at this location *(i.e.* no tall tree vegetation). For all other turbine locations, the level of bat activity for the less common bat species was consistent during each of the surveillance periods.
- Habitat 1 (mature deciduous treeline) was particularly important for brown long-eared bats during the 2nd Autumn Static Surveillance.

5.4.7.3.3 Bat Survey Results - Summary

The figures provided in Appendix 5.3 illustrate the location of bat encounters recorded during all of the bat surveys completed. A total of eight bat species were recorded within the Site. The only Irish resident bat species not recorded during these surveys was Nathusius' pipistrelle. While the Auto-Id function of the audio file analysis reported the presence of this bat species, manual inspection of such files confirmed such calls as low-echolocating common pipistrelles.

While a large array of night-time surveys were undertaken, an overall low level of bat activity was recorded during dusk and dawn surveys and walking/driving transects. For less common bat species, the bat encounters recorded were primarily on static units as these were left in the "field" for a minimum of 10 days and therefore provide a greater opportunity to record bat species.

5.4.7.4 Field Survey Results – EcoBat Tool Results

All of the static surveillance results were entered into the "Per Night" forms and submitted for analysis using the EcoBat tool[2]. These forms were collated for the three seasonal surveillance periods – Spring, Summer and Autumn 2022.

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.

The Ecobat tool provides a series of summary tables to enable analysis of the bat activity level at each static location. These are presented in **Appendix 5.3** and categorisation of activity level is based on the following table:

Table 5.14: 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

Additional figures are presented in the appendices which provide information on the spread of nightly activity according to the five percentile ranges in the above table.

[2] The ECOBAT tool has been offline since November 2022. Only four of the six static units for the summer surveillance data were analysed prior to this. The analysis carried out for the present assessment was carried out in line with the ECOBAT tool using the professional judgment of Dr Aughney.

5.4.7.4.1 Summer Surveillance 2022 – Preliminary EcoBat Tool Analysis

Bat surveys were conducted at Summer 5, Summer additional location, Summer 1, Summer 4, for 11 nights between 2022-07-21 and 2022-07-31, using Wildlife Acoustics static bat detectors. The maximum of passes recorded in a single night was 111 passes, and 8 species were recorded.

The reference range dataset was 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.

Only one species had a High level of bat activity according to the Median Percentile value (highlight in table below).

Differences in activity between static detector locations split by species and location were analysed (see details in **Appendix 5.3**). The analyses indicate that, in general, the level of bat activity varied greatly from static location and that there was not a consistent of species activity from night to night.

5.4.7.4.2 Summer Surveillance 2022 – Preliminary EcoBat Tool Analysis

The EcoBat Tool analysis demonstrated that levels of bat activity is reported as "High" when the number of nightly passes is greater than 40. Therefore, using this information, all of the static surveillance data collected in 2022 for each individual bat species recorded was examined to complete analysis in absence of the EcoBat Tool. Only the nightly bat activity level of common pipistrelles exceeded this criteria and therefore this species is used to determine the assessment of the proposed location of the turbines.

The number of nights when the number of nightly passes was greater than 40 for common pipistrelles was calculated (raw data are presented in the appendices). Over the course of the 2022 surveillance, at the proposed turbine locations for T1, T4 and T5 were deemed to have a Low level of bat activity. T3 was deemed to have a Medium level of bat activity while T2 and the additional location were deemed to have a High level of bat activity.

Table 5.15: Summary table showing the number of nights recorded bat activity fell into High activity band for common pipistrelles only.

Turbine No.	No. of Nights >40 bat passes	No. of Nights of Surveillance	Percentage	Activity Level
T1	0 nights	37 nights	0%	Low
T2	23 nights	47 nights	49%	High
T3	18 nights	47 nights	38%	Medium
T4	1 night	34 nights	3%	Low
T5	2 nights	34 nights	6%	Low
Additional location	21 nights	37 nights	57%	High

5.4.8 Summary of Important Ecological Features and Conservation Value of Site

5.4.8.1 Habitats, vegetation and flora

The north-western sector of the site comprises a mosaic of wet heath and upland blanket bog, which is part of a larger area of bog and heath which continues to the west. The heath and bog habitat mosaic within the site is of good quality as it appears largely intact (uncut) and has not been burned or over-grazed in recent times. However, the low cover of woody heath species such as cross-leaved heath and ling heather present may reflect past events of burning and/or over-grazing. Both wet heath and blanket bog are Annex I listed habitats, with active blanket bog having priority status. In addition, the Annex I listed habitats dry heath and exposed siliceous rock occur scattered throughout the unplanted sector of the site, typically in association with each other and/or wet heath. The total area of this heath/bog area within the Red-line study area is approximately 22 ha. As the condition of the heath and bog habitat is good, in respect of representativity (*i.e.* a typical example) and conservation status (*i.e.* conservation structure and functionality), the area is assigned a rating of County Importance. It is noted that while wet heath and blanket bog are relatively widespread habitats throughout much of the upland areas of counties Cork and Kerry, the status at a National Level for both habitats is given as 'Bad and deteriorating' in the review of EU Protected Habitats and Species in Ireland (Department of Culture, Heritage and the Gaeltacht, 2019). Reasons given for the 'Bad and deteriorating' rating are new forestry, paths, tracks and land clearance, while overgrazing, burning, wind farm development and erosion continue to be issues for these habitats.

The condition of the area of cutover bog habitat on site is poor due to ongoing erosion caused by peat-cutting and subsequent livestock grazing/poaching. It was observed during field surveys that sheep tend to graze preferentially on the cutover areas of the site rather than the wetter heath and bog habitats. The cutover bog habitat is assigned an overall rating of Local Importance (lower to higher value).

The other habitats recorded on site are assigned overall ratings varying from Local Importance (lower value) to Local Importance (higher value) – these comprise dry humid acid grassland, wet grassland and eroding/upland rivers. The conifer plantation is a non-native habitat managed entirely by man, is species-poor and is not of conservation importance.

There were no plant species listed in the Flora (Protection) Order 2022 recorded within the survey area. There is a ten-kilometre-square record (W17) for the protected species Killarney fern (*Vandenboschia speciosa*) (see https://bsbi.org/maps), however the species was not recorded from within the survey area during the present survey.

The Project area supports a number of plant species which have a relatively restricted distribution in Ireland, *i.e.* large-flowered butterwort (*Pinguicula grandiflora*) and St. Patrick's cabbage (*Saxifraga spathularis*). These species are considered to be locally common in suitable habitats in the south-west of Ireland (Parnell and Curtis, 2012).

The project area supports least cudweed *Filago minima*, a species which had been legally protected on the Flora (Protection) Order 2015. This occurs within a section of forest track which will support the grid connection cable.

5.4.8.2 Terrestrial mammals, amphibians and reptiles

The study site supports a typical mammalian fauna of open bog/heath habitat and conifer plantation. All mammal species recorded on site or expected to occur on site are listed as 'Least Concern' on the Irish Red List (Marnell *et al*. 2019).

The Irish hare, pine marten and all deer species are protected under the Wildlife Acts 2007-2022 as amended.

The common frog and the common lizard are protected under the Wildlife Acts, though both are listed as 'Least Concern' on the Irish Red List (King *et al.* 2011).

5.4.8.3 Bats

A total of eight bat species were recorded within the Site. The only Irish resident bat species not recorded during these surveys was Nathusius' pipistrelle.

While a large array of night-time surveys were undertaken, an overall low level of bat activity was recorded during dusk and dawn surveys and walking/driving transects. For less common bat species, the bat encounters recorded were primarily on static units as these were left in the "field" for a minimum of 10 days and therefore provide a greater opportunity to record bat species.

A bat roost occurs within a building on site though this is not at or near a location for wind farm infrastructure development – there was evidence of three species of bat using the building, including lesser horseshoe bat.

All bats recorded are listed as 'Least Concern' on the Irish Red List and protected under the EU Habitats Directive Annex IV and Wildlife Acts. One species, Lesser Horseshoe, is listed as 'Annex II' under the EU Habitats Directive.

5.4.8.4 Kerry Slug

The Kerry slug (*Geomalacus maculosus*) is protected by the Wildlife (Amendment) Act 2000 and is listed under Annex II of the Habitats Directive. The Kerry slug is also listed in Annex IV of the Habitats Directive and as such is strictly protected from injury, or disturbance / damage to their breeding or resting place wherever it occurs.

Historically, the Kerry Slug has been considered to be restricted to Devonian Old Red Sandstone areas of Kerry and West Cork where it occurs most commonly in either of three distinct habitats:

- deciduous woodlands in particular those with rocky outcrops or boulders;
- rock outcrops associated with heath or blanket bog; and
- lake shores.

Within these habitats, the species tends to only be present if there is outcropping Devonian Old Red Sandstone, humid conditions and lichen, liverwort and / or mosses in which the species shelters and feeds (Platts and Speight 1988).

The overall conservation status of the species has been reported as 'favourable and improving' and it is not currently considered threatened within its range (NPWS 2019).

Based on the 2020 survey, it is considered that the habitat types "wet heath / blanket bog and rock outcrop habitat" at the Site support an important population of Kerry Slug, which is rated as County Importance.

5.5 ASSESSMENT OF EFFECTS

5.5.1 The 'Do-Nothing' Impact

Without the proposed wind farm development proceeding, it is expected that the present main landuses on site, namely livestock grazing and forestry, will continue. It is possible that further afforestation would occur on the site in the future.

The ecology of the site would be expected to remain fairly similar as at present though any increase in grazing pressure could be detrimental to the quality of peatland habitats on site. Also, any further afforestation on heath and bog habitats would be detrimental.

5.5.2 Potential Impacts on European Conservation Sites

The Appropriate Assessment report that accompanies this planning application has shown objectively that for 11 of the European sites identified within the zone of influence, there are no realistic Source-Pathway-Receptor linkages and hence there is no potential for effects on qualifying interests or Special Conservation Interests as a result of the proposed Inchamore Wind Farm project. These sites are:

- Mullaghanish Bog SAC (code 001890)
- St. Gobnet's Wood SAC (code 00106)
- Blackwater River (Cork/Waterford) SAC (code 002170)
- Glanlough Woods SAC (code 002315)
- Kilgarvan Ice House SAC (code 000364)
- Old Domestic Building, Curraglass Wood SAC (code 002041)
- The Gearagh SAC (code 000108)
- Great Island Channel SAC (code 001058)
- Killarney National Park SPA (code 004038)
- The Gearagh SPA (code 004109)
- Cork Harbour SPA (code 004040)

In the absence of mitigation, likely significant effects on two of the European listed in Table 5.5 could not be excluded during the construction, operational and/or decommissioning stages of the proposed development:

- Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC (code 000365)
- Mullaghanish to Musheramore Mountains SPA (code 004162)

For the Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC impacts of potential concern may arise as a result of contaminants originating within the project area, and specifically the grid connection route, reaching the designated site and causing harmful effects on relevant qualifying interests for the site. The significance of any effect would be dependent on the magnitude and duration of a pollution event. Full details are presented in the accompanying NIS.

For the Mullaghanish to Musheramore Mountains SPA, a section of the route for the grid connection cable will pass within 170 m of the SPA. Construction works along the grid connection route carried out during the breeding season could have disturbance effects on hen harriers breeding within the SPA. The significance of an effect is unknown as such would be dependent on the locations of the nesting sites and the foraging ranges of the breeding pairs at the time of the works.

5.5.3 Potential Impacts on National Conservation Sites

There are three Natural Heritage Areas within a 15 km radius of the proposed wind farm site (see **Table 5.6**), namely Sillahertane Bog NHA (5.5 km distance), Slaheny River Bog NHA (14 km distance) and Conigar Bog NHA (14.5 km distance). All three sites are designated for 'Peatlands'.

As these sites are geographically separated from the proposed Inchamore wind farm site, and without any ecological or hydrological connectivity between the sites and the proposed wind farm location, it can be concluded with full scientific certainty that the proposed wind farm project could not have any impacts on these three NHA sites.

5.5.4 Potential Impacts on proposed Natural Heritage Areas

There are 13 No. proposed Natural Heritage Areas within a 15 km radius of the proposed wind farm site (see **Table 5.6**). For eleven of these sites, there are substantial geographical separation distances and/or no ecological or hydrological linkages – these sites are:

- Mullaghanish Bog pNHA (c.300 m distance)

- Prohus Wood pNHA (13.5 km distance)
- Lough Allua pNHA (11 km distance)
- Ballagh Bog pNHA (11.5 km distance)
- Gouganbarra Lake pNHA (12 km distance)
- Kilgarvan Wood pNHA (12 km distance)
- Roughty River pNHA (7 km distance)
- Kilgarvan Ice House pNHA (11 km distance)
- Old Domestic Building, Leitir pNHA (14 km distance)
- Old Domestic Building, Curraglass Wood pNHA (7 km distance)
- Doo Lough pNHA (11 km distance)

It can be concluded that the proposed wind farm project could not have any impacts on these ten pNHA sites.

For the Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment pNHA impacts of potential concern may arise as a result of contaminants originating within the project area, and specifically the grid connection route, reaching the designated site and causing harmful effects on relevant qualifying interests for the site. The significance of any effect would be dependent on the magnitude and duration of a pollution event. Mitigation is required to avoid or minimise any risk to the designated site.

The St. Gobnet's Wood pNHA has hydrological connectivity to the site for the proposed wind farm via the Sullane River. While there is a channel distance of approximately 8 km from the wind farm site to the pNHA, there is still a risk that contaminants generated on site during the construction, operational and/or decommissioning phase could flow to the pNHA and possibly have adverse effects on water quality of the river within the pNHA. Mitigation is therefore required to avoid or minimise this risk.

5.5.5 Impacts on Habitats, Vegetation and Flora

The construction of the proposed development will result in the following:

- permanent loss of habitat;
- disturbance to habitat , and
- changes to existing habitats.

For this assessment on habitats, the worse-case scenario is assumed for the turbine range in respect to turbine foundation diameter (22-25.5 m)

5.5.5.1 Permanent loss of habitat

The permanent loss of habitat to facilitate the construction of the project is estimated at 30.75 ha. This will result from the following:

- Turbines foundations and hardstand areas
- Foundation for substation
- Foundation for met mast
- Wind farm road system

The majority of the affected habitat, approximately 26.13 ha, is conifer plantation. As conifer plantation is a non-native habitat that is not classed as a key ecological receptor, the permanent loss of this habitat is rated as Not Significant.

The construction of turbine T1 will result in the permanent loss of 2.32 ha of wet heath and wet heath/blanket bog mosaic. A small area of wet heath (0.2 ha) will be lost as a result of the T2 construction. The total loss of wet heath and wet heath/blanket bog mosaic is approximately 2.5 ha. The peatland habitat within the site is part of a larger complex of heath/bog habitats, which is rated as of County Importance. The loss of 2.5 ha of Annex I listed habitats, which have good representivity and conservation status and functionality, is rated as a Significant Adverse effect of Permanent duration. Compensation for loss of heath and bog habitats will be provided through a Habitat Enhancement Plan (see Appendix 5.5).

The construction of turbine T3, and associated roads, will result in the loss of 1.63 ha of cutover bog. However, the cutover bog at this site is of poor quality (rated as being of Local Importance, higher-lower value). The significance of the effect is rated as Slight Adverse of Permanent duration.

5.5.5.2 Disturbance to habitats

Areas adjoining the infrastructure will be disturbed by the construction works, including the need for construction of a drainage system and for the insertion of the electrical cabling including along the grid connection route.

Such disturbance within the conifer plantation and along the forest tracks and roads is rated as Not Significant due to the low ecological importance of this habitat.

Disturbance to wet heath and wet heath/blanket bog mosaic will occur around the location of T1 and its hardstand, and along part of the hard stand of T2. The extent of the zone of disturbance will vary, with both direct physical disturbance of heath/bog and probable indirect drying effects on adjoining heath/bog due to hydrological changes. Areas of heath and bog that may become drier would be expected to support more vigorous growth of ling heather *Calluna vulgaris* and less development of bog mosses. As the habitats affected by this impact are listed as Annex I habitats, disturbance is rated as a Significant Adverse effect of Medium-term duration. Mitigation to minimise disturbance of heath and bog as a result of construction works will be implemented.

5.5.5.3 Changes to existing habitats

The proposed borrow pit will result in removal of existing conifer plantation (c.42.6 ha). This will be reinstated using surplus inert material from the site, such as peat and subsoil and allowed to revegetate naturally. It is expected that a vegetation dominated by rushes will develop. Depending on the portion of peat, some bog plants, such as *Molinia caerulea*, are likely to become established in the long-term. Scrub (brambles / willows) and self-seeded conifers would also be expected in the long-term.

Further conifer plantation will be removed from the location of the proposed compound (0.36 ha), from alongside the road and other infrastructure (to facilitate construction works) and from the stretch of grid route between chainage 16,420 to 16,750 m. After the works are complete, including removal of the compound, these areas are expected to regenerate to a mix of rush and scrub vegetation, with self-seeded conifers becoming established over time.

The loss of conifer plantation (a non-native habitat) and replacement with more open habitat which support native plant species will be of benefit to small mammals, birds and insects, and overall the creation of open habitat will be of more value to local biodiversity than the existing conifer plantation. The impact of this change in habitat is rated as a Positive effect of Moderate significance of Long-term duration.

5.5.6 Potential Impact on terrestrial mammals, amphibians and reptiles

The effect on terrestrial mammal species by the loss and disturbance of habitats due to the proposed development is considered to be not significant on the basis that the species involved are all widespread species of the countryside which occur in similar habitats in the immediate and wider environs.

Pre-construction survey will take place to confirm possible badger presence before any felling of conifer plantation occurs. Should a sett be located, appropriate mitigation will be implemented (see **Section 5.6.3**).

The local otter populations associated with the Sullane River downstream of the Site could be affected adversely if there was a water pollution incident that affected their prey items (fish etc.). With appropriate mitigation to maintain water quality during the construction and operational phases of the proposed development (see CEMP in Appendix 2.1, Chapter 9: Hydrology and Hydrogeology and Chapter 6: Aquatic Ecology), the risk to the otter population is minimised.

Construction activity may cause larger mammals such as the Irish hare and deer to remain in cover. However, this will be a localised and temporary effect (and not generally relevant to nocturnal mammal activity) and the effect is considered to be Not significant.

The common frog and common lizard populations would be affected by loss of habitat during the construction works and some individuals may be killed.

In the absence of mitigation, the significance of the effect on amphibian and reptile species within the site is rated as Significant.

5.5.7 Impact on Bats

For this assessment on bats, the worse-case scenario is assumed for the turbine range, in respect to overall ground to blade tip height (177-185 m), rotor diameter (149-155 m) and hub height (102.5-110.5).

5.5.7.1 Bat Species Recorded and Sensitivity

Eight species of bat and additional records for *Myotis* species group were recorded during the 2022 bat surveys. This represents eight of the nine bat species know to be resident in County Kerry. The ninth bat species, Nathusius' pipistrelle, was recorded in previous bat surveys completed in 2019/2020.

The table below provides an ecological valuation of each the nine bat species and the collision risk factor in relation to wind farms. Three of the bat species recorded are considered to be High risk.

Table 5.16: Evaluation of the bat species recorded during the bat survey.

Yellow = *low population vulnerability*
Orange = *medium population vulnerability*
Red = *high population vulnerability*

Bat Species	Ecological Value / Geographical Scale of Importance	Irish Status	Bat Risk	Population Numbers / Core Area
Leisler's bat	International	Least Concern	High	Common
Natterer's bat	County	Least Concern	Low	Widespread
Whiskered bat	Regional	Least Concern	Low	Rare
Nathusius' pipistrelle	Regional	Least Concern	High	Rare
Daubenton's bat	County	Least Concern	Low	Common
Brown long-eared bat	County	Least Concern	Low	Widespread
Common pipistrelle	Local	Least Concern	High	Common
Soprano pipistrelle	Local	Least Concern	High	Common
Lesser horseshoe bat	National	Least Concern	Low	Rare

5.5.7.2 EcoBat Tool Evaluation

While the static surveillance data collected during 2022 was only partially analysed using the EcoBat Tool, this partial analysis was used to form an analysis to continue the evaluation process and was sufficient for assessment purposes. This identified locations where a high value of bat activity for specific bat species was recorded. Over the course of the 2022 surveillance, the proposed turbine locations for T1, T4 and T5 were deemed to have a Low level of common pipistrelle bat activity. T3 was deemed to have a Medium level of common pipistrelle bat activity, while T2 was deemed to have a High level of common pipistrelle bat activity.

Therefore, in summary, the following proposed turbine locations are considered to be important in relation to level of bat activity recorded during static surveillance and their potential impact on local bat populations:

- T2 and T3.

5.5.7.3 Site Risk Assessment

The Site Risk Assessment is calculated according to SNH, 2021. The assessment value (i.e. Turbine Risk value) is compared to the ranges below:

- Low (green) 0-4;
- Medium (amber) 5-12, and
- High (red) 15-25.

While Leisler's bat can be considered as common in Ireland, its status as an "Internationally Important" population, ranks it higher than the two common *Pipistrellus* species. However, both the bat activity level of Leisler's bat and soprano pipistrelle was low during the 2022 surveillance while the majority of bat passes recorded was identified as common pipistrelle. Therefore, the Risk Assessment were completed for this bat species only (i.e. for common pipistrelle).

Common pipistrelle

With reference to the nightly bat activity at each of the static locations, T1, T4 and T5 were deemed to have a Low level of common pipistrelle bat activity. T3 was deemed to have a Medium level of common pipistrelle bat activity while T2 was deemed to have a High level of common pipistrelle bat activity. In order to complete the table below, the Bat Activity Category (using similar values as per EcoBat Tool) is valued as follows:

- Low = 1 point;
- Medium = 3 points, and
- High = 5 points.

Table 5.17: Risk assessment for each proposed turbine location for local bat populations using Common pipistrelle bat activity levels.

Turbine No.	Site Risk Value	Bat Activity Category	Turbine Risk
			Site Risk x Bat Activity Category
1	3	1	3
2	3	5	15
3	3	3	9
4	3	1	3
5	3	1	3

In summary, for common pipistrelles, the proposed turbine locations have the following Risk Factor:

- Low: T1, T4, T5
- Medium: T3
- High: T2

5.5.7.4 Impact Assessment

The impact assessment takes into consideration the following:

- Eight bat species were recorded during the 2022 and 2023 bat surveys of the proposed development site.
- Three of these species are considered to be High Risk bat species in relation to wind turbines: Leisler's bat, common pipistrelle and soprano pipistrelle.
- The remaining five species are Low Risk: Natterer's bat, Daubenton's bat, whiskered bat, lesser horseshoe bat and brown long-eared bat.
- Partial Eco Bat Analysis results highlighted turbine locations with High Risk and Medium Risk for common pipistrelle, as this bat species were recorded at High levels of bat activity during static surveillance.
- Spread of bat encounter records within the proposed development site, particularly, in relation to infrastructure.
- Bat habitats present within 200 m of turbine locations and along infrastructure routes.

Potential Impact on Local Bat Populations

One set of buildings is located within the proposed development area and this was recorded as a bat roost for three bat species: lesser horseshoe bat, Natterer's bat and brown long-eared bat (Building 2). However, all three bat species recorded roosting are considered to be Low Risk bat species in relation to wind farms and there is no proposed turbine or infrastructure adjacent to the buildings (the nearest turbine, T5, is 423 m from the roost).

The following table summarises the result of the impact assessment for each of the turbine locations. If no mitigation measures are implemented, there are two High Risk turbines (T2 and T6) and one Medium Risk turbine (T3).

Table 5.18: Summary table showing the number of nights recorded bat activity fell into High activity band for common pipistrelles only.

Turbine No.	Risk Assessment: Common pipistrelle	Other bat species recorded within 200 m of turbine	If no mitigation is applied, what is the potential impact level?
T1	Low	SP, BLE, Leis, Daub	Low
T2	High	SP, BLE, Leis, Daub, Natt, Whis	High
T3	Medium	SP, BLE, Leis, Daub, LHB, Natt, Whis	Medium
T4	Low	SP, BLE, Leis, Daub, Natt	Low
T5	Low	SP, BLE, Leis, Daub, Natt, Whis	Low

The above table summarises the result of the impact assessment for each of the turbine locations. If no mitigation measures are implemented, there is one High Risk turbine (T2) and one Medium Risk turbine (T3).

Cumulative Impacts of Existing Forestry Operations

Forestry operations will continue within sections of the proposed development site outside of the felling required to enable the development of the Project and the turbine buffer zones throughout the life span of the proposed development. Such operations include clear felling and new planting. The cumulative impact of these forestry operations in combination with the proposed development will not cause a significant increase to potential impacts of the proposed development identified above.

5.5.8 Impact on Kerry slug

The development of the Project could potentially impact on the local population of Kerry Slug due to loss and disturbance of suitable habitat. Based on the likely extent of habitat loss (see terrestrial habitats section) throughout the wind farm site, this impact is likely to be minor and localised as only a small proportion of suitable Kerry Slug habitat (primarily the mosaic of heath and outcropping rock) within the site will be impacted. It is noted that the species is known to populate extensive areas of this type of habitat throughout the wider landscape and has a favourable conservation status across its range (NPWS 2019). However, during construction, works could also result in the death of individual Kerry Slugs due to machinery movements in areas of suitable habitat. Mitigation is required to minimise potential loss of individual slugs.

5.5.9 Decommissioning Phase Potential Effects

The applicant is applying for a consent for a period of 35 years for the operation of the wind farm. A detailed Decommissioning Plan is included as part of the CEMP in **Appendix 2.1**. Briefly, decommissioning will involve the following:

- Removal of five wind turbines and concrete plinths.
- Removal of permanent meteorological mast.
- Removal of all associated underground electrical and communications cabling connecting the wind turbines to the wind farm substation. Ducting is to remain *in-situ*

All other elements of the proposed development will remain in-situ. The Site Access Roads and associated drainage systems will serve ongoing forestry and agriculture activity in the area. All other hard surfaced areas will be allowed to revegetate naturally.

Cranes of similar size to those used for construction will disassemble each turbine using the same crane hardstands. The towers, blades and all above ground components will be removed from site and reused, recycled, or disposed of in a suitably licenced facility.

Turbines will be cut on site so as to fit on articulated trucks, therefore allowing the use of the civil construction delivery route for removal.

The key targets of the Plan are as follows:

- Ensure decommissioning works and activities are completed in accordance with mitigation and best practice approach presented in the accompanying Environmental Impact Assessment Report (EIAR) and associated planning documentation.
- Ensure decommissioning works and activities have minimal impact/disturbance to local landowners and the local community. This will relate to transport, particularly of material off site with noise and dust also impacting on receptors at time of decommissioning to a lesser extent.
- Ensure decommissioning works and activities have minimal impact on the natural environment. Disturbance to habitats will be avoided and the use of existing infrastructure and drainage will ensure silt does not enter waterways.
- Adopt a sustainable approach to decommissioning. This means comparing alternative methods for turbine disassembly and taking the approach with the least impact on the natural environment; and,
- Provide toolbox talks, environmental training and awareness of sensitive receptors and waste management within the Site for all project personnel.

From the perspective of terrestrial ecology, the anticipated potential impacts would be:

- Disturbance to peatland habitats, namely wet heath, blanket bog and cutover bog at T1, T2 and T3 locations;
- Disturbance to breeding birds and protected mammal species which may be on site at the time;
- Potential pollution of local waterways, and
- Creation of new habitats on site.

5.5.9.1 Disturbance of peatland habitats

The Annex I listed heath and bog habitats are of ecological importance (County level), while cutover bog is of Local importance. Any disturbance to these habitats during the works to dismantle turbines no. 1, 2, and 3 would be an adverse impact of potential significance. The Decommissioning and Restoration Plan has a target of minimal impact on the natural environment and it is not anticipated that personnel will need to traverse out onto the bog surface for any reason. The Plan also highlights a target of providing training on sensitive receptors on site to all involved personnel.

With work carried out in accordance with the Plan, it is not expected that the decommissioning works will have adverse effects on the peatland habitats on site.

5.5.9.2 Disturbance of fauna species

Particular care will be taken to ensure that the decommissioning works do not cause disturbance to animal species occurring on site at the time. Pre-construction baseline surveys will be carried out for species identified of conservation importance at the present time (2023), as well as for further species of importance which may be on site at the time of the works. Relevant legislation relating to flora and fauna in force at the time will be strictly adhered to.

Mitigation measures described in the present report to avoid or minimise disturbance to protected fauna species will be implemented as necessary.

With the above approach followed, it is not expected that the decommissioning works will cause significance disturbance to fauna species associated with the site.

5.5.9.3 Maintenance of water quality

The issue of potential impacts on hydrology is reviewed in **Chapter 9. Hydrology and Hydrogeology** (Section 9.4.7). The assessment notes the following:

There will not be a requirement for additional drainage measures to be implemented during the decommissioning phase and with the passage of time, the Site is expected to revert to a more natural drainage regime. All anticipated impacts are similar in nature to those already highlighted during the Construction Phase of the Development, i.e., release of hydrocarbons, waste water / sanitation and suspended soils through the excavation of material in order to remove cabling from joint bay locations. The works to be completed during the decommissioning phase are expected to be an imperceptible to slight, neutral, permanent impact on the hydrological and hydrogeological setting surrounding the Site.

On this basis, it can be expected that the decommissioning works will not result in adverse impacts on local watercourses and associated species, including otter.

5.5.9.4 Creation of new habitat

The Plan specifies that the turbine plinths and hard stands will be allowed to naturally revegetate. At the time of decommissioning, parts of the hardcore surface will likely already support a sparse flora of annual and perennial species (this is normal at operational wind farms after a few years and indeed often attracts sheep to graze the tender shoots). The amount of vegetation that will eventually colonise will depend on the physical and chemical character of the gravel surface. Such recolonising surfaces, which retain warmth in sunshine compared to surrounding areas of soil, tend to attract insects (butterflies etc) as well as passerine bird species such as skylark and various finches, with the birds feeding on seeds from plants. The habitat that would be expected to develop is likely to fall into a mosaic of semi-natural grassland (GS) and artificial stone surfaces (BL3).

The natural re-vegetation of the above-mentioned surfaces is rated as a Positive effect of Moderate significance.

5.6 MITIGATION MEASURES

5.6.1 Designated sites

The present report has identified pathways between the site of the proposed wind farm project and two European sites and four proposed Natural Heritage Areas. The pathways are via the River Clydagh and the Sullane River.

In the absence of mitigation, there is a risk that contaminants generated on site during the construction phase could enter local watercourses and ultimately flow to the designated sites where there could be resultant adverse effects on water quality and aquatic life and relevant qualifying interests within the sites. Mitigation is therefore required to minimise this risk.

The mitigation proposed to maintain water quality in the drainage channels and watercourses which drain the site is detailed in **Chapter 9: Hydrology and Hydrogeology**. The implementation of mitigation through avoidance principles, pollution control measures, surface water drainage measures and other preventative measures have been incorporated into the project design in order to minimise potential significant adverse impacts on water quality at the Site. A 50 m stream buffer zone will be implemented at the Site which will largely result in the avoidance of sensitive hydrological features. Direct discharges to surface waters of dewatered loads will not be permitted under any circumstances. This in turn will avoid or reduce the potential for adverse impacts on downstream designated sites.

All of the mitigation measures described in Chapter 9 are contained in the Construction and Environmental Management Plan (CEMP) (appended to the EIAR in **Appendix 2.1**). The CEMP provides a contractual commitment to mitigation and monitoring, and reduces the risk of pollution whilst improving the sustainable management of resources. The environmental commitments of the Project will be managed through the CEMP and will be secured in contract documentation and arrangements for construction and later phases, such that there will be a robust mechanism in place for their implementation. The CEMP addresses the construction phase, and will be continued through to the commissioning, operation and final decommissioning phases.

It is noted that an Ecological Clerk of Works (ECoW)/Environmental Manager with experience in overseeing wind farm construction projects will be appointed by the Contractor for the duration of the construction phase to ensure that the CEMP is effectively implemented. The Contractor will be required to appoint an Environmental Manager.

With such mitigation in place and rigorously enforced, it can be concluded that there would not be any significant effects on the qualifying interests of the identified designated sites as a result of the proposed wind farm project.

5.6.2 Habitats and flora

5.6.2.1 Mitigation for habitat disturbance

The construction works will cause substantial disturbance to adjoining wet heath and blanket bog habitats around the turbine, hardstand and access road for the T1 turbine, as well as the cutover bog at the T3 turbine. To minimise disturbance to the heath and bog habitats and to ensure good recovery, as well as to minimise areas of bare peat which would be prone to erosion, the following approach will be adhered to during the construction phase:

Restricted access to bog and heath

At the commencement of works at the T1 and T3 locations, the required work footprint on the bog will be identified and the area will be marked by a rope fence (using range poles or similar) and with appropriate signage. No activities of any type will be allowed outside of this agreed work area. The ECoW will inspect the area regularly whilst works are on-going at T1 and T3. Excavated peat and other material will be removed to the approved storage area with no storage of spoil or materials on unplanted bog or heath. The fence will remain in place until the works are fully complete.

Revegetation of bare surfaces

An ecological objective is to minimise the area of exposed peat surface and to encourage revegetation. This will be achieved by the removal from suitable areas of the vegetated heath and bog surface (cut out as sods or 'turves') within the work footprint at T1, the storage of this material, and subsequent reuse around the turbine and hardstand margins.

The surface turves of vegetated bog and heath will be dug out to a depth of 30 cm or more using a dumper/digger with a bucket. Care will be taken to keep the turve as intact as possible and the vegetated side upwards (though this is not always possible). The turves will be loaded to a trailer and transported to a pre-identified storage area. The storage area will be located in an area of site (not heath or bog) where disturbance during the storage period will not occur. The turves will be off-loaded from the trailer and placed side by side and vegetation side upwards. They will be placed in single layers, *i.e*. not piled on top of each other. Should storage be for prolonged periods (months), the turves will need to be watered during dry spells (as determined by the ECoW). When ready for placement at the finished turbine/hardstand, they will be lifted with a dumper and bucket and taken to the destination. Here they will be off-loaded, placed side by side on the disturbed peat surface with vegetation side up. The turves will be bedded in with the bucket of a dumper so that they form a continuous layer without gaps between them. This approach will provide almost immediate cover of the bare surfaces. All of the above will be monitored by the ECoW.

It is noted that where adequate peat depth is not available to dig out turves, as well as in the cutover bog at T3, the surface peat will be scraped off and stored in piles in a location similar to that for turves. This material will contain root stock, rhizomes and seed of peatland plant species and will be spread on disturbed surfaces when works are complete to assist in revegetation.

5.6.3 Badgers

As the interior of the conifer plantations on site could not be physically accessed at the time of the baseline surveys, a pre-construction survey for badger will be carried out just before and during the time of the tree felling operations within a minimum of 50 m of the working/construction corridor. Surveys will be undertaken by an ecologist with experience of badger surveys and working in association with the tree felling contractor. Before any felling commences, the ecologist will survey marginal areas around the plantation and internal tracks and firebreaks for signs of badger presence. Once felling commences, the ecologist will monitor the progression of the works as the required trees are cleared to facilitate the proposed Development.

Should there be any evidence of a badger sett within the works area or within 50 m of the works area, all felling work will cease immediately and a buffer zone will be established where felling works will be restricted. The surveyor will determine whether the sett is active and whether closure of the sett is necessary to avoid disturbance to the animals. Note that since closure of active setts is prohibited during the badger breeding season (December to June inclusive), appropriate scheduling of the tree felling process will occur to avoid delays.

Furthermore, should 3 years elapse between the time of the baseline surveys (in 2021) and the commencement of construction works, the entire site will be re-surveyed for badger presence as the local distribution may have changed since then.

5.6.4 Otter

Otter was not recorded on site and are not likely to occur due to the small size of the watercourses within the site and the absence of fish and larger aquatic organisms (see **Chapter 6: Aquatic Ecology**). However, they are present within the main channel of the Sullane River system downstream of the site.

The mitigation proposed to maintain water quality in the aquatic zones (as detailed in **Chapter 9: Hydrology and Hydrogeology**, **Chapter 5: Aquatic Ecology** and the CEMP) will ensure that the food supplies for otters are not affected.

5.6.5 Common frog

Areas where construction works are due to commence during the period February to August will be checked by the ECoW for the presence of frog spawn, tadpoles and adult frogs. If present, these will be removed under licence from NPWS and transferred to suitable ponds, drains or wetlands in the vicinity.

5.6.6 Bats

In order to reduce the potential impact of the proposed development on local bat populations the following mitigation is proposed.

5.6.6.1 Construction Phase

Mitigation is best achieved through avoidance especially in relation to bat fauna. It is proposed that the following measures be put in place to avoid or lessen the degree of impacts on local bat populations.

Minimum buffer zone

To minimize risk to bat populations, a buffer zone will be implemented around any forestry, treeline, hedgerow or woodland feature, into which no part of the turbine will intrude. Using the formula quoted below, the minimum distances of wind turbines for bat mitigation are calculated for each of the potential turbine models (information supplied by Jennings O'Donovan). 50 m is used in the formula as it is considered an average of the distance a bat species will be detected on standard ultrasonic microphones (NatureScot 2021).

formula: $\text{Buffer distance} = \sqrt{(50 + b1)^2 - (hh - fh)^2}$

where bl = blade length, hh = hub height, fh = feature height (all in meters)

The dimensions of the potential wind turbine models proposed to be used are provided in the table below.

Feature height is 25 m (typical conifer plantation height, the predominant habitat type present within the survey area). Dimensions of Blade length and Hub height were provided and the calculation is as follows:

Buffer distance = √(50 + 77.5)^2 – (102.5 – 25)^2

Buffer distance = 101.24 m

Construction Phase Bat Mitigation Measures

Following the formula in the above section, ensure that the required minimum distance from tall vegetation is achieved.

Table 5.19: Bat Mitigation Measures recommended during the Construction Phase

HcoBat Tool High Level Turbine Locations This applies to T2	**EcoBat Tool Medium Level Turbine Locations** This applies to T3 This also applies to remaining Internal Road Network	**EcoBat Tool Low Level Turbine Locations** This applies to T1, T4 & T5
Ensure that wind turbine is 101.2 m away from plantation edge.	Ensure that wind turbine is 101.2 m away from plantation edge.	Ensure that wind turbine is 101.2 m away from plantation edge.
A zone of 101 m around the wind turbines (from the tip of the blade) will be cleared of tall vegetation (shrubs, trees, scrub etc.) to reduce favourability of this zone for foraging and commuting bats. A low level of vegetation will be maintained for the entire operational phase. This will be monitored to ensure that scrub vegetation does not develop within the zone around the turbines.	A zone of 50 m around the wind turbines (from the tip of the blade) will be cleared of tall vegetation (shrubs, trees, scrub etc.) to reduce favourability of this zone for foraging and commuting bats. A low level of vegetation will be maintained for the entire operational phase. This will be monitored to ensure that scrub vegetation does not develop within the zone around the turbines.	A zone of 50 m around the wind turbines (from the tip of the blade) will be cleared of tall vegetation (shrubs, trees, scrub etc.) to reduce favourability of this zone for foraging and commuting bats. A low level of vegetation will be maintained for the entire operational phase. This will be monitored to ensure that scrub vegetation does not develop within the zone around the turbines.
Clearance work will be completed at least 6 months prior to installation of wind turbines. Studies have shown that bats are attracted to clear felled forestry areas due to increase insect loading. This has been shown to occur for a period of 3-6 months before the insect loading reduces to pre-cleared felled levels.	Clearance work will be completed at least 6 months prior to installation of wind turbines. Studies have shown that bats are attracted to clear felled forestry areas due to increase insect loading. This has been shown to occur for a period of 3-6 months before the insect loading reduces to pre-cleared felled levels.	Clearance work will be completed at least 6 months prior to installation of wind turbines. Studies have shown that bats are attracted to clear felled forestry areas due to increase insect loading. This has been shown to occur for a period of 3-6 months before the insect loading reduces to pre-cleared felled levels.
Building 2 and mature trees surrounding the building will not be removed during construction of the proposed development. This area will be protected from any construction works proposed to be undertaken in vicinity of this area. This area will also be protected during the operation of the proposed development.		

5.6.6.2 Operational Phase

Feathering of blades

The operation of the turbines should be in a manner that will restrict the rotation of turbine blades as much as possible below the manufacturer's cut-in speed (*e.g*. by feathering the blades during low wind levels - changes in blade feathering by altering the angle of the blade and therefore preventing the blades from rotating during low wind situations). This would prevent freewheeling or idling of the blades. Therefore, to ensure that blades of turbines are prevented from freewheeling (idling/spinning), feathering of the blades during low wind conditions will be implemented for all turbines.

Turbine cut-in speeds

There are bat mitigation measures available in relation to wind farms to reduce fatalities. One successful measure applied to wind farms in Europe is to increase the cut-in speeds of the individual turbines. This is important in order to protect High Risk species (Leisler's bat, soprano and common pipistrelle) foraging/commuting in vicinity of turbine locations.

Increasing the cut-in speed to 5.5 m/s from 30 minutes prior to sunset and to 30 minutes after sunrise to reduce bat collisions with turbines will be employed where required*, i.e.* at turbine locations where surveillance recorded high bat activity levels for High Risk and Medium Risk bat species and/or bat carcasses were recorded. The duration required depends on the level of bat mitigation required for individual turbine sites (i.e. full bat activity season or confined to spring & autumn months – this will be determine by first year surveillance – see below). A risk assessment will be undertaken using the surveillance data and analysed using best practice e.g. assessment of static data should be completed using the online tool *EcoBat* (http://www.mammal.org.uk/science-research/ecostat/) as recommended by SNH, 2021 or other equivalent tool depending on most up to-date recommendations at the time of monitoring.

Where cut-in speeds are required, they will be operated according to specific weather conditions. In a previous bat survey undertaken by the author, static units were erected on an anemometer at 4 m and 50 m level. The number of bat passes recorded on the static units was analysed according to temperature and wind speed recorded at similar height levels. During this survey, it was determined that:

1. The vast majority of bat passes were recorded at the temperatures of 8°C and greater. Therefore, when the air temperature was less than 7°C there was no bat activity recorded below this temperature during the surveys completed.

2. In general, bat activity was highest at low wind speeds (<5.5 m/s). It has been shown that curtailing the operations of wind turbines at low wind speeds can reduce bat mortality dramatically, especially during the late summer and early autumn months.
3. SNH (2021) recommend that curtailment is implement for 10°C and above.

Reducing fatalities can be reduced by changing the speed trigger or cut-in speeds of the turbines (i.e. meaning that the turbine is not operational during low wind speeds) or by changing the turbine blades angles which will mean that higher wind speeds are needed to start the wind turbine blades moving. Modern remotely operated wind turbines allow such cut-in speeds to be controlled centrally and automatically. Due to the high levels of bat activity, cut-in speed is required at T2.

a. Surveillance will be undertaken at the High and Medium Risk turbine (T3) over a period of three years (first three years of operation, but an annual review is required to determine the cut-in speeds after 1 year of operation). If the *Common pipistrelle* activity remains moderate to high at the T3 Medium Risk turbine after the first year of surveillance then the cut-in speeds (coupled with carcass search results) will be put in place immediately. High and Medium Risk turbines surveillance will continue to review the situation at each individual turbine location for the remaining two years. This will allow refinement of the curtailment regime.

For all other turbines, operation without cut-in speeds coupled with 3 years of surveillance (according to SNH, 2021 guidelines) to determine if cut-in speeds are required at these turbine locations.

As recommended by SNH, 2019 if curtailment is put into operation, *"then the effectiveness of curtailment needs to be monitored in order to determine (a) whether it is working effectively* (i.e*. the level of bat mortality is considered to be incidental), and (b) whether the curtailment regime can be refined such that turbine down-time can be minimised whilst ensuring that it remains effective at preventing casualties".*

"Where the need for curtailment has been identified, a curtailment regime should be developed and presented as a part of the supporting Environmental Statement for the project. The proposed operating regime should specify, and be designed around the values for the key weather parameters and other factors that are known to influence collision risk which may include any or 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 acoustic surveys provide additional information which, when used in conjunction with appropriate carcass search data, can support any proposed changes to pre-application predictions concerning the need for curtailment or adjustments to an agreed curtailment regime.

This surveillance and annual review should be carried out by an independent experienced bat ecologist and all reports should be issued to the Local Authority and NPWS for review.

Table 5.20: Bat Mitigation Measures proposed during the Operational Phase.

EcoBat Tool High Level Turbine Locations This applies to T2	**EcoBat Tool Medium Level Turbine Locations** This applies to T3 This also applies to remaining Internal Road Network	**EcoBat Tool Low Level Turbine Locations** This applies to T1, T4 & T5
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).	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).	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).
Operate the wind turbine from 30 minutes prior sunset to 30 minutes after sunrise at a cut-in speed of 5.5 m/s during specified weather conditions and during the active bat season (April to October) when air temperatures are 10ºC or more at the nacelle height. Undertake monitoring the first three years of operation to determine bat activity levels post construction. Review the results of monitoring at individual High Risk turbines after Year 1. Operate wind farm with specific cut-in speeds from Day 1 of Year 2, if required, and review after surveillance/monitoring is completed.	Put in 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 (e.g. cut-in speeds).	

EcoBat Tool High Level Turbine Locations This applies to T2	**EcoBat Tool Medium Level Turbine Locations** This applies to T3 This also applies to remaining Internal Road Network	**EcoBat Tool Low Level Turbine Locations** This applies to T1, T4 & T5
Undertake a carcass search for 3 years post operation of the wind farm to determine whether a higher cut-in speed of the blades is required. Review after Year 1 along with bat activity monitoring.	Undertake a carcass search for 3 years post operation of the wind farm.	Undertake a carcass search for 3 years post operation of the wind farm.
Annual inspection of each buffer zone around each turbine will be undertaken and any regenerating trees or tall shrubs will be cut back.	Annual inspection of each buffer zone around each turbine will be annually inspected and any regenerating trees or tall shrubs will be cut back.	Annual inspection of each buffer zone around each turbine will be annually inspected and any regenerating trees or tall shrubs will be cut back.

Bat mitigation measures during the Operational Phase will be reviewed by implementing a strict surveillance programme for the first three years of operation of the wind farm in order to identify if there exists a substantial risk at a particular turbine location or during a particular time-period (3 years - as per recommendation of SNH, 2021 guidelines). This surveillance required is as follows (following SNH 2021 guidelines):

a) Bat activity surveillance
The level of bat activity will be monitoring for a minimum of 10 nights at each turbine location (ground level) during three of the eight month activity period (March/April to October/November). The surveillance periods will be divided into three survey periods to represent the three main periods where bat collisions have been documented: Spring (April/May); Summer (June/July) and Autumn (August/September).

b) Carcass search
During the surveillance periods of specific wind turbines, carcass search is proposed for a minimum of 1 morning per turbine (i.e. 3/4 mornings in total over the 1 year surveillance i.e. one per surveillance period). For each turbine, the search area will be 100 m radius after ideal bat foraging weather conditions (mild, calm and dry weather and greater than 10ºC). A scavenger trial is required to facilitate analysis (as per SNH, 2021 guidelines).

c) Assessment of static data will be completed using the online tool *EcoBat Tool* (http://www.mammal.org.uk/science-research/ecostat/) as recommended by SNH, 2021 or other equivalent tool depending on most up to-date recommendations at the time of monitoring.

5.6.7 Kerry Slug

The following measures will be implemented for Kerry Slug:

- Areas of suitable habitat that occur outside of the footprint of the development will be avoided during the course of construction thereby minimising the loss and disturbance of Kerry Slug habitat.
- Immediately prior to undertaking works in areas of suitable habitat (wet heath / blanket bog / rock outcrop), the project ecologist will check for the presence of Kerry Slug. Should slugs be discovered, then they will be transferred to suitable habitat in the surroundings. Similar on-going monitoring of suitable habitat within works areas will continue throughout the construction phase. Such monitoring will be undertaken during periods of wet weather when slugs are most active and feeding on the surface and therefore at greater risk of impacts by movement of machinery. The transfer of Kerry Slugs will be subject to a derogation licence from the Department of Housing, Local Government and Heritage.

Subject to the above mitigation being implemented it is concluded that impacts of significance on the conservation status of Kerry Slug will not arise, i.e. the effect of the proposed development on Kerry Slug would be Not Significant.

5.7 RESIDUAL EFFECTS OF THE DEVELOPMENT

With mitigation measures as presented implemented in full, and specifically preservation of water quality in local watercourses and avoidance of disturbance to breeding hen harrier, it is considered that the significance of the effect of the predicted impact on designated sites as a result of the proposed wind farm project will be 'Not Significant'.

With mitigation measures as presented implemented in full, it is considered that the significance of the predicted effect on wet heath and blanket bog habitats as a result of the proposed wind farm development will be a Significant Long-term adverse effect. However, compensation will be provided for the loss of habitat through a Habitat Enhancement Plan (see section 5.9).

With mitigation measures as presented implemented in full, including preservation of water quality in local watercourses, it is considered that the significance of the predicted impact on terrestrial mammal species as a result of the proposed wind farm development will be Not significant.

As long as the mitigation measures presented are implemented in full, the impact of the proposed development on local bat populations is considered to be a Slight to Imperceptible residual negative effect. The conservation status of each of the local bat species will remain unaffected.

With mitigation measures as presented implemented in full, it is considered that the significance of the predicted impact on the Kerry Slug population as a result of the proposed wind farm development will be Not significant.

5.8 CUMULATIVE EFFECTS

There are 26 wind farms within 20 km[3] of the Inchamore proposed development (an area of 1,256 km^2). **Figure 5.12** shows the location of proposed, permitted and operational wind farms within a 20 km radius of the Inchamore site and further information on these wind farms is provided in the accompanying EIAR (**Appendix 2.3, Chapter 2**). Of the 26, 18 no. are operational (175 turbines total), 6 no. are permitted (25 turbines), 1 no. is at pre-planning stage (17 turbines) and 1 no. is proposed (14 turbines).

The nearest operational wind farms to the Inchamore site is Coomagearlaghy, Kilgarvan Wind Farm (15 turbines), which is located 2.7 km to the south-west, and Inchee, Poulbatha & Foilgreana (6 turbines), which is located 3.3 km to the south-west. The permitted Gortnakilla, Clonkeen, Killarney Wind Farm is located 1.87 km to the west of the Inchamore site.

Most of the wind farms are clustered to the north-east, south and south-west of the Inchamore site.

The Inchamore project will add a further 5 turbines to the total of 231 turbines. Based on the locations of the 26 wind farms (see **Figure 5.12**), it is expected that most are on heath and/or bog habitats and the construction of such projects would have (or will) caused loss and disturbance of peatland habitats. The proposed wind farm project at Inchamore will contribute to further loss of heath and bog habitats (from T1 and T2).

A detailed inventory of permitted projects within a 3 km radius of the site for the Inchamore wind farm and 50 m either side of the grid connection route has been compiled (see **Appendix 2.5, Chapter 2**). These projects received planning permission between 2017

[3] A distance of 20 km is taken as a precautionary distance for potential in-combination effects to occur – such a distance is beyond the normal foraging range of bird species associated with SPAs.

and 2022. Most of the projects are domestic scale developments or agricultural related developments and no potential pathways to European sites are identified. Potentially relevant projects which have received planning permission are:
Planning Ref. 174167 **–** A solar photovoltaic panel array consisting of up to 37,800 m^2 of solar panels on ground mounted steel frames and all associated infrastructure and site works. Located at Coumaclovane, Coolea, Co Cork, approximately 4 km south-southwest of the Inchamore site. Permission granted by Cork County Council 01/07/2017.

Planning Ref. 215127 **–** The erection of a temporary meteorological mast for a period of 5 years, located at Inchamore, Coolea, Co. Cork (within the site for the proposed Inchamore Wind Farm). This consists of a 100 m high lattice mast and associated stay wires. Permission granted by Cork County Council 31/08/2021.

Planning Ref. 217318 **–** A 30 m high telecommunications structure together with antennas, dishes and associated telecommunications equipment and all associated works. Located at Derreenaling, Ballyvourney, Co. Cork, approximately 2 km east of the Inchamore site. Permission granted by Cork County Council 15/02/2022.

All of the wind farm and other projects will have been assessed by the competent authority for potential adverse effects on designated sites and habitats and species of conservation importance. As it has been demonstrated in this report that the Project, with mitigation in place, will not have adverse effects on the integrity of any designated site, it can be concluded that there is no pathway for it to act in-combination with other plans and projects to give rise to cumulative effects.

The peatland habitat in much of the Site has been severely degraded by afforestation. The construction of the proposed wind farm will contribute to an existing and ongoing adverse effect on the peatland resource of the site and county.

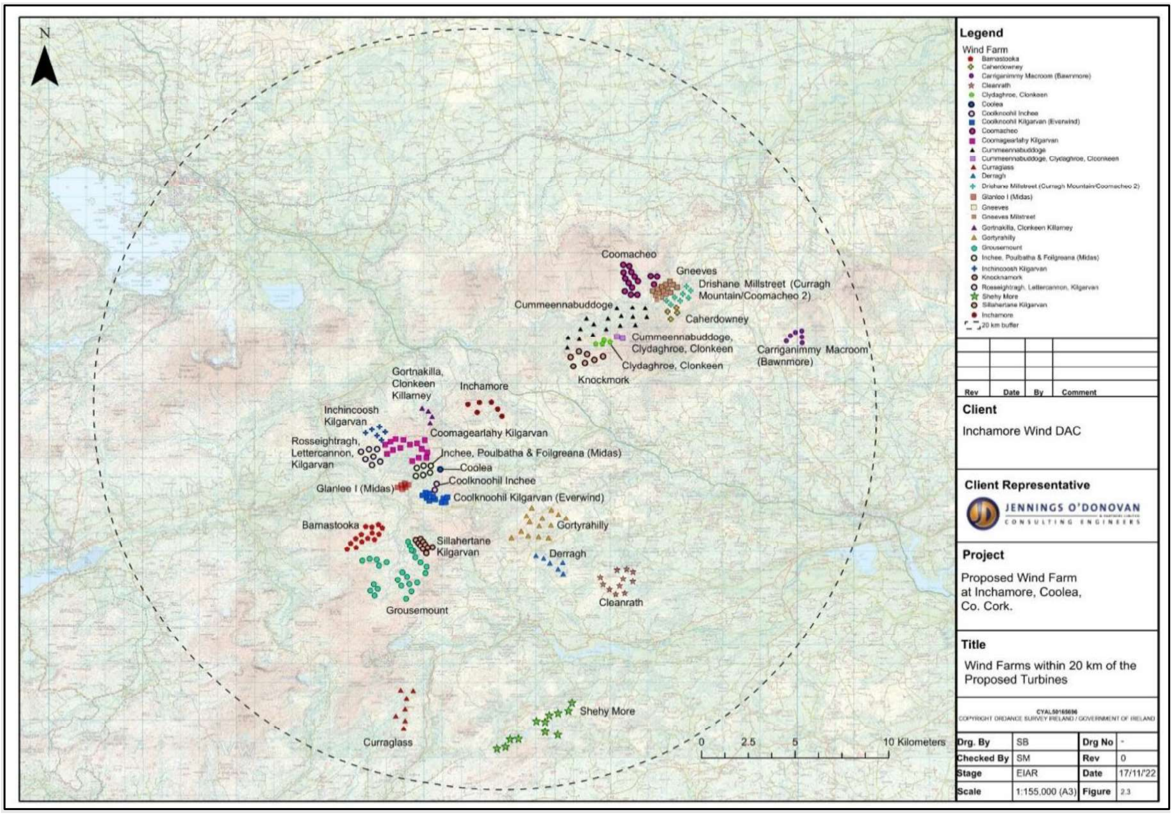


Figure 5.12: Distribution of wind farm sites within a 20 km distance of the proposed Inchamore Wind Farm.

5.9 PROPOSED BIODIVERSITY ENHANCEMENT

The Habitat Enhancement Plan is presented in **Appendix 5.5**. The Plan will restore and enhance an area of blanket bog habitat that has been severely eroded following over-grazing by sheep. This will provide compensation for the loss of heath and bog habitats on site as a result of wind farm construction (total of 2.5 ha intact heath and bog and 1.6 ha of cutover bog). The total area of the HEP, which includes some relatively intact blanket bog and some cutover bog, is 10.8 ha.

The objectives of the Plan are as follows:

Objectives - primary

- To enhance existing areas of blanket bog (Annex I habitat) which are subject to ongoing erosion.
- To increase the vegetation cover in areas of cutover blanket bog that have been intensively grazed by livestock in the recent past.

Objectives - secondary

- To enhance existing habitats for peatland associated species such as Red Grouse, (Red-listed), Snipe (Red-listed), Meadow Pipit (Red-listed) and the Irish Hare.

The objectives for the Plan are achievable as similar work has been carried out successfully at other sites in Ireland. The Plan will be underwritten by a detailed monitoring programme, which will allow modifications to ensure that the objectives are being achieved (See **Appendix 5.6**).

5.10 MONITORING

5.10.1 On-going monitoring during construction

An Ecological Clerk of Works (ECoW) and Environmental Manager will be on site as required during the construction phase. As required, a consultant ecologist with expertise in peatland habitats will assist the ECoW and Environmental Manager. The consultant ecologist will be employed by the developer and will be independent of the Contractor.

The ECoW will ensure that all mitigation relating to ecological impacts is being implemented throughout the construction phase of the project.

Mitigation for Kerry Slug, as described in **Section 5.6.7**, will involve monitoring of potential Kerry Slug habitat prior to any works commencing. This will be carried out by an ecologist with proven expertise in the ecology of Kerry Slug and will be under licence.

5.10.2 Pre-construction bat survey

Should three years lapse from between planning-stage surveys in 2022 and installation of the wind turbines, it will be necessary to repeat one full season of surveys during the activity period (EUROBATS, 2014). Future survey work should be completed according to best practice guidelines available. The most current guidance document for Irish wind farms is from NatureScot (NatureScot, 2021) (NIEA, 2021)

5.10.3 Pre-construction badger survey

Should three years lapse since the 2021 baseline survey before construction commences, all work areas will be subject to a pre-construction survey for badger. This survey will give particular focus to the afforested part of site where badger is most likely to occur (and where full survey was not achieved in the 2021 baseline survey due to difficulty of access through dense conifer plantation).

5.10.4 Bat monitoring

Bat mitigation measures during the Operational Phase can be reviewed by implementing a strict surveillance programme for the first three years of operation of the wind farm in order to identify if there exists a substantial risk at a particular turbine location or during a particular time-period (3 years - as per recommendation of SNH, 2021 guidelines). This surveillance will then be repeated at Year 10 and Year 20 of the operation of the wind farm to ensure the efficacy of the mitigation being implemented. This surveillance required is as follows:

- Bat activity surveillance
  The level of bat activity will be monitored for a minimum of 10 nights at each turbine location (ground level) during three of the eight-month activity period (March/April to October/November). The surveillance periods will be divided into three survey periods to represent the three main periods where bat collisions have been documented: Spring (April/May); Summer (June/July) and Autumn (August/September).
- Carcass search
  During the surveillance periods of specific wind turbines, carcass search will be conducted for a minimum of 1 morning per turbine (i.e. 3/4 mornings in total over the 1 year surveillance i.e. one per surveillance period). For each turbine, the search area will be 100 m radius after ideal bat foraging weather conditions (mild, calm and dry weather and greater than 10ºC). A scavenger trial is required to facilitate analysis (as per SNH, 2021 guidelines).
- Assessment of static data will be completed using the online tool *EcoBat Tool* (http://www.mammal.org.uk/science-research/ecostat/) as recommended by SNH, 2021 or other equivalent tool depending on most up to-date recommendations at the time of monitoring.

5.11 SUMMARY OF SIGNIFICANT RESIDUAL EFFECTS

From the perspective of Biodiversity, the principal residual effect as a result of the proposed wind farm project is the permanent loss of approximately 2.5 ha of wet heath and blanket bog habitat, which includes areas of dry heath and outcropping silicious rock (all Annex I listed habitats) – this adverse effect is considered Significant and of Long-term duration at the County Level. With implementation of a Habitat Enhancement Plan to compensate for the loss of habitat, the significance of the loss is reduced.

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6 AQUATIC ECOLOGY

6.1 INTRODUCTION

This chapter assesses the impacts of the Project (**Figure 1.2**) on Aquatic Biodiversity. The Project refers to all elements of the Inchamore Wind Farm (**Chapter 2: Project Description**) including the Grid Connection Route and the Turbine Delivery Route. This chapter will identify, describe and assess the direct and indirect effects of the Project on aquatic biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC". Where negative effects are predicted, the chapter identifies appropriate mitigation strategies therein. The assessment will consider the potential effects during the following phases of the Project:

- Construction of the Project
- Operation of the Project
- Decommissioning of the Project

Common acronyms used throughout this EIAR can be found in **Appendix 1.2.** This chapter of the EIAR is supported by Figures provided in Volume III.

A detailed Construction and Environmental Management Plan (CEMP) is appended to the EIAR in **Appendix 2.1**. This document includes all of the mitigation prescribed within the EIAR. For the purpose of this application, a summary of the mitigation measures is included in **Appendix 17.1**.

6.1.1 Statement of Authority

This chapter has been written by Paul Murphy of EirEco Environmental Consultants who also undertook the aquatic field surveys and Freshwater Pearl Mussel surveys. He holds an MSc in Environmental Science and a Diploma in Aquatic Biology, is a Chartered Environmentalist (Society for the Environment), a full member of the Chartered Institute of Ecology and Environmental Management and a member of the Institute of Fisheries Management. Paul has been operating in the environmental field for over three decades covering a broad range of projects in a variety of countries. He has expert knowledge of the various EU Environmental Directives and extensive experience in Environmental Impact Assessment and ecological mitigation design for numerous major infrastructural schemes (roads, bridges, power plants, wind farms, etc.).

Karen Banks assisted during the Freshwater Pearl Mussel survey as bankside recorder. Karen is a professional ecologist with 15 years' experience in the field of ecological assessment and holds a BSc in Environment and Development from Durham University, and is a full member of the Chartered Institute of Ecology and Environmental Management.

Electro-fishing surveys were undertaken by Ross Macklin (Triturus Environmental Ltd.) and John Brown (Stillwater's Consultancy). Ross is an environmental scientist who specialises in freshwater and fisheries ecology, in addition to informing engineering solutions for construction works on rivers, including site improvement and rehabilitation. He has fifteen years professional experience and holds a PhD and BSc. John is a retired Inspector of Fisheries in the Fisheries Research Centre of the Department of Fisheries and Forestry, and Head of the Stock Assessment Section in the Marine Institute. He established Stillwaters Consultancy in 1999 to provide fisheries management and water quality advice to the public and private sector.

The assessments in this chapter, together with the desktop study outlined in Section 6.2.1.2 and the field investigations outlined in Section 6.2.1.4 are considered adequate to allow the Council to carry out an assessment of the Development.

6.1.2 Assessment Structure

In line with the revised EIA Directive and EPA 2022 Guidelines on the information to be contained in Environmental Impact Assessment Reports, the structure of this Aquatic Biodiversity chapter is as follows:

- Assessment Methodology and Significance Criteria.
- Description of baseline conditions at the Site.
- Identification and assessment of impacts to Biodiversity associated with the Development, during the construction, operational and decommissioning phases of the Development.
- Identification of cumulative impacts if and where applicable
- Mitigation measures to avoid or reduce the impacts identified.
- Identification and assessment of residual impact of the Development considering mitigation measures.

6.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

6.2.1 Assessment Methodology Aquatic Biodiversity

6.2.1.1 Guidance

The general approach used for the evaluation of ecological receptors and assessment of potential impacts for this current assessment is based on the '*Guidelines for Ecological Impact Assessment in the UK and Ireland*' (CIEEM, 2018). The evaluation of ecological receptors contained within this report uses the geographic scale and criteria defined in the *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (NRA, 2009).

Effects were considered to be either significant or not significant at a geographic scale equivalent to or less than the conservation importance of the ecological feature being assessed (Chartered Institute of Ecology and Environmental Management, 2018). Duration of impacts is considered according to Environmental Protection Agency (EPA) guidance (EPA, 2022). The magnitude of an impact will depend on the nature and sensitivity of the ecological features and will be influenced by intensity, duration (temporary/permanent), timing, frequency and reversibility of the potential impact (CIEEM, 2016).

6.2.1.2 Desktop Study

A review was completed of existing data and records for fish, protected aquatic species and habitats (including Annex II species and aquatic Annex I habitats), and invasive species (listed under the Third Schedule of S.I No. 477 of 2011, European Communities (Birds and Natural Habitats) Regulations 2011)) on watercourses hydrologically connected (i.e., downstream) of the Development. The main sources of information are the National Biodiversity Data Centre and National Parks and Wildlife Service websites.

6.2.1.3 Consultations

A sensitive species data request was made to the NPWS for aquatic flora and fauna within 10 km grid squares IW17 and IW27 on 13th March 2023. Consultations were also undertaken with Inland Fisheries Ireland in relation to existing data on fish stocks and in relation to concerns or requirements vis-a-vis the Development. Licence applications were submitted to NPWS in relation to Stage 1 survey for Freshwater Pearl Mussel and to IFI in relation to Electro-fishing surveys.

6.2.1.4 Field Survey

Zone of Influence

The Zone of Influence (ZOI) differs for different habitats and species. Within terrestrial habitats, the ZOI may be confined to the study area, whereas for aquatic habitats, the ZOI will be much more extensive and the surveys undertaken were scoped accordingly. In view of hydrological connectivity, this entailed establishing the baseline conditions in aquatic habitats at a range of points downstream in the various watercourses draining the site and is reflected in the range and extent of surveys undertaken. An Appropriate Assessment Screening Report and Natura Impact Statement have been prepared as part of this application which assesses potential impacts on European designated sites (the Natura 2000 network), a number of which are hydrologically connected via surface water flow.

Aquatic Habitats

A survey of watercourses at the Site and within a potential zone of influence of the Development and for c. 500 m downstream was undertaken on 3rd June 2020 and on the 14th and 15th July 2020. The surveys identified and mapped aquatic habitats, determined fisheries value and potential, and determined presence or suitability for Annex listed species or invasive alien species. The aquatic habitat assessment conducted at all sites was based on the Environment Agency's '*River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003*' (EA, 2003) and the Irish Heritage Council's '*A Guide to Habitats in Ireland*' (Fossitt, 2000). All sites were assessed in terms of:

- Stream width, depth and other physical characteristics.
- Substrate type, listing substrate fractions in order of dominance, i.e., bedrock, boulder, cobble, gravel, sand, silt etc.
- Flow type, listing percentage of riffle, glide and pool in the sampling area.
- In-stream macrophyte, bryophytes occurring and their percentage coverage of the stream bottom at the sampling sites.
- Riparian habitats and species composition.

A Biosecurity protocol was rigidly followed to avoid the potential for transfer of invasive alien species to or from the site in accordance with guidance produced by Invasive Species Ireland and Inland Fisheries Ireland (Decontamination and Disinfection procedures for equipment and personnel). A specific Biosecurity Method Statement was produced for the survey operation.

Electro-fishing Survey and Fisheries Habitat Assessment

Electro-fishing was undertaken at six (6 No.) locations on watercourses downstream of the wind farm site under Section 14 authorisation (dated 9th July 2020) from the Department of Communications, Climate Action and Environment. The electro-fishing survey was undertaken by Ross Macklin (Triturus Environmental Ltd.) and John Brown (Stillwater's Consultancy). A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish a total of six sites on the Inchamore Stream within the Sullane catchment.

The electro-fishing survey is considered adequate for the following reasons: As three primary species groups were targeted during the survey, i.e., salmonids, lamprey, and eel, the electro-fishing settings were tailored for each species. By undertaking electro-fishing using the rapid electro-fishing technique, the broad characterisation of the fish community at each sampling reach was determined. Electro-fishing methodology followed accepted European standards (CEN, 2003) and adhered to best practice (e.g., Central Fisheries Board, 2008). Stations were selected on the basis of representative and accessible locations along each of the watercourses within or draining the Development. Each station was fished over a length of 30 m of channel with a series of three electro-fishing passes (these are shown as the upstream and downstream extents in **Figure 6.1**). All captured fish were removed from the water using dip nets with insulated handles and transferred into water filled plastic bins. All specimens fished were anesthetized to facilitate identification, age class and length measurement before being subsequently returned to the water. Photographs of each survey location were recorded.

Given the occurrence and ecological implications of a number of aquatic invasive alien species and diseases throughout the country, appropriate measures were undertaken to ensure there was no risk of transfer of any alien invasive species or diseases to or from the survey locations. Guidance produced by Invasive Species Ireland and Inland Fisheries Ireland (*Decontamination and Disinfection procedures for equipment and personnel*) in relation to reducing the risks of spread was adhered to rigorously and a specific Biosecurity Method Statement was produced for the fish survey operation.

The river channel morphology, substrate and flow regime were assessed to determine the suitability of the habitat for spawning or as nursery habitat by salmonids and other species including lamprey and ammocoete larvae in marginal silt beds. The presence and abundance of aquatic vegetation in the river was recorded and a species list compiled. A photographic record was made with locations noted on the field maps.

Freshwater Pearl Mussel Stage 1 Survey

On the basis of the known distribution of Freshwater Pearl Mussel (FPM) within the catchment of the Development derived from consultation with NPWS, a review of OSI mapping and aerial imagery was undertaken to identify potentially suitable locations for survey. A licence application to carry out a Stage 1 Survey was submitted to NPWS and this was subsequently received (Licence No. C171/2020). Field maps and data sheets were prepared and the NPWS Divisional Manager was notified in advance of the proposed survey. The surveys were undertaken on 14th, 15th and 16th July 2020 using the NPWS Stage 1 methodology (presence/absence survey) detailed in the Irish Wildlife Manual No. 12 (2004) aimed specifically to establish presence or absence at eight locations. At each survey location a total length of c. 200 m was intensively searched using a bathyscope wading in an upstream direction covering areas of fast flowing water, glides and pools. Specific attention was given to areas under overhanging vegetation where mussels frequently are found in rivers subject to periodic algal growth. Bankside shingle banks were also surveyed for dead shells where they occurred. The operation was undertaken by two people with one operator instream (Paul

Murphy) and one bank-side recorder (Karen Banks). The surveys were carried out in conditions of moderate flow though with high water clarity. The weather during the survey period was generally bright and sunny with occasional cloudier periods.

Biotic Index (Q Value) Macro-invertebrate Assessment

Water quality was assessed using the Q Value biotic index system at the six locations sampled for electro-fishing on each of the watercourses draining the wind farm. This standardised approach for the biological assessment of water quality as used by the Environmental Protection Agency is based on the composition of the macroinvertebrate community which inhabit the substratum of rivers and streams. These comprise in the main, immature aquatic stages of insects, together with crustacean (shrimps), molluscs (snails and bivalves), oligochaetes (worms) and hirudinea (leeches). Shallow, fast-flowing stretches of riffle habitat are sampled in preference to non-riffle areas as they show most clearly the water quality status and effects of pollution. For assessment purposes the invertebrate communities are divided into four groups – sensitive, less sensitive, tolerant and very tolerant forms. The relative proportions of the various organisms in samples are determined and the water quality status is inferred by comparison with the expected ratios in unpolluted habitats of the type under investigation. The assessment procedure also takes into account other relevant factors such as the intensity of algal and or / aquatic plant growth, water turbidity, bottom siltation, nature of the sub-stratum, speed of current, and water depth. The biological information is then condensed to readily understandable form by means of a 5-point biotic index (Q values) in which invertebrate diversity and water quality are related as outlined in **Table 6.1**. Intermediate values (e.g., Q3-4) are used to describe conditions where appropriate.

Table 6.1: EPA Water Quality and Status Summary (EPA, 2010)

Biotic Index	Quality Status	Water Quality	WFD Ecological Status
Q5	Unpolluted	Good	High
Q4-5	Unpolluted	Fair-to-Good	High
Q4	Unpolluted	Fair	Good
Q3-4	Slightly Polluted	Doubtful-to- Fair	Moderate
Q3	Moderately Polluted	Doubtful	Poor
Q2-3	Moderately Polluted	Poor-to-Doubtful	Poor
Q2	Seriously Polluted	Poor	Bad
Q1-2	Seriously Polluted	Bad-to-Poor	Bad

6.2.1.5 Ecological Evaluation and Impact Assessment Methodology

The evaluation of the key ecological receptors and the criteria used to assess the significance of impacts are derived from the Guidelines for Assessment of Ecological Impacts on National Road Schemes (TII, June 2009) (the "TII Guidelines"), Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EPA, May 2022) (the "EPA Guidelines") and the Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal (CIEEM, 2016) (the "CIEEM Guidelines").

The criteria used for assessment of the value of the ecological resources sets out the context for the determination of value on a geographic basis with a hierarchy assigned in relation to the importance of any particular receptor. The guidelines provide a basis for determination of whether any particular site is of importance on the following scale:

- International Importance;
- National Importance;
- County Importance;
- Local Importance (Higher Value), and
- Local Importance (Lower Value).

Receptors of Local Importance (Lower Value) contain habitats and species that are widespread and of low ecological significance and of importance only in the local area. Internationally Important sites are either designated for conservation as part of the Natura 2000 network, i.e., Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) or provide the best examples of habitats or internationally important populations of protected flora and fauna.

The CIEEM Guidelines define a significant effect as, "an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features'...or for biodiversity in general". The criteria used for assessment of impacts are as follows while the Criteria for Assessing Impact Significance are presented in **Table 6.2**:

Positive or Negative: Positive and negative impacts/effects should be determined according to whether the change is in accordance with nature conservation objectives and policy;

Extent: Extent should be predicted in a quantified manner and relates to the area over which the impact occurs;

Magnitude: Magnitude refers to size, amount, intensity and volume. It should be quantified if possible and expressed in absolute or relative terms e.g. the amount of habitat lost, percentage change to habitat area, percentage decline in a species population;

Duration: Duration is intended to refer to the time during which the impact is predicted to continue, until recovery or re-instatement (which may be longer than the impact-causing activity). Duration should be defined in relation to ecological characteristics (such as a species' lifecycle);

Frequency and Timing: The timing of impacts in relation to important seasonal and/or life-cycle constraints should be evaluated. Similarly, the frequency with which activities (and concomitant impacts) would take place can be an important determinant of the impact on receptors and should also be assessed and described;

Reversibility: An irreversible effect is one from which recovery is not possible within a reasonable timescale or there is no reasonable chance of action being taken to reverse it. A reversible effect is one from which spontaneous recovery is possible or which may be counteracted by mitigation.

Likelihood:

- Certain/Near Certain: >95% chance of occurring as predicted;
- Probable: 50-95% chance as occurring as predicted;
- Unlikely: 5-50% chance as occurring as predicted and
- Extremely Unlikely: <5% chance as occurring as predicted.

Table 6.2: Criteria for Assessing Impact Significance (EPA, 2022)

Impact Magnitude	Definition
No change	No discernible change in the ecology of the affected feature
Imperceptible Impact	An impact capable of measurement but without noticeable consequences
Slight Impact	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate Impact	An impact that alters the character of the environment that is consistent with existing and emerging trends
Significant Impact	An impact which, by its character, its magnitude, duration or intensity alters a sensitive aspect of the environment
Profound Impact	An impact which obliterates sensitive characteristics

6.3 BASELINE DESCRIPTION

6.3.1 Aquatic Environment

6.3.1.1 Aquatic Habitats

The Proposed Wind Farm Site

The Site lies entirely within the Inchamore Stream sub-catchment where five tributaries flow into the Bardinch River which then joins the Sullane River, a tributary of the Lee. The Sullane River supports good populations of brown trout (*Salmo trutta*) with resident populations as well as larger fish running up from the reservoir downstream (O'Reilly, 2004). The catchment of the Development is listed as supporting extant populations of Freshwater Pearl Mussel (*Margaritifera margaritifera*). The watercourses within the proposed wind farm site itself are small 1st order tributaries which have high gradients and do not provide suitable habitat for fish or larger aquatic organisms. There are three minor watercourses within the site that will be crossed by the proposed road network within the site, all of which will entail clear-span structures and thus will not interact with the waterbodies and will avoid instream works.

Grid Connection Route

The Grid Connection Route is 19.9 km in length and traverses in an east to south easterly direction from the existing Ballyvouskill 220 kV substation to the Inchamore Wind Farm substation location utilising public local road networks, and existing forestry access tracks. There are three minor streams along the length of the Grid Connection Route (refer to planning drawings 05934-DR-201-210) which will be crossed by horizontal directional drilling (HDD) thereby avoiding any instream works. These are small watercourses with no fisheries value or the potential to support any protected aquatic species. Other minor watercourses (streams and drainage ditches) along the length of the route will be crossed on existing culverts as they have adequate depth of fill to accommodate the cable.

Turbine Delivery Route

The Turbine Delivery Route (TDR) extends from Ringaskiddy Port to the Site via the N28, N40 and N22, and from there onto an upgraded forestry road as shown on **Figure 2.5**. The TDR is on a public road and crosses innumerable existing watercourses – all on existing bridges / culverts and with no requirement for modification to the watercourses to enable turbine delivery.

6.3.1.2 Electro-fishing Survey and Fisheries Habitat

The six locations of watercourses surveyed by electro-fishing is shown in **Figure 6.1**. A description of the aquatic and riparian habitats at each site and summary of the results of the electro-fishing survey with an appraisal of their ecological value is presented below.

Site1. Inchamore Stream (Sullane Catchment) (photos of locations provided below in Table 6.3)

Site 1 was situated in an upland eroding stream (FW1) with 1.5 m water width and was predominantly shallow (0.1 m to 0.4 m depth). The bank heights were variable between 1.0 m and 3.0 m. The channel comprised of boulder cascade reaches with equal proportions of pool, riffle and glide. The bed was boulder and cobble dominated with very localised pockets of coarse gravels and medium energy (reflective of the higher gradient and higher energy environment). The bed comprised loose (unconsolidated) bed material with low siltation levels. The riparian areas comprised of semi-improved grassland (wet in nature) and were predominantly sheep grazing lands. The channel was open with no overhanging trees, and bordered by open pasture (i.e., semi-improved grassland as previously described).

From a fisheries perspective the small upland spate stream could be considered a moderate to good quality brown trout nursery. The stream had a good semi-natural profile with holding and nursery habitat being good overall for an upland trout stream. Spawning areas were as expected for a stream of this nature, being localised and restricted to small pockets in pools between boulder areas. Overall spawning potential can be considered moderate within the survey reach.

Site 2. Inchamore Stream (Sullane Catchment)

Site 2 was an upland eroding stream (FW1) that had 1.5 m to 2.0 m water width. The stream was predominantly shallow (0.1 m to 0.3 m depth). The bank heights were typically 1.5 m high. The channel was of high energy with dry boulder and cobble bars indicating much higher winter flows. The bed was boulder and cobble dominated with frequent pockets of coarse, medium and fine gravels. The stream gradient was lower than site 1 and had higher proportions of gravel. The bed comprised loose (unconsolidated) bed material but siltation levels were moderate with evident silt deposition in pools. The riparian areas comprised of semi-improved grassland.

From a fisheries perspective the upland spate stream could be considered a moderate to good quality brown trout nursery but this was not reflected in the fish population recorded. It is considered that land use practices may have impacted the stream fish population (e.g., heavily afforested upstream catchment). The stream had a good semi-natural profile with holding and nursery habitat being good overall for an upland trout stream. Spawning areas were locally good with mixed unconsolidated gravels at pool tailings. Overall spawning potential can be considered good within the survey reach for brown trout. Surprisingly recruitment was much poorer than would be expected for a stream of this nature as reflected in the fisheries demographic.

Site 3. Inchamore Stream (Sullane Catchment)

Site 1 was an upland eroding stream (FW1) that had a 1.0 m water width. The stream was predominantly shallow (0.1 m to 0.2 m depth) with bank heights typically between 2.0 m to 2.5 m high. The channel was of very high energy with boulder cascade reaches. The profile comprised of 50% pool, 10% riffle and 40% glide. The bed was boulder and cobble dominated with locally frequent pockets of coarse, medium and fine gravels. These were most common in the glide tailings of pool. The stream gradient was steep and higher than at sites 1 and 2. The bed comprised loose (unconsolidated) bed material and siltation levels were low. The riparian areas were either open (east bank) or comprised dense grey willow stands with scattered Sitka spruce, gorse and bramble. The upstream catchment comprised of gorse scrub and conifer plantation.

From a fisheries perspective the upland spate stream could be considered a lower quality brown trout nursery given very high energy and smaller size. The stream had a good semi-natural profile with holding being good overall for an upland trout stream. Spawning areas were locally good with mixed unconsolidated gravels at pool tailings. However, despite relatively good habitat characteristics for an upland brown trout stream, the recorded population was very small (single adult recorded). The high energy and small upland nature of the stream likely accounted for the lower fisheries value overall.

Site 4. Inchamore Stream (Sullane Catchment)

Site 4 was an upland eroding stream (FW1) site that had a 1.0 m water width widening locally to 1.5 m and had an average depth of 0.2 m. The river was bank heights were typically 1.0 m to 1.5 m high. The river had a sinuous profile with no evident historical modifications at the survey area. The channel was of high energy with boulder cascade areas with equal proportions of pool, riffle and glide. The bed was dominated by boulder and cobble. Pockets of coarse and medium gravels were present in pool and glide areas behind boulders. The stream gradient was high and similar to site 1. The riparian areas comprised of willow, bracken and bramble scrub with frequent fuchsia. The site was bordered by improved pasture (GA1; sheep grazing).

From a fisheries perspective the stream could be considered a moderate quality brown trout nursery given the smaller size and shallower depth. The stream however had a well-defined profile, with good sinuosity and riffle, glide and pool sequences. The substrata while dominated by boulder and cobble had good areas of mixed coarse and medium gravels for spawning. Consequentially, the river spawning was considered good. Holding habitat value was also locally good.

Site 5. Inchamore Stream (Sullane Catchment)

Site 5 was an upland eroding river (FW1) site that had a 4.0 m water width and an average depth of 0.3 m. The river had bank heights that were1.0 m to 1.5 m high. The river was historically straightened along the road with boulder armour present. However, the river exhibited excellent recovery with a good semi-natural profile with clean unbedded substrata. The channel was of moderate energy with exposed bedrock, large boulders and cobbles present but was not cascading as with upstream areas. Pockets of coarse and medium gravels were present in pool and glide areas behind boulders. The profile comprised of 30% shallow pool, 50% glide and 20% riffle. No macrophytes were present in the channel but *Fontinalis squamosa* moss was frequent on instream boulders. The stream gradient was significantly lower than upstream sites (i.e., Sites 1, 2 and 3) resulting in improved spawning potential. The riparian areas comprised of mature willow with bracken and bramble scrub.

From a fisheries perspective the river could be considered a good quality brown trout nursery given the larger size and good river profile with mixed pool, glide and riffle sequences. The river had good riparian cover that improved the holding value in deeper glide and shallow pool areas between boulder and bedrock. The river spawning was considered good with mixed unconsolidated gravels in pool areas behind bedrock and boulder.

Site 6. Inchamore Stream (Sullane Catchment)

Site 6 was an upland eroding river (FW1) site that had a 6.0 m water width and an average depth of 0.3 m but deepened to 0.8 m locally. The river had bank heights that were 1.0 m to 1.5 m high. The channel was of moderate energy with exposed bedrock, large boulders and cobbles present but was not cascading as with upstream areas. Pockets of coarse, medium and fine gravels were present in pool and glide areas behind boulders. The profile comprised of 30% pool, 50% glide and 20% riffle. No macrophytes were present apart from localised *Myriophyllum* species. The moss species *Fontinalis squamosa* was localised. The river gradient was significantly lower than upstream sites and was similar to site 5, meaning spawning potential improved. The riparian areas comprised of mature willow and gorse with scattered mature Sitka spruce. The banks were however more open immediately downstream of the bridge and the river was adjoined by improved pasture (GA1).

From a fisheries perspective the river could be considered a very good quality brown trout nursery given the larger size and good river profile with mixed pool, glide and riffle sequences. The spawning habitat was considered good given large pockets of coarse, medium and fine gravels in glide areas and also in pools. The nursery habitat was also very good given the presence of abundant shallow glide and riffle sequences. Holding habitat as with nursery habitat and spawning habitat was also very good. The combination of very good, nursery, spawning and holding habitat was reflected in the mixed cohort fish population recorded.

6.3.1.1 Freshwater Pearl Mussel Stage 1 Survey

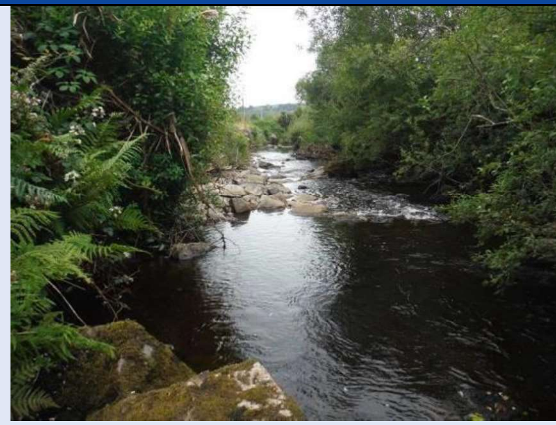
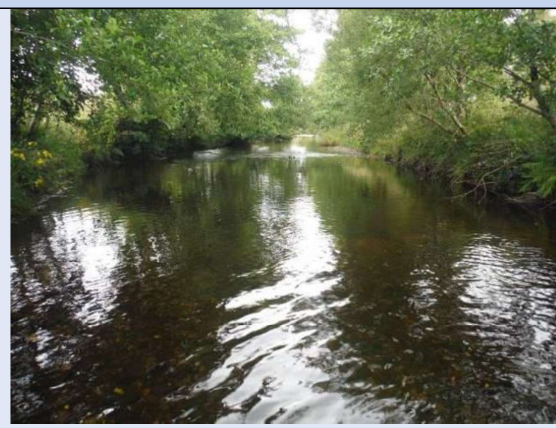
The known distribution of Freshwater Pearl Mussel (*Margaritifera margaritifera*) (FPM) in the catchment is shown in **Figure 6.2** based on records provided by the NPWS (2020). The nearest records of FPM to the wind farm site are on the River Sullane at Coolea approximately 6 km downstream of the Site.

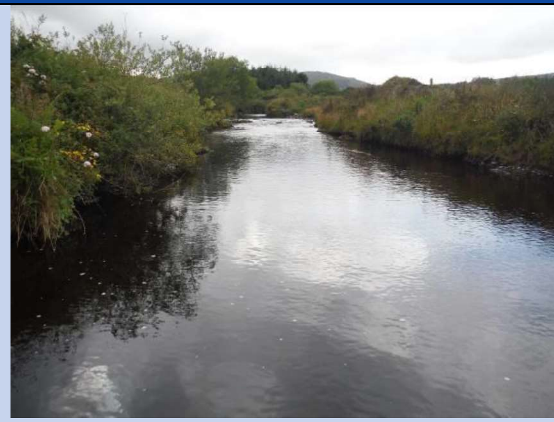
A total of eight locations (see **Figure 6.3**) were surveyed for FPM using a bathyscope wading in an upstream direction over a length of c. 200 m of river bed at each site. Each location was subject to an intensive search which included examination of shingle banks where they occurred for evidence of dead shells. The results of the survey are detailed in **Table 6.3** which presents an overview of each survey location including a description of the aquatic and riparian habitats, and a photograph showing a typical view of the survey area.

No evidence of freshwater pearl mussels was recorded from any of the transect locations surveyed for the Project with the exception of a single dead shell on the Sullane River at a point upstream of the Bardinch Confluence at Site 6, where anecdotal records of mussels having existed in the past were reported by a landowner. A section of the Sullane River c. 500 m downstream of Mahony's Bridge (not within the drainage catchment of the wind farm) was surveyed on the basis of this information though no live mussels were recorded despite the apparent suitability of the habitat.

Table 6.3: Summary results of Stage 1 Freshwater Pearl Mussel survey on watercourses draining the proposed Inchamore Wind Farm

Site number	Grid ref.	Description and Results	Overview Photograph
1	512016 577418	Inchamore Stream W=5-7 m. Cobble and gravel with occasional boulder. Series of mini-cascades and riffles with small pools. Banks open with wet heath and gorse scrub. Subject to spate flows. Accessed by cattle. No FPM recorded and conditions considered unsuitable.	
2	512775 577171	Inchamore Stream W=7-8 m. Boulder, cobble and gravel substrate. Small cascades and pools. Fontinalis abundant. Subject to spate flows. Banks open with rushy grassland and gorse scrub. Accessed by cattle. No FPM recorded and conditions considered unsuitable.	
3	513612 577141	Inchamore tributary W=1.5-2 m. Small boulders, cobble and gravel. Numerous small cascades. Banks steep and heavily tunnelled with overhanging vegetation including willow, gorse, bracken and ruderals. No FPM recorded and conditions considered unsuitable.	

Site number	Grid ref.	Description and Results	Overview Photograph
4	513741 576826	Inchamore Stream W=7-8 m. Small boulders, cobble and gravel, with occasional exposed bedrock. Pools, glides and occasional small cascade. Banks with boulder reinforcement along road, heavily vegetated with willow dominated scrub. No FPM recorded but conditions considered potentially suitable in pockets.	
5	513972 576138	Bardinch River W=10 m. Cobble and boulders with pockets of gravels. Layer of fine silt on substrate. Riffles with small cascades and occasional pools. Myriophyllum beds occasional. No FPM recorded but conditions considered potentially suitable.	
6	514901 575718	Sullane River W=12 m. Sands, gravels and occasional cobbles with silt layer. Pool and gentle glide. Ranunculus, Myriophyllum and Callitriche occasional. Banks tree-lined with adjacent grassland pasture. One dead mussel shell recovered. Potentially suitable habitat and anecdotal records from landowner of mussels present in the past.	

Site number	Grid ref.	Description and Results	Overview Photograph
7	514976 575894	Bardinch River W=20 m. Cobbles with pockets of gravel. Riffle and glide habitat, with evidence of channel being artificially straightened. Algae on substrate. Banks with low scrub fringe and adjacent improved pasture. No FPM recorded but potentially suitable habitat.	
8	516148 575963	Sullane River W=15-25 m. Boulder, cobbles and pockets of gravel / sands. Fontinalis and Ranunculus frequent. Series of cascades with large boulders transforming to deep pool conditions with soft substrates downstream. Banks with woodland cover, subject to active clearance on the east of the river downstream of Milleeny Bridge. No FPM recorded but potentially suitable habitat.	

6.3.1.2 Biotic Index (Q Value) Macro-invertebrate Assessment

Water quality was assessed using the Q Value biotic index system at the eight locations sampled for electro-fishing (see **Figure 6.1**) on each of the watercourses draining the Site The results are presented in **Table 6.4** which gives their Q Value and corresponding Water Framework Directive status (see **Table 6.1** above).

The most recent EPA data available for the Sullane River at Milleeny Bridge near Coolea (Site 8 of the FPM survey) is from 2017 when the river was given a Q4-5 equating to high quality. The river maintained its high quality status downstream as far as Macroom where a Q4 (good status) was recorded.

All watercourse sampled were in High status with good macroinvertebrate diversity and no evidence of algal cover or excessive macrophyte growth. The watercourses are all high energy reflecting the topography and high levels of rainfall within the catchments.

Table 6.4: Water Quality Assessment of Watercourses (Q Value and WFD Ecological Status)

Site No.	Q Value	WFD Ecological Status	Comments
1	4-5	High	1.5 m width, 0.1 m to 0.4 m depth, banks 1.0 m and 3.0 m. Riffle, glide and pool with boulder cascade reaches. Substrate boulder and cobble dominated with pockets of gravels. No macrophytes. Macroinvertebrate diversity good with abundant flattened mayfly, stonefly and cased cadis.
2	4-5	High	1.5 m to 2.0 m width, depth 0.1 m to 0.3 m, bank heights 1.5 m. High energy channel with dry boulder and cobble bars indicating higher winter flows, forming series of pools with riffle sections. Substrate boulder and cobble dominated with frequent pockets of gravels, and moderate silt deposition in pools. No macrophytes. Macroinvertebrate diversity good with abundant flattened mayfly, frequent stonefly, cased cadis and blackfly.
3	4-5	High	1.0 m width, depth 0.1 m to 0.2 m, bank height 2.0 m to 2.5 m. High energy channel with boulder cascade reaches and riffle, glide and pool sequence. Substrate boulder and cobble dominated with pockets of gravels. No macrophytes. Macroinvertebrate diversity high with abundant flattened mayfly, stonefly, cased cadis, beetle and blackfly.
4	4-5	High	1.0 – 1.5 m width, depth 0.2 m, bank heights 1.0 m to 1.5 m. High energy channel with boulder cascade and riffle, glide, pool sequence. Substrate dominated by boulder and cobble with pockets of gravels. No macrophytes. Macroinvertebrate diversity high with abundant flattened mayfly, stonefly and cased cadis.
5	4-5	High	4.0 m width, depth 0.3 m, bank heights 1.0 m to 1.5 m. Historically straightened channel adjacent road but with good semi-natural profile and riffle, glide, pool sequence. Substrate exposed bedrock, large boulders and cobbles with pockets of gravels. No macrophytes but frequent willow moss. Macroinvertebrate diversity high with abundant flattened mayfly, stonefly, cased cadis, blackfly and beetle larvae.
6	4-5	High	6.0 m width, depth 0.3 m to 0.8 m, bank heights 1.0 m to 1.5 m. Moderate energy channel with exposed bedrock, large boulders and cobbles, and pockets of gravels. Riffle, glide and pool sequence. Occasional water milfoil and willow moss. Macroinvertebrate diversity good with abundant flattened mayfly, frequent stonefly, cased cadis, water louse, beetle larvae and molluscs.

6.4 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS

A more in-depth discussion of water quality is provided in **Chapter 9: Hydrology and Hydrogeology**. The focus in this section is on the effects on aquatic species and ecology. Groundwater pathways are not considered an issue for the Development on account of the underlying geology (Devonian sandstones) and the area is mapped as low vulnerability by the EPA (EPA Maps).

6.4.1 The 'Do-Nothing' Impact

If the Development does not proceed, lands at and in the vicinity of the Site will continue to be used for forestry and agricultural purposes. This 'do-nothing' scenario would result in no significant change to aquatic ecology and habitats within or downstream of the Site subject to the continuation of current activities and practices.

6.4.2 Construction Phase Potential Effects

A full description of the Project is given in **Chapter 2: Project Description**. A summary of potential sources of direct impacts on aquatic ecology during the construction and decommissioning stage include:

- Clearance of vegetation, soil and rock for widening and construction of access roads, hardstand and turbine bases with associated impacts on the drainage network and site run-off on water quality within the watercourses onsite and downstream;
- Clear-fell of approximately 26.43 ha coniferous forestry mostly consisting of Sitka Spruce or Lodgepole Pine with potential effects of felling on water quality as a result of sediment and nutrient release;
- Crossing of watercourses within the proposed site and along the grid connection route;
- Placement and storage of material arising from infrastructure works;
- Access by construction equipment, including access away from the proposed infrastructure location (compaction and other damage);
- Potential for accidental spillage of hydrocarbons and other pollutants including concrete laitance;
- Potential of peat slippage or failure, and,
- Removal of infrastructure at decommissioning stage.

All construction activities have the potential to cause negative effects to receiving watercourses and aquatic species and habitats as a result of the release of suspended solids, concrete and hydrocarbons in run-off. The potential for increased silt loads could negatively impact on water quality, salmonid spawning habitat and Freshwater Pearl Mussel

(FPM) populations in the downstream reaches, with the scale of impact being proportionate to the scale and duration of siltation.

Wind Farm Site

The principal potential construction phase effects of the development relate to the release of sediments into the drainage network arising from all construction related site works including the access road network, turbine bases and associated hardstands, drainage network, sub-station building, borrow pits and repository areas, and the grid connection route. The Turbine Delivery Route will utilise the existing road network with no modifications of watercourses or potential impacts on any watercourses along its entire length. There is a minor risk of nutrient release as a result of the clear-fell of conifers (26.43 ha) required for the proposed development though this is of a minor scale in comparison to the normal forestry activities taking place at the Site due to the limited scale proposed. The most pertinent potential sources of impact on the aquatic environment are considered to be:

- The construction of three watercourse crossings within the site.
- Water quality degradation in surface and groundwater from siltation or other forms of pollutants associated with the construction phase including tree felling.

The three watercourse crossings on the proposed road network within the site are all on minor headwater streams which do not support fish stocks due to their elevation and gradients on downstream sections preventing access. All three watercourses will none-the-less be crossed with clear-span structures avoiding any requirements for channel modification or instream works. While the construction of these presents risks of sediment or other pollutants entering the watercourses and affecting water quality downstream, the structures themselves will not result in any significant loss of instream habitat or impede the movement of fish or other aquatic biota, including otter.

All turbine locations are located a minimum of 65 m from the nearest watercourse, while the borrow pit location is over 500 m from the nearest watercourse. No works will take place within a 65 m buffer zone of watercourses except for the three clear span watercourse crossings on the proposed access track network.

Grid Connection Route

The connection of the wind farm to the national electricity grid, will be via 38 kV underground cable connection to the existing Ballyvouskill 220 kV Substation. Approximately 15.7 km of the route will be located along the route of an existing forestry road which runs parallel to the Clydagh River and entails the crossing of numerous small tributaries of the river. The

Clydagh River is within the Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC.

For most of the watercourse crossings along the Grid Connection Route, as shown on planning drawings 05934-DR-201-210, there is sufficient depth over existing culverts to accommodate trenching of the cable within the road structure. This operation will result in no instream works and presents a low risk of generating suspended solids or other pollutants, which are readily controlled by mitigation. There are three water crossings along the Grid Connection Route which do not have sufficient depth of material on the existing culverts. To avoid instream works, these will be crossed by means of directional drilling technology. Details of the directional drilling procedure are outlined in **Chapter 2: Project Description** (**Section 2.9.5.2**). This methodology addresses the potential risks of siltation or other pollutants entering the watercourses during the construction phase.

There are in addition, a number of minor ditches running under the existing road, which are either dry or have minimal flows, that will be crossed by damming the ditch upstream and over-pumping (if necessary) during the trenching operation. Without mitigation, these crossings present a temporary minor risk of sediment release and of other pollutants entering the Clydagh River downstream. To mitigate this risk, the trenching and laying of the grid connection pipe at these open crossings will be undertaken as a single operation which will be completed in a number of days. These works will be confined to dry periods during the summer months.

Freshwater Pearl Mussel

The nearest records of Freshwater Pearl Mussel (FPM) to the wind farm site are on the River Sullane at Coolea approximately 6 km downstream of the site. While the population of FPM are not within a Special Area of Conservation, in view of their Annex II Listed status, their unfavourable conservation assessment (NPWS, 2013) and being listed as critically endangered in the Republic of Ireland (Moorkens 2006), they are considered of international importance.

FPM also occur on the River Flesk (the lower reaches of the Clydagh River) and are a qualifying interest for the Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC which extends to include the Clydagh River. The construction of the Grid Connection Route parallels the Clydagh River where it runs along an existing forestry track.

Fine sediment can affect adult FPM, as it interferes with filter feeding. It can also dramatically change the nature of a river bed where juveniles require water movement through gravel beds to obtain oxygen. Even short-term sedimentation is likely to kill all juveniles present (DAFM, 2018). In addition, nutrient-rich sediment may enter watercourses following felling, while the decomposition of harvest residue onsite can lead to the release of phosphorous for several years after harvesting.

Any impact on FPM as a result of construction phase activities is considered a medium term significant negative effect at the international scale. In view of the existing threats to water quality in the lower reaches of the Sullane River, effects on the FPM populations from siltation or other pollutants, may last longer than the impact-causing activity.

Salmonids

Salmonid species require very high levels of water quality in order to complete their life cycles. High levels of suspended solid concentrations in waterbodies can affect the feeding and health of individual species through increased turbidity (inhibiting respiration through gills) and increased siltation affecting composition of riverbed substrate (reducing fry survival) as well as affecting spawning beds. Suspended solids often hold nutrients such as phosphorus that can result in eutrophication and reduced oxygen levels, which can affect all life stages of Atlantic salmon. Aquatic invertebrate communities and aquatic macrophytes can also be affected by sediment loading which reduces both the biotic diversity and the food resource for fish populations through direct toxicity to fish and invertebrates, and also indirectly effecting top predators such as otter and kingfisher in downstream reaches through a reduction in prey availability.

Watercourse Crossings within the Wind Farm Site

Direct effects on watercourses within the wind farm site are limited to the crossing points of the road access network which will entail three separate watercourse crossings as shown in **Figure 6.4**. All watercourse crossings are on minor headwater streams at locations that are of limited fishery value on account of their small size and variable flow rates. Some also have potential barriers to fish movement in their lower reaches. The new proposed watercourse crossings have been designed on a bespoke basis in consultation with Inland Fisheries Ireland (IFI) (design calculations are presented in **Appendix 2.1** of the EIAR). The following approach and guidance were used in the sizing of the proposed watercourse crossings:

- Detailed mapping of drainage paths across the wind farm site has been undertaken; utilising topographical surveys, contour mapping and aerial photography.

- Hydrological assessments made using a number of methods including *Flood Estimation Handbook* (Statistical Analysis) and *Flood Studies Report* (FSR) where appropriate to determine the design flow.
- CIRIA *Culvert Design and Operation Guide* (C689).
- Inland Fisheries Ireland (2016) *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters*.
- In addition, where planning consent is received a Section 50 Application will be submitted to Office of Public Works (OPW) for approval prior to works commencing on site (required to ensure unimpeded conveyance and storage capacities of channels and floodplains). It should be noted that the Section 50 application will be based on the details proposed in this application, subject to compliance with any conditions relating to the permitted development.

Without appropriate design and construction methodologies, the crossings would result in a loss of aquatic habitat or interfere with the connectivity of the watercourses. In addition, the construction works for the crossings would have the potential to give rise to water quality effects which would extend downstream to stretches with higher fisheries value and supporting freshwater pearl mussel populations. Pollutants entering the watercourses could result in direct mortality of aquatic biota with the scale and extent dependant on the volumes and toxicity of the pollutant. The potential for release of sediment, fine concrete particles and the spillage of hydrocarbons is primarily associated with the construction of watercourse crossings due to the set-backs of other infrastructure from the watercourses. The potential impact of sediment release in the absence of mitigation is therefore considered **short term but significant negative at the local scale**.

The three water crossings within the wind farm site will be clear span structures (as shown on **Planning Drawing No. 6226-PL-WC1 to 6226-PL-WC3** with the following design criteria:

- The clear span design is a segmented precast arch or similar and will avoid disruption to the stream bed and banks, protecting fishery habitats.
- The crossing direction will be perpendicular to the stream direction, therefore minimising the length of stream affected.
- The crossing detailed design allows for the passage of out-of-bank flood flows within the clear span.
- The crossing locations have been informed by the hydrological analysis and identification of constraints to:
    - Ensure location in an area where bank slopes are shallow, thus reducing the potential for runoff to carry sediment into the watercourse.

  - Avoid locations with any incoming tributary streams.
- The structure shall include ledges or areas of undisturbed riverbank to allow for the free passage of otters.

The clear span design of the crossings will not affect instream aquatic habitat or interfere with the passage of fish or other aquatic fauna.

A number of existing minor drains along the existing Site Access Road network within the site will require upgrading to accommodate the increased width of the road. These are minor surface drains which are mainly dry and receive flows only following heavy rainfall events. However, due to their connectivity to the more important lower reaches in the catchment, appropriate mitigation measures as detailed in Section 6.5 below will be required during the track upgrade stage to avoid siltation or other pollutants entering the drainage network. The existing drainage network is shown on **Figure 9.2 (a) Surface Water Network Wind Farm.**

Invasive Alien Species

Machinery required for construction activities also poses a risk as a vector for the introduction and spread of invasive non-native species (e.g., Himalayan balsam, Japanese knotweed) to watercourses, which would have negative effects on aquatic ecology and riparian habitats. There are no records or evidence of any invasive plant species recorded from the Site or its surrounds.

Peat Slippage

The risk of peat failure or slippage occurring on the Site during the construction phase has been analysed by RSK Group as part of the hydrogeological assessment (**Chapter 9**). The depth of peat has informed the layout of the Site and all areas of deep peat have been avoided. The risk of peat failure is therefore considered to be very low to low due to the overall shallow nature of the peat deposits in the works zone.

Summary Assessment

In the absence of mitigation, potential impacts on the aquatic environment are classified as being **medium term significant negative** at the international scale on account of the sensitive freshwater pearl mussel populations in the downstream catchments and the value of the lower reaches of the watercourses for salmonids.

6.4.3 Operational Phase Potential Effects

There is potential for effects on watercourses within the wind farm site during the operational phase due to ongoing activities and maintenance of permanent site drainage. The risk to watercourses during the operational phase of the wind farm is considered slight and would primarily arise from the use of oils and lubricants for infrastructure maintenance either through accidental spillage or inappropriate disposal. These effects are already described for the construction phase of the development in **Section 6.4.2** above. Impacts on water quality and aquatic habitats occurring during the operational phase are not considered likely in view of the distance between the turbines and substation and watercourses (>65 m) and the measures detailed in Section 6.5.3 below. Site maintenance activities such as road repair and drainage network maintenance may give rise to a localised risk of sediment release, but again, this risk is considered to be very unlikely in view of the infrequency and limited scale of such operations.

Taking this into account, the potential for secondary effects on watercourses resulting from the unmitigated operational phase of the wind farm site is considered to be imperceptible. There will be no operational effects from the Grid Connection Route once the cable laying process is complete, though any repairs or maintenance would be required to adopt the same approach and mitigation as for the construction phase.

6.4.4 Decommissioning Phase Potential Effects

The decommissioning phase of the Site (as described in in **Chapter 2: Project Description**, Section 2.9 and the Decommissioning Plan, which is included as part of the CEMP in **Appendix 2.1**) poses a similar suite of potential risks with less likelihood of potential effects on the aquatic environment as the construction phase, though in view of the presence of the road network and associated infrastructure, the resultant scale of impact is considered to be much lower. In the absence of mitigation, the potential impact on the aquatic environment is considered to be a moderate short-term negative impact at the local scale.

6.5 MITIGATION MEASURES

6.5.1 Embedded Mitigation

The entire development proposal incorporates embedded mitigation aimed at minimising the potential impacts during the design phase. This includes the design principle of maintaining set-backs of 65 m for turbines and associated infrastructure from watercourses and utilising existing forestry access tracks, rather than constructing new tracks, where feasible.

6.5.2 Construction Phase Mitigation

6.5.2.1 Mitigation by Avoidance

The greatest risk of negative impacts on the aquatic environment will occur during the construction phase of the development. Key to minimising this risk has been the siting of all works, including turbine locations and other key infrastructure at a minimum set-back from watercourses (65 m). In designing the layout of the access roads, careful consideration has been given to minimise the numbers of watercourse crossings and in choosing locations where crossing design can readily achieve the objective of maintaining the potential for unimpeded fish pass and ecological connectivity. The layout (as assessed in **Chapter 9: Hydrology and Hydrogeology**) has also avoided any interference with existing hydrology on the Site and along the proposed Grid Connection Route and Turbine Delivery Route, and maintains surface water flow networks through the use of cross drains on access roads.

6.5.2.2 Mitigation by Design

A comprehensive suite of drainage measures has been developed to protect all receiving waters from potential impacts during the construction of the development in the catchment of the Site and along the proposed Grid Connection Route and Turbine Delivery Route, and are outlined in full in **Chapter 9: Hydrology and Hydrogeology**. These measures are aimed at preventing sediments or other pollutants from entering watercourses through the containment and treatment of all surface water run-off from areas of works and the diversion of upstream flows away from works areas. An Ecological Clerk of Works (ECoW) will be appointed to ensure compliance during the construction stage with all mitigation measures and legislative requirements related to aquatic ecology.

The mitigation measures have been incorporated into a Construction and Environmental Management Plant (CEMP) (**Appendix 2.1**) for the Development which includes Construction Method Statements for key works. The CEMP includes a Surface Water Management Plan (SWMP), a Water Quality Management Plan (WQMP), a Waste Management Plan (WMP), a Peat and Spoil Management Plan (PSMP) and an Emergency Response Plan (ERP). The CEMP and associated plans will require mandatory adherence by all parties involved in the construction of the Development (including any sub-contractors) in order to protect aquatic conservation interests within the study area. The development of the mitigation measures and all method statements for watercourse crossings follows all relevant guidance and current best practice as detailed in:

- CIRIA (2001). Control of water pollution from construction sites - Guidance for consultants and contractors (C532). 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.
- IWEA (2012). Best Practice Guidelines for the Irish Wind Energy Industry. Guidance prepared by Fehily Timoney & 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. Southern Regional Fisheries Board.
- Murphy, D.F. (2004). Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites. Eastern Regional Fisheries Board.
- NRA (2008). Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes. National Roads Authority.
- SNH (2019). Good Practice during Wind Farm Construction (4th edition). Scottish Natural Heritage.

The use of Sustainable Drainage Systems (SuDS) on site will eliminate risk to watercourses from sedimentation during the construction, operational and decommissioning phases of the proposed development. SuDS adopts the following design principles to drainage:

Minimise → Intercept → Treat → Disperse → Dilute

All surface water management measures will be put in place concurrently during the development of the road network. The measures entail the following key elements which are described in detail within the Surface Water Management Plan:

- Open Constructed drains for development run-off collection and treatment;
- Collection Drains for upslope "clean" water collection and dispersion;
- Filtration Check Dams to reduce velocities along sections of road which run perpendicular to contours;
- Settlement Ponds, Settlement Lagoons and Buffered Outfalls to control and store development runoff to encourage settlement prior to discharge at Greenfield runoff rates as illustrated on planning drawings 6226-PL-100-108.

There will be no direct site run-off to watercourses during the construction phase with all outflows from drainage via settlement ponds from which treated surface water is released by diffuse overland flow at appropriate locations. To reduce the amount of silt laden water to be treated, clean water drains will be created upstream of the works area to divert water away from construction areas, thereby lessening the volume of water to be treated onsite.

De-watering of excavations where required, will be through filtered 'silt socks' / dewatering bags or a 'Siltbuster' or similar system, prior to discharge. Excavations will be kept to the absolute minimum for the specific task and undertaken on a 'just in time' basis to minimise the extent of silty water generated and requiring treatment prior to discharge.

The three watercourse crossings along the access road network are all designed as clear span structures with abutments set back from the river banks to avoid any modification to the stream channel in accordance with the requirements of IFI. The method statements prepared for the construction of the bridges and associated works in Section 4 of the WQMP (Appendix 2.1) detail the sequencing of works required to avoid the risk of silt or other pollutants entering the watercourses. The construction of the watercourse crossings will be undertaken during the period 1st July to 30th September as required by IFI Guidance (2016) to avoid accidental damage or siltation of spawning beds, unless otherwise specified by IFI during consultations in advance of works. There will be no instream works undertaken and no tracking of machinery across any watercourse. Temporary crossings will be undertaken by Bailey bridge (a type of portable, pre-fabricated, truss bridge) or similar if required. All machinery will stay within designated routes (working corridor) within the development Site Boundary for the windfarm and Grid Connection Route. This will include preparatory work in the vicinity of all watercourses and all river bank works. All bank-sides in the vicinity of the new crossings will be fully reinstated with vegetation cover as quickly as possible using only native species appropriate to the existing environment.

The directional drilling of the three watercourses on the grid connection route will be undertaken by either Horizontal Directional Drilling (HDD) or Auger Bore method in accordance with the method statements provided in **Appendix 2.3: Grid Connection Route Details**. These methods detail the potential risks of pollutants or contaminants arising during the works and provide specific measures to neutralise the risks.

A Slope Stability Risk Assessment was carried out and indicates that the risk of significant mass movement of soils or landslides occurring is Very Low to Low within the footprint of the Development. However, an assessment of the peat quality indicates that there remains the potential for peat stability issues to arise at a localised scale, for example, point locations associated with deeper peat and/or steeper inclines and/or close proximity to sensitive receptors. In accordance with the requirements of IFI, the CEMP contains a contingency plan to deal with the scenario of a peat movement occurring on the Site which includes measures to control silt in such a scenario, and measures to be put in place at the initial stages of construction to off-set this risk. Specific measures are detailed in **Chapter 9: Hydrogeology and Hydrology** (**Section 9.5.2.10 Emergency Response**) to be implemented in the unlikely eventuality a peat failure or some other form of failure or over-loading of the drainage and attenuation design.

6.5.2.3 Mitigation by Reduction

The specified measures detailed below are aimed at protection of instream aquatic biota within the vicinity of any proposed works at watercourses effected by the Development of the windfarm site and Grid Connection Route but equally with regards to the protection of the downstream population of Freshwater pearl mussel and salmonids. No mitigation is required for the Turbine Delivery Route. These measures are a summary of the principal requirements with full detail being presented in **Chapter 9: Hydrogeology and Hydrology**, which are transposed into the Construction Environmental Management Plan (see **Appendix 2.1: CEMP**).

- During the construction phase the appointed Contractor(s) will ensure that the following mitigation is adhered to in line with IFI (2016) Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters:
- No works will take place within the 65 m buffer zone of watercourses except for the clear span bridges, road development and drainage measures as detailed.
- Site compounds and Soil storage areas will be located at a minimum distance of 65 m from any watercourse. All drainage from these facilities will be directed through a settlement pond with appropriate capacity and measures to provide spill containment.
- All site drainage, as described in the surface water management plan and shown on associated drawings, will be directed through either sediment traps, settlement ponds and / or buffered drainage outfalls to ensure that total suspended solid levels in all waters discharging to any watercourse will not exceed 25 mg/L (IFI, 2016). All construction site run-off will be channelled through a stilling process to allow suspended solids to settle out and through a spill-containment facility prior to discharge. Discharge outside of surface water buffer zones will be by buffered outfall to vegetated areas. Within the surface water buffer zones, discharges will be directed through the use of stilling ponds, in line check dams and provided with erosion control to the receiving drain or surface water feature. No discharges will occur in areas identified as high-risk landslide areas.
- Daily monitoring of all sediment traps and settlement ponds will be undertaken by the Environmental Manager or Ecological Clerk of Works to ensure satisfactory operation

and/or maintenance requirements. A full specification for the water quality monitoring is presented in the WQMP (provided as part of **Appendix 2.1**).

- The storage of oils, hydraulic fluids, etc., will be undertaken in accordance with current best practice for oil storage (Enterprise Ireland, BPGCS005).
- All machinery operating on the windfarm site and on the Grid Connection Route will be fully maintained and routinely checked to ensure no leakage of oils or lubricants occurs. All fuelling of machinery will be undertaken at a discrete "fuel station" within the temporary site compound and will be designated for the purpose of safe fuel storage and fuel transfer to vehicles.
- Any extensions to existing drainage culverts on the site roads will be undertaken in dry conditions and in low flow conditions on drains that do not run dry.
- The pouring of concrete, sealing of joints, application of water-proofing paint or protective systems, curing agents, etc., will be completed in the dry to avoid pollution of the freshwater environment (see **Chapter 9** for further details). There will be no batching or storage of cement allowed in the vicinity of any watercourse crossing construction area.
- Procedures (as detailed in **Chapter 9**) will be put in place to ensure the full control of raw or uncured waste concrete to ensure that watercourses will not be impacted.
- Should there be any incidents of pollution to watercourses, immediate steps as specified in the Emergency Response Plan (CEMP-Management Plan 1) will be undertaken to resolve the cause of the pollution and where feasible, mitigate against the impact of pollution.
- Re-seeding / re-vegetation of all areas of bare ground or the placement of Geo-jute (or similar) matting will take place prior to the start of the operational phase to prevent silt-laden run-off. The seed mix will contain only suitable native species of plant.
- Silt traps erected during the construction phase within roadside and artificial drainage will be replaced with stone check dams for the lifetime of the project. These stone check dams will only be placed within artificial drainage systems such as roadside drains and not in natural streams or drainage lines.

A full review of construction stage temporary drainage will be undertaken by the Developer (in conjunction with the Project Hydrologist/ Site Engineer and the Project Ecologist) following the completion of construction.

6.5.3 Operational Phase Mitigation

The following measures will be implemented during the operational phase to ensure the ongoing protection of watercourses and water quality at the Site and in downstream reaches:

- The temporary Site compound / office will house all potential pollutants within a secure bunded COSSH store for the operational phase of the project.

6.5.4 Decommissioning Phase Mitigation

Decommissioning will be scheduled to take place after the proposed 35-year lifespan of the Project. Decommissioning phase impacts for the Project are likely to be broadly similar to construction phase impacts, in terms of potential surface water quality impacts from ground disturbance, refuelling and the storage of potentially hazardous materials onsite. The implementation of all mitigation measures detailed for the construction phase will be adopted in full during the decommissioning phase to ensure all such impacts are avoided. A Decommissioning Plan has been included in **Appendix 2.1**.

When the final Decommissioning Plan is prepared prior to decommissioning, all drainage management measures, which will include maintenance of the operational drainage measures, will be included in that document. However, it should be noted that by the time decommissioning is undertaken after the planned 35-year lifespan of the Development, the areas within the Site will have revegetated resulting in a resumption of the natural drainage management that will have existed prior to any construction. It is not anticipated that the decommissioning phase will interrupt this restored drainage regime in any way with the works proposed. As a minimum measure, areas where freshly placed soil is placed as part of turbine foundation reinstatement work will be surrounded by silt fencing if deemed necessary until the area has naturally revegetated.

Restoration of the Site following decommissioning of infrastructure will require the prior establishment of the new baseline conditions at the site which will have developed over the intervening 35 years life of the Project. These studies will inform any modification or additional sensitivities that may need to be factored in restoration and site-specific measures.

6.6 RESIDUAL EFFECTS OF THE DEVELOPMENT

The three watercourse crossings along the site access road network are clear-span structures which will require no channel modification and result in no loss of instream habitat. The design of the crossings will ensure no impediment to movement of fish or other aquatic biota.

The approach to the development design, the use of SuDS drainage and the suite of comprehensive measures to avoid, reduce or remedy all potential impacts on water quality will ensure that the receiving water bodies in the catchment of the development do not suffer any deterioration in water quality, either during construction, operation, or decommissioning. The populations of Freshwater Pearl Mussel in the lower catchments of the Development and along the Grid Connection Route will not be negatively affected by the Project.

There is expected to be no negative residual impact on any aquatic species, habitat or on water quality at a local or catchment level as a result of the Development.

6.7 MONITORING

In order to verify the efficacy of pollution prevention and mitigation works during construction, Water Quality Monitoring will be undertaken prior to, during and post completion of construction works in accordance with the parameters and schedules as set out in the in the **Chapter 9: Hydrogeology and Hydrology** and in the **Water Quality Management Plan (Appendix 2.1 CEMP, Management Plan 2)**. Monitoring will be undertaken in all watercourses within the catchment of the construction area. During both the construction and operational phases of the project watercourse crossings will be monitored frequently (daily during construction and intermittently during operational phase i.e., weekly / monthly inspections initially and reduced gradually in line with observed stability and confidence in longer term data obtained. The water course crossings will be monitored in terms of structural integrity and in terms of their impact on respective watercourses.

Site water runoff quality at all surface water monitoring locations will be monitored on a continuous basis during the construction phase of the Project. Monitoring will continue into the operational phase until such time that the Site and water quality have stabilised (stable conditions in line with baseline conditions for e.g., eight (8 No.) consecutive quarterly monitoring events). This monitoring will be carried out at the downstream surface water baseline sampling location (**Appendix 9.6**)

Continuous monitoring systems will be in place, particularly in principal surface water features draining the site using telemetric turbidity monitoring sensors.

Monitoring will be overseen by an independent Environmental Consultant and undertaken by the Environmental Manager or by the Ecological Clerk of Works qualified and experienced on the required monitoring methods and the use, calibration and maintenance of all monitoring equipment used).

Baseline monitoring undertaken at the Site as part of this study will be repeated periodically i.e., before, during and after construction phase, to measure any deviations from baseline hydrochemistry that occur at the Site, including discharge rates. The construction monitoring programme for the Inchamore site will include the following:

- During the construction phase daily inspection of silt traps, settlement ponds, buffered outfalls and drainage channels will be undertaken. Routine measurement of total suspended solids, electrical conductivity, pH and water temperature at selected water monitoring locations at the Site will be carried out. Monitoring of locations where excavations are being dewatered (likely high in solids) will be done in real time.
- During the construction phase of the Project, the Development areas will be monitored daily for evidence of groundwater seepage, water ponding and wetting of previously dry spots, and visual monitoring of the effectiveness of the constructed drainage and attenuation system so that it does not become blocked, eroded or damaged during the construction process.

6.7.1 Post-construction phase monitoring

On completion of the construction phase, post construction monitoring will be agreed with Cork County Council and undertaken using the suite of parameters as detailed in the WQMP which is included as part of **Appendix 2.1**. During the operational phase and post decommissioning of the project, the stilling ponds and buffered outfalls will be periodically inspected during maintenance visits to the Site.

6.8 SUMMARY OF SIGNIFICANT EFFECTS

The Development will entail the crossing of three small watercourses along the access track network. The watercourses are all minor headwater tributaries with limited fisheries value, though the downstream catchments are of significant value for salmonids as well as supporting populations of the Annex II listed Freshwater Pearl Mussel. All watercourses will be crossed by clear-span structures with the abutments set back from the river banks, ensuring no impediment to movement of fish or other aquatic biota. These and other construction works however, present a risk of impacting on water quality within the streams with potential for impacts extending downstream to affect salmonid and Freshwater Pearl Mussel populations. An extensive suite of mitigation measures is prescribed through all phases of the Project to prevent deterioration of surface waters within and downstream of the Site. The mitigation will ensure there are no significant effects on water quality within any receiving waters and on their associated biota.

The construction of the Grid Connection Route parallels the Clydagh River where it runs along an existing forestry track. The Clydagh also supports a population of Freshwater pearl mussel as well as being an important salmonid river. There are numerous feeder tributaries crossed by existing culverts along the track, the majority of which have sufficient depth of over-lying material to accommodate the burying of the Grid Connection Route across the culvert.

There are three watercourses which do not have culverts and these will be directionally drilled thereby minimising risks of silt or other pollutants entering the watercourse, with all frack arising from the drilling contained and disposed of appropriately. A small number of un-culverted drains will be crossed by open-cut but these do not support perennial flows and the works will be undertaken in the dry to avoid siltation. Subject to the adoption of the prescribed measures in **Section 6.5** above, the laying of the grid connection does not pose a risk of giving rise to any effects on water quality within the Clydagh River.

The mitigation measures as described in this chapter and within the CEMP and WQMP are aimed at avoiding any deterioration in water quality during the construction phase. Subject to their successful implementation, there is considered to be no significant risk of a deterioration in water quality in any receiving waters associated with the Development.

The operational phase of the Development is considered not to present any significant risk of affecting water quality within the catchment. Decommissioning will be scheduled to take place after the proposed 35 year lifespan of the Project. Decommissioning phase impacts are likely to be broadly similar to construction phase impacts and the implementation of all mitigation measures detailed for the construction phase will be adopted in full during the decommissioning phase to ensure all such impacts are avoided.

6.9 STATEMENT OF SIGNIFICANCE

It is considered that with the proposed mitigation successfully implemented, the Development will result in an overall negligible to low significance residual impact upon the aquatic ecological features that lie within the Zone of Influence.

7 ORNITHOLOGY

7.1 INTRODUCTION

This Chapter considers the potential effects of the Project (see **Figure 1.2 in Chapter 1: Introduction**) on ornithology. It details the methods used to establish the bird species and populations present, together with the process used to determine their Nature Conservation Importance. The ways in which birds might be affected (directly or indirectly) by the construction, operation and decommissioning of the Project are explained and an assessment is made with regards the significance of these effects.

The Development refers to all elements of the application for the construction of Inchamore Wind Farm (**Chapter 2: Project Description**). Where negative effects are predicted, the chapter identifies appropriate mitigation strategies therein. The assessment considers the potential effects during the following phases of the Development:

- Construction of the Project
- Operation of the Project
- Decommissioning of the Project

Common acronyms used throughout this EIAR can be found in **Appendix 1.2**. This chapter of the EIAR is supported by Figures provided in Volume III and by the following Appendix documents provided in Volume IV of this EIAR:

- **APPENDIX 7.1 -** VP Summer 2017 - Survey Details
- **APPENDIX 7.2 -** VP Winter 2017/2018 - Survey Details
- **APPENDIX 7.3 -** Bird Survey VP Flight Line Data, 2017-2018
- **APPENDIX 7.4 -** VP Summer 2018 - Survey Details
- **APPENDIX 7.5 -** VP Winter 2018/2019 - Survey Details
- **APPENDIX 7.6 -** Bird Survey VP Flight Line Data, 2018-2019
- **APPENDIX 7.7 -** Additional Bird Survey Data, 2018 - 2019
- **APPENDIX 7.8 -** VP Summer 2020 - Survey Details
- **APPENDIX 7.9 -** VP Winter 2020/21 - Survey Details
- **APPENDIX 7.10 –** Bird Survey VP Flight Line Data, Summer 2020 & Winter 20/21
- **APPENDIX 7.11 -** Hinterland Survey Data, 2020 / 2021
- **APPENDIX 7.12 -** VP Summer 2021 - Survey Details
- **APPENDIX 7.13 –** Bird Survey VP Flight Line Data, Summer 2021
- **APPENDIX 7.14 -** Hinterland Survey Data, Summer 2021

- **APPENDIX 7.15 -** List of Birds recorded within Inchamore site during Surveys 2017-2021
- **APPENDIX 7.16 –** Vantage Point Flight Line Maps for Surveys 2017 - 2021
- **APPENDIX 7.17 –** Collision Risk Modelling Report
- **APPENDIX 7.18 –** First Year Ornithological Surveys – Inchamore/Gortyrahilly Wind Farm Summer 2017 and Winter 2017 / 18. Prepared by Fehily Timoney & Company
- **APPENDIX 7.19 –** Second Year of Ornithological Surveys – Inchamore/Gortyrahilly Wind Farm Summer 2018 and Winter 2018 / 19. Prepared by Fehily Timoney & Company
- **APPENDIX 7.20 –** Baseline Ornithological Surveys – Inchamore Wind Farm Summer 2020 and Winter 2020/21. Prepared by Fehily Timoney & Company

A Construction and Environmental Management Plan (CEMP) is appended to the EIAR in **Appendix 2.1**. The CEMP includes an emergency spillage plan, a peat and spoil management plan, a surface water management plan, a traffic management plan and a waste management plan. The CEMP includes all of the construction phase mitigation proposed within the EIAR. A summary of the mitigation measures is included in **Appendix 17.1**.

7.1.1 Site Description

The Site is situated on the border of Counties Cork and Kerry and is approximately 5.9 km west of Ballyvourney. It is located within the Derrynasaggart Mountains and situated within a landscape dominated by agricultural land (mainly used for stock grazing), commercial forestry and bog and heath of varying quality.

The altitude of the site ranges from approximately 300 m to 460 m AOD, with the local peak of Knockbwee at 461 m AOD. The primary soil type across the site is blanket peat, with some outcropping bedrock. The topography of the site varies, ranging from mostly gently to occasional steep inclinations. The Site is located within the Lee, Cork Harbour and Youghal Bay catchment. The site lies entirely within the Inchamore Stream sub-catchment. The natural streams within the Site are small 1st order tributaries which have high gradients and do not provide suitable habitat for fish or larger aquatic organisms.

The Grid Connection Route runs in an east to north-easterly direction from the Inchamore site to the existing Ballyvouskill 220kV substation (see **Figure 1.2 in Chapter 1: Introduction**).

Ecologically, the Site can be described as being dominated by conifer plantation (WD4 of Fossitt 2000). The unplanted area of the site is mostly wet heath (HH3), with areas of upland blanket bog (PB2) and cutover bog (PB4). Other habitats represented within the Site are dry siliceous heath (HH1), exposed siliceous rock (ER1) and eroding/upland rivers (FW1). The grid connection route is almost entirely along forest tracks.

A full description of the Habitats, Flora and Fauna associated with the project site is presented in **Chapter 5: Biodiversity**.

7.1.2 Details of the Project

Permission is being sought by the Developer for the construction of 5 No. Wind Turbines, an on-site substation and all ancillary works and works along the turbine delivery route. Details of the Project are given in **Chapter 2: Project Description**.

7.1.3 Purpose of this Chapter

- To describe the baseline data collection and assessment methods used;
- To summarise the baseline ecological conditions;
- To identify and describe all potentially significant ecological effects associated with the proposed development;
- To set out the design, mitigation and compensation measures required to ensure compliance with nature conservation legislation and to address any potentially significant ecological effects;
- To identify how mitigation measures will be delivered;
- To provide an assessment of the significance of any residual effects in relation to the effects on biodiversity and the legal and policy implications;
- To identify appropriate enhancement measures and how these will be delivered; and
- To set out the requirements for post-construction monitoring.

7.1.4 Project Team

The chapter has been prepared by Dr Brian Madden of BioSphere Environmental Services. The baseline ornithology surveys between 2017 and 2020 were carried out by Fehily Timoney ecologists. Baseline surveys in April and May 2021 were carried out by BioSphere Environmental Services.

Brian Madden BA (Mod.), Ph.D, MCIEEM graduated in Natural Sciences from the University of Dublin in 1984 and earned a Ph.D. degree in 1990 from the National University of Ireland for his research on ecosystem processes in raised bogs. Since then, he has carried out botanical surveys and habitat assessments for most terrestrial habitats which occur on the island of Ireland. Brian is an experienced ornithologist, with particular interests in birds of prey and wetland birds. Brian is the principal ecologist with BioSphere Environmental

Services. The consultancy specialises in energy related developments, including wind farms, solar farms, overhead power lines and substations.

Joe Adamson B.Sc., M.Sc., MCIEEM is a consultant senior ornithologist with BioSphere Environmental Services. He is highly experienced, having worked in the field of ornithology and ecology since 1988 and has extensive knowledge of Irish birds and their habitats. Joe has been involved in baseline bird surveys on the Bord na Móna cutaway bogs since 2014 and carries out winter and summer bird surveys. Joe carried out baseline ornithological surveys for the project.

Aidan Duggan has more than 30 years of bird surveying experience in Ireland and abroad and is an active member of the Cork branch of Birdwatch Ireland. Aidan has worked on a variety of projects throughout Ireland and is proficient in Vantage Point surveys, Transect Surveys, Hinterland surveys, merlin surveys and red grouse surveys. Clients include Fehily Timoney & Co. Consultants, BioSphere Environmental Services, and Kelleher Ecology Services. Aidan carried out baseline ornithological surveys for the project.

7.2 METHODS

7.2.1 Study area

The principal study area was the actual Redline boundary for the site of the Development. However, this extended to a distance of approximately 10 km from the Site Boundary for the hinterland surveys.

The study area for the assessment of collision risk is the 'flight activity survey area' or 'FASA' which refers to a polygon around the outermost turbines plus an additional 500 m strip around that polygon.

The study area also included the route for the underground grid connection cable though site surveys were not carried out along this route.

7.2.2 Field Surveys

Baseline field surveys reported here were carried out between April 2017 and June 2021. A detailed methodology for all surveys is provided in **Appendices 7.18 & 7.19 and** is briefly summarised here. The surveys carried out comprised the following:

- Flight Activity (Vantage Point) Surveys
- Breeding Moorland/Wader Survey;
- Breeding & Winter Bird Transect Survey;

- Hinterland Survey;
- Merlin Survey
- Red grouse Survey

Flight activity (vantage point) surveys

Flight activity surveys were carried out by Fehily Timoney & Company over a 24-month period from April 2017 to March 2019 following the methods described in NatureScot 2017 Guidelines (formerly SNH). Further Vantage Point surveys were carried out at the proposed Development site during the period May 2020 to May 2021.

The locations of the vantage points used (no. 3) are given in **Table 7.1**, with the locations and viewsheds shown in **Figure 7.1.**

Table 7.1: Grid References for VP locations used at the proposed Inchamore Wind Farm

Vantage Point	Location (ITM)
VP1	512600 578973
VP2	512393 578592
VP3	514385 579799

The main purposes of vantage point survey watches are to collect data on *target species* that will enable estimates to be made of:

a. The time spent flying over the defined survey area;
b. The relative use of different parts of the defined survey area; and
c. The proportion of flying time spent within the upper and lower height limits as determined by the rotor diameter and rotor hub height.

In line with recommended best practice (Scottish Natural Heritage 2017, Band *et al*. 2007), viewshed analysis was undertaken using ARCMAP 10.3, to calculate a theoretical zone of visibility from each vantage point.

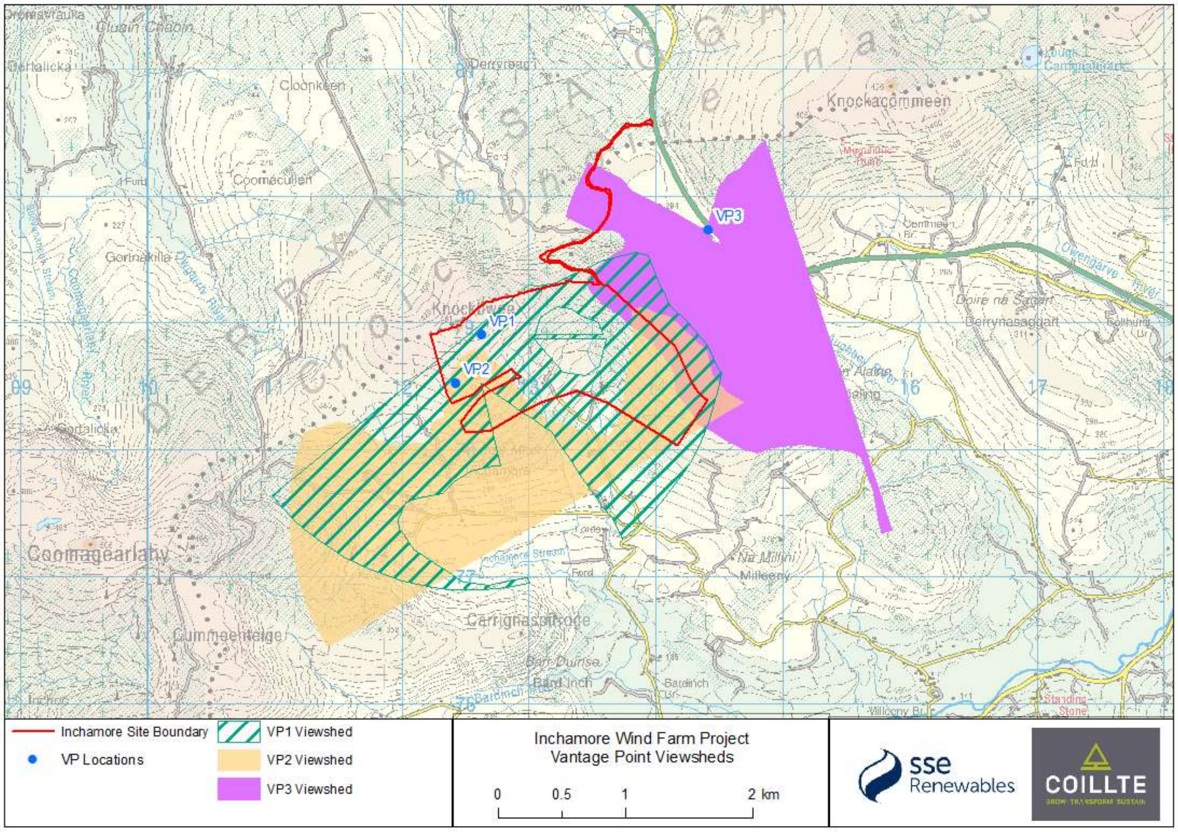


Figure 7.1: Locations of Vantage Points and associated viewsheds.

Following Scottish Natural Heritage guidance, watches were conducted to sample diurnal, crepuscular and nocturnal activity of target species. The method of observing was via constant search effort mostly through binoculars and/or a telescope. Data recorded included flight activity of target species (flight height, duration, directionality) in addition to metrics such as flock size and time of observation. Flight activity was annotated onto field maps.

As per Scottish Natural Heritage guidance (2017) thirty-six hours of vantage point effort was carried out at each vantage point during each winter period and each breeding period from April 2017 to March 2019 inclusive. The watches comprised 2 x 3 hour sessions at each VP every month. The proportion of survey time that activity was recorded inside and outside (up to 2 km) the Site Boundary was used as part of the overall analysis and assessment of target species usage of the study area. Surveys were conducted during suitable weather conditions and a proportion of surveys spanned dawn and dusk periods.

Breeding Wader Surveys

Survey transects to assess the presence of moorland breeding bird species, and especially waders, were completed in 2017 (May-July), 2018 (May-June) and 2021 (April-May). Breeding birds were surveyed using methodology of the breeding wader survey and breeding moorland survey, following Bibby *et al.* (2000) and Gilbert *et al.* (1998). A series of transects were carried out from east to west within the open bog habitats of the site and adjoining area (see **Figure 7.2**).

All species encountered (seen or heard) on the transect were recorded and their abundance noted. Survey details are given in **Appendices 7.18 & 7.19**.

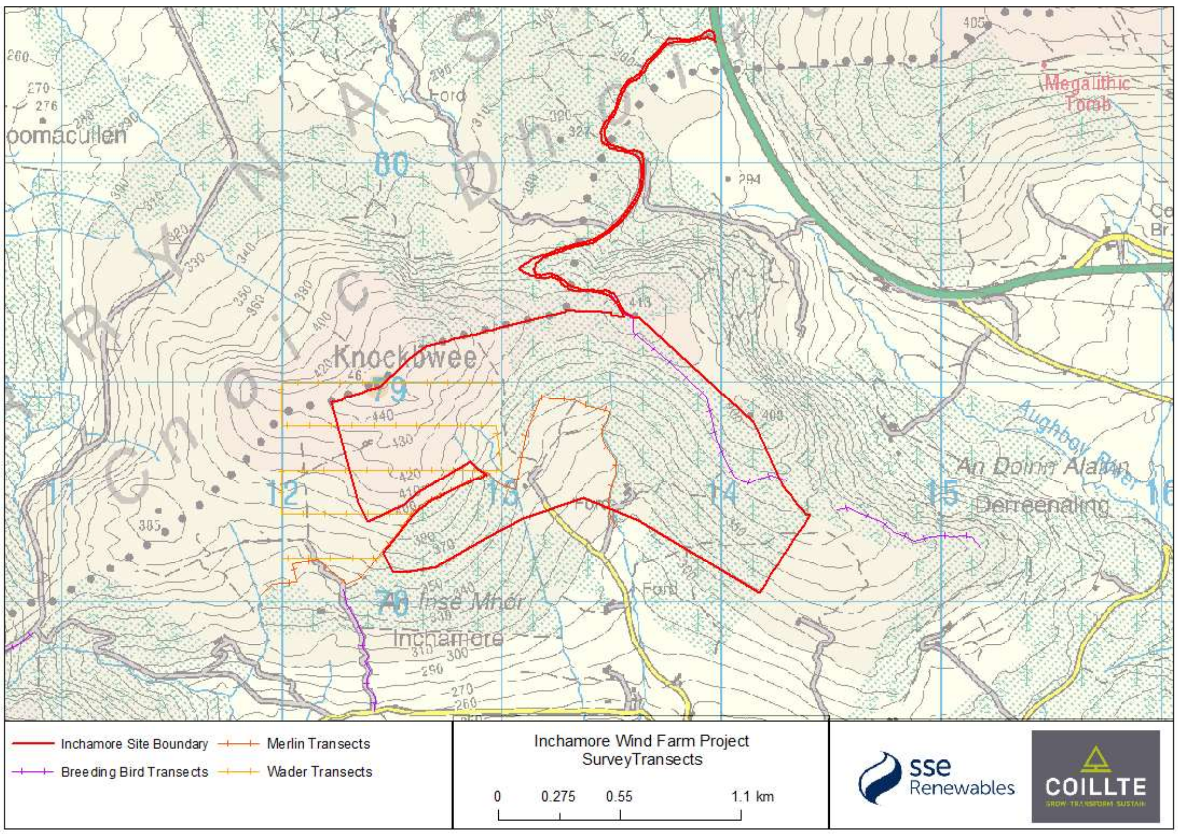


Figure 7.2: Locations of breeding bird, wader and merlin transects.

Hinterland Surveys

Hinterland surveys were undertaken to establish populations of target species that could potentially cross the Site of the proposed wind farm whilst moving to and from roosting and feeding grounds. Target species included raptors, waders, geese, swans and wildfowl. Survey methodology followed that of Bibby *et al.* (2000). Surveys were carried out in suitable wetland habitats over a distance of approximately 10 km radius from the Site.

Surveys were carried out from October 2017 to March 2019 and from May 2020 to May 2021. The sites surveyed are listed below, with locations of sites shown in **Figure 7.3.**

- Lough Nabuddoga
- Inchigeelagh
- Grousemount
- Gearagh
- Lough Allua
- Sillahertane Windfarm entrance
- Lee Valley
- Ballyvourney North
- Ballyvourney South
- Gortyrahilly
- Gougane Barra
- Kilgarvan North
- Roughty River
- Toon Valley/Killeens

Hinterland I-WeBS style surveys were carried out following a 'look-see' methodology as outlined in BirdWatch Ireland/NPWS's counter manual[1]. Full details of the surveys are given in **Appendices 7.18 & 7.19.**

Breeding and Wintering Bird Transect Surveys

Breeding bird transect surveys were carried out in 2017, 2018 and 2020. The method utilised was based on the British Trust for Ornithology Breeding Bird Survey (Bibby *et al.*, 2000). A total of 3 no. c. 1 kilometre transects were selected and centred on different habitats present within the subject site or in adjoining areas (within 500 m of site Redline boundary) (see **Figure 7.2**). Birds were counted over two visits, each timed to coincide with the early part of the breeding season (April to mid-May) and later part of the season (mid-May to late June) with visits at least four weeks apart. Surveyors recorded all birds seen or heard as they walked methodically along the transect routes. Birds were noted in four distance categories, measured at right angles to the transect line (within 25 m, between 25m-100m and over 100m from the transect line) and those seen in flight only. Recording birds in distance bands gives a measure of bird detectability and allows relative population

[1] https://birdwatchireland.ie/app/uploads/2019/03/IWeBS-Counter-Manual.pdf. Accessed 26/06/2021.

*Location approximate – hen harrier roost counts conducted at numerous points in vicinity – locations withheld due to sensitivity.

densities to be estimated if required (BTO, 2018). Full details of the breeding bird transect surveys are presented in **Appendices 7.18, 7.19 & 7.20**.

The winter transect survey followed the same routes as the breeding surveys, with details given in **Appendices 7.18, 7.19 & 7.20.**

Merlin Survey

Merlin *Falco columbarius* surveys were carried out in order to assess the presence of the species within the proposed development site. Survey methods followed Gilbert *et al.* (1998), with use of transects. Four visits of potential merlin habitat were completed between May and July 2017, while three visits were completed between May and July 2018, and two in April and May 2021. Potential habitat types included areas of moorland, forestry plantation edges and young conifer plantation. Within all suitable areas within the subject site, signs of presence of merlin were recorded. **Figure 7.2** displays the location of the merlin survey transect, with details of surveys in **Appendices 7.18 & 7.19**.

Red Grouse Survey

A Red grouse (*Lagopus lagopus)* survey was carried out in February 2019 (under licence no. 27/2019). This followed standard methodology (Bibby, C. J. *et al*., 2000; BWI, 2007; Cummins, S. *et al*., 2010), using the line transect method with tape lures across sample each 1 km^2 survey squares. The survey locations and transects for the red grouse surveys are shown in **Figure 7.4**. Survey details are presented in **Appendix 7.19**.

7.2.3 Assessment Approach

The impact assessment and ecological evaluation approach used in this report is based on "Guidelines on the information to be contained in Environmental Impact Assessment Reports" (EPA, 2022) and "Guidelines for Ecological Impact Assessment in the UK and Ireland" (CIEEM, 2018).

7.2.4 Sensitivity of Receptors

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

Ornithological receptors were considered within a defined geographical context and for this project the following geographic frame of reference is used (following NRA Guidance, 2009):

- International;
- National
- County
- Local (higher value / lower value).

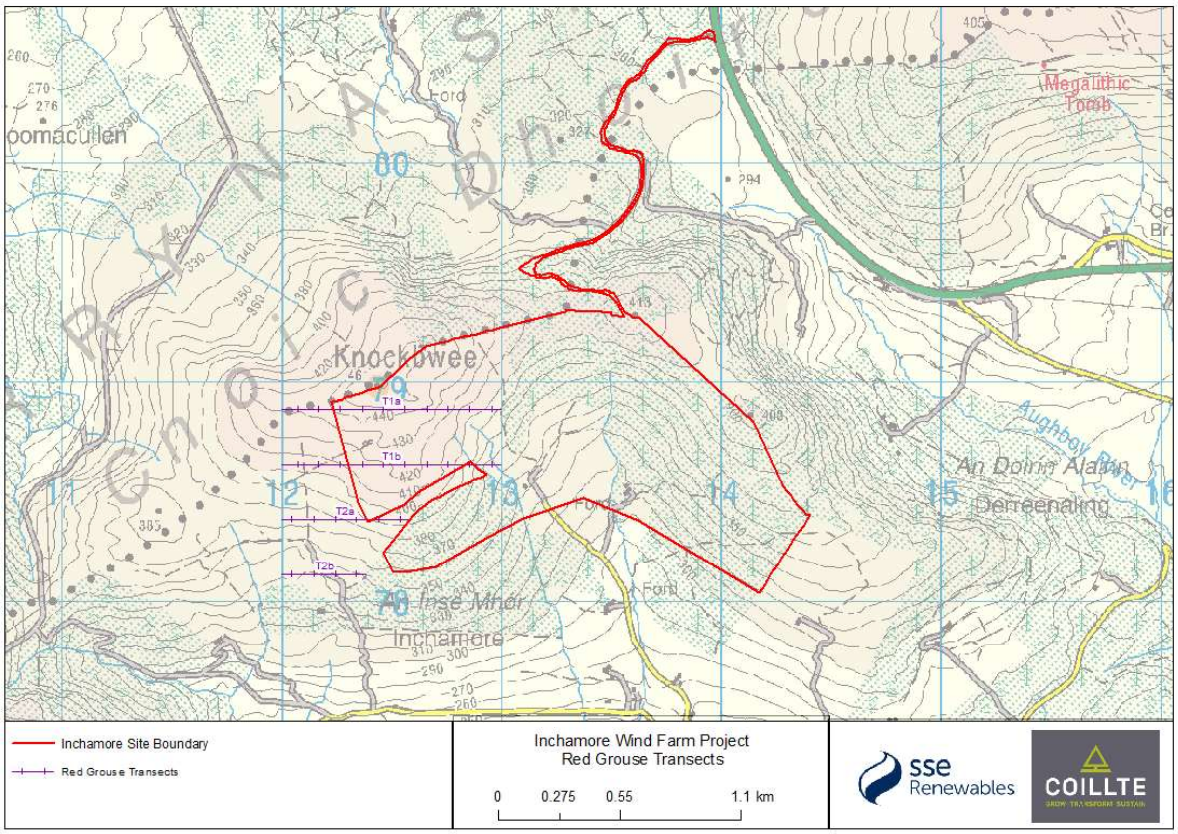


Figure 7.4: Locations of Red Grouse transects.

For designated sites, importance reflected the geographical context of the designation. For example, an SPA is considered internationally important while a Natural Heritage Area (NHA) is considered nationally important.

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

- species of European conservation importance (as listed on Annex I of the Birds Directive); and
- species Red-listed[2] in Ireland under the relevant lists of Birds of Conservation Concern Ireland (BoCCI), *e.g.* Gilbert *et al*. 2021.

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

7.2.4.1 Assessing Impacts and the Significance of Effects

The terms impact and effect are defined by CIEEM (2018) as:

- Impact – Actions resulting in changes to an ecological feature. For example, the construction activities of a development removing a hedgerow (CIEEM, 2018).
- Effect – Outcome to an ecological feature from an impact. For example, the effects on a dormouse population from loss of a hedgerow (CIEEM, 2018).

CIEEM (2018) guidelines state that when describing ecological impacts and effects, reference should be made to the following characteristics as required: positive or negative; extent; magnitude; duration; frequency and timing and reversibility.

Following the characterisation of impacts, an assessment of the ecological significance of their effects is made. The guidelines promote a transparent approach in which a beneficial or adverse effect is determined to be significant or not, in ecological terms, in relation to the integrity of the defined site or ecosystem(s) and/or the conservation status of habitats or species within a given geographical area, which relates to the level at which it has been valued. The decision about whether an effect is significant or not, is independent of the value of the ecological feature; the value of any feature that will be significantly affected is then used to determine the implications, in terms of legislation and / or policy (CIEEM, 2018).

Significance is a concept related to the weight that should be attached to effects when decisions are made. For the purpose of this assessment, 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for 'important ecological

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

features'. A significant effect is simply an effect that is sufficiently important to require assessment and reporting so that the decision maker is adequately informed of the environmental consequences of permitting a project. The EcIA guidelines (CIEEM, 2018) state that "*A significant effect does not necessarily equate to an effect so severe that consent for the project should be refused planning permission. For example, many projects with significant negative ecological effects can be lawfully permitted following EIA procedures as long as the mitigation hierarchy has been applied effectively as part of the decision-making process*". The assessment of significance is based on professional judgement.

7.3 BASELINE CONDITIONS

7.3.1 Data Presentation

There follows a summary of observations from the various surveys between 2017 and 2021. Data for the species recorded during the surveys are presented in **Appendices 7.1 – 7.14**. Flight lines are shown for each target species recorded during vantage point surveys in **Appendix 7.16**.

An overview of the status on site for each species of conservation importance based on the surveys from 2017 to 2021 is then presented.

7.3.2 Flight Activity Surveys - Breeding Season

Kestrel was the most frequently recorded target species during the summer surveys. There were concentrations of observations in the south-west sector of the site and to the north-east (most outside of Redline boundary). The majority of records were of single birds hunting or flying and involved both male and female birds. While there was no evidence of nesting within the site, the frequency of records, including several of two birds together, suggests breeding territories to the west and east of the site (outside of the Red-line boundary).

Sparrowhawk was a relatively scarce species during the surveys, with records in summers 2017, 2020 and 2021. All observations were of single birds most of which were engaged in hunting. Several of the records were off-site, with some close to VP 3 location at c.700 m from the Redline Boundary. There was no evidence of breeding behaviour within the Site.

On 20th July 2018, a sighting of a **merlin** was made from VP 3 over forestry approximately 500 m to the east of the Redline Boundary. This was the only sighting during the vantage point surveys.

Single **peregrines** were observed on 19th April 2017 and on 11th September 2018. Both records were in the western sector of the site. There are no known peregrine breeding territories within the vicinity of the proposed wind farm. [It is noted that a pair of peregrines was recorded over site on 28th February 2021 – as peregrine is an early breeder, this would have been an active pair]

There was one record of **hen harrier** from within the south-western sector of the site on 27th September 2018. The bird (a ringtail) was observed flying in an eastward direction over bog and forestry. Also, a male hen harrier had been recorded approximately 2 km southwest of the Redline Boundary of the site on 6th July 2018. There was no evidence of breeding by hen harrier within at least a 2 km distance of the site.

Buzzard was recorded on one occasion, on 27th September 2018. The record involved a bird flying south-eastwards over the western sector of the site. Buzzard is considered a scarce species in the area.

7.3.3 Flight Activity Surveys – Non-Breeding Season

Kestrel was recorded both on and off site in each of the three winter survey periods. The species is expected to be resident in the area and at times hunts within the study site.

Sparrowhawk was observed in winter 2017/18 and 2020/21. Both records involved single birds hunting off-site (near VP3 location).

Merlin was recorded on one occasion in winter 2017/18 – a bird flew over open ground to the south of VP3 location (off-site) on 15th November 2017.

A pair of **peregrines** was observed flying westwards from the area of the VP1 location on 28th February 2021. In addition, a peregrine was recorded approximately 1.5 km south-west of the Redline boundary of the Site on 17th October 2018.

Hen harrier was recorded within and around the site as follows:

- In winter 2017/18, there were six records though only one flightline was partly within the site (over bog/heath in westernmost sector). The other records were within a distance of approximately 500 m of the Redline boundary of the site. It is certain that at least two birds were involved (male and a ringtail) though possibly more. The records were between the 22nd January and 21st March 2018. In addition, single birds were observed approximately 3.5 km to the southwest of the site on 20th November 2017 and 1 km south of the site and on 22nd January 2018.
- In winter 2018/19, there were three records of single birds involving a male and female between 11th October 2018 and 16th January 2019. Two of the records within the western sector of the site and the third less than 500 m north-east of the Redline boundary.

From the pattern of records, it is considered that Hen Harrier is an occasional winter visitor to the site and its environs. There was no evidence to indicate that Hen Harriers roost within the site or within at least a 1 km distance of the Redline boundary.,.

There was a single observation of **white-tailed eagle** during each of the 2017/18 and 2018/19 winters. Whilst neither record was from within the Red-line boundary of the project, both were within a 1 km distance, as follows:

- On 22nd January 2018, a juvenile was observed circling approximately 500 m west of the Redline boundary of the Site.
- On 18th December 2018, a juvenile with a wing tag was observed approximately 1 km to the west of the Redline boundary of the site.

The observers considered that both records may have been of the same individual. No observations within or surrounding the redline boundary have been recorded in the surveys completed since 2018.

Golden plover was recorded from within the site in each of the three winter surveys. The records were largely from over the bog and heath habitats in the western sector of the site and over the area of bog to the west of that.

- In winter 2017/18 there was a total of 36 observations, with flock size ranging up to 40 birds. Most of the records were of birds in flight, though some involved birds roosting on the open bog and heath.
- In winter 2018/19, there was a similar pattern with a total of 17 observations and flock size ranging up to 49 birds. Again, birds were observed roosting on the open bog and heath on some occasions.
- In winter 2020/21, there were two records as well as a bird heard but not seen. The records were of a single bird and a flock of 25, and were from the north-west sector of the site.

7.3.4 Breeding Wader Surveys

There were no wader species recorded breeding on the Development site during the various moorland surveys (see **Appendix 7.7**).

7.3.5 Merlin Surveys

Signs of **merlin** presence were recorded on 25th May 2017 during a merlin transect survey (see **Table 7.2**) **–** these involved the recording of droppings and feathers from within the site and of pellets at a location approximately 500 m from the Redline boundary. In July 2017, a possible record of a bird calling from forestry near VP 1 was made. While no sightings were made of birds in 2017, the evidence indicate an active territory was present.

On 30th April 2018, a merlin was sighted over open bog/heath in the western sector of the site during a moorland transect survey. On 20th July 2018, a sighting of a merlin was made over forestry approximately 500 m to the east of the Redline boundary of the site. Earlier in July, there were two sightings of merlin approximately 2 km to the south-west of the site. As in 2017, it would appear that there was an active merlin territory in the vicinity of the site during the 2018 season.

There was no evidence of the presence of breeding merlin in the area during the (albeit limited) surveys in 2020 and 2021.

Table 7.2 Merlin Transect Survey, 25th May 2017 – Indicator signs.

Date	Sign	Location	Notes
25/05/2017	Pellet	51.9483744, -9.2809656	Pellets found at location & several more nearby
25/05/2017	Feathers	51.9539560 -9.2648599	Feathers found
25/05/2017	Droppings	51.9528344 -9.2666969	Droppings on rocks

7.3.6 Red Grouse Surveys

The red grouse survey in February 2019 recorded flying birds, a calling bird and feathers (see **Appendix 7.7**). This confirms the presence of at least one territory on the unplanted bog and heath in the western sector of the Site. In addition, grouse were flushed from within the site during the habitat surveys.

7.3.7 Transect Surveys

The results of the transect surveys at Inchamore for the period summer 2017 to winter 2020 are presented in **Appendices 7.18, 7.19 and 7.20.**

Meadow pipit (Red list) was a widespread breeding species on the bog and heath habitats within the Site. The species was also present in winter though in lower numbers. A further Red-listed species, grey wagtail, was considered to be breeding on the larger watercourses within the site.

Amber-listed species recorded during the breeding surveys were goldcrest, skylark, swallow, wheatear, willow warbler, starling and linnet. These species are expected to breed on site or at least in the surrounding areas and use the Site for feeding.

The site is relatively quiet in winter, though the Red-listed species meadow pipit and snipe were recorded in the bog and heath habitats. Other species recorded during winter included goldcrest and linnet.

7.3.8 Hinterland Breeding Bird Searches

For site-specific hinterland survey results see **Appendices 7.7, 7.11 and 7.14.**

During the summer season, 52 bird species were recorded in total across hinterland surveys including 23 target species. Of the target species recorded, three are Red-listed (dunlin, kestrel, and snipe). Little egret, peregrine, ruff and whooper swan, which are listed on Annex I of the Birds Directive, were also recorded.

White-tailed eagle was recorded on five occasions during hinterland surveys. These observations, all in 2018, were noted at the Sillahertane Wind Farm and Grousemount area. Three of the five observations concerned a sub-adult in its primary moulting stage. These observations occurred on 11th July, 22nd August and 13th September 2018. The remaining two observations consisted of a single individual being mobbed on the 10th & 24th May 2018. These observations show that while white-tailed eagle is rare in the vicinity of the Inchamore Site and has not been recorded since 2018, the species has a presence in the wider area.

The target species were recorded at three principal hinterland sites: the Gearagh, Gougane Barra and Lough Allua.

7.3.9 Swan and Goose Feeding Distribution Surveys

Winter hinterland surveys were carried out from October 2020 to March 2021. These surveys were for wintering target species. Species recorded during the winter surveys are listed in **Appendices 7.7, 7.11 and 7.14**.

During the winter season, 65 bird species in total were recorded including 31 target species. Of these target species seven are Red-listed, namely curlew, dunlin, golden plover, kestrel, lapwing, snipe and woodcock. Barnacle goose, golden plover, hen harrier, little egret, merlin, peregrine and whooper swan, which are listed on Annex I of the Birds Directive, were also recorded.

Whooper swan was observed during the months of November, February and March across three of the hinterland survey sites (The Gearagh, Lough Allua and Lee Valley). Observations of whooper swan, an Annex I listed species, were typically joined by those of greylag goose and mute swan during hinterland surveys.

7.3.10 Evaluation of Ornithological Receptors

The following species, which were recorded in the on-site surveys, are species of European conservation importance (as listed on Annex I of the Birds Directive) and/or are species of national conservation importance (Red- or Amber-listed after Gilbert *et al.* 2021). Also included are sparrowhawk and buzzard (Green-listed), as these species are potentially sensitive to wind energy projects. A summary of the status of each species follows.

Table 7.3: Conservation status of species recorded within the area of the proposed Inchamore Wind Farm.

Species	Annex I	Red list	Amber list	Green list
White-tailed eagle	Y	Y		
Hen harrier	Y		Y	
Sparrowhawk				Y
Buzzard				Y
Kestrel		Y		
Merlin	Y		Y	
Peregrine	Y			Y
Red grouse		Y		
Golden plover	Y	Y		
Snipe		Y		
Woodcock		Y		
Lesser black-backed gull			Y	
Goldcrest			Y	
Skylark			Y	
Swallow			Y	
Willow warbler			Y	
Starling			Y	
Wheatear			Y	
Grey wagtail		Y		
Meadow pipit		Y		
Linnet			Y	

Red grouse – Red List

Red grouse is resident on site. Suitable habitat for grouse occurs in western sector of the Redline boundary and continues westwards.

White-tailed eagle – Red List; Annex I

White-tailed eagle was observed on two occasions in the area to the west of the Redline Boundary (within 1 km of Site).

There was also a series of off-site records in the hinterland area. Most of these (listed below) were recorded from the Sillahertane/Grousemount area, c.7 km south-west of Inchamore:

April 2017: one c.6 km south-west of site (south of The Coom)
January 2018: adult flew west of Grousemount towards Sillahertane
February 2018: one feeding on dead sheep c.6 km southwest of site
March 2018: adult flew east from Lough Nabuddoga towards Sillahertane
10th May 2018: one in Sillahertane/Grousemount area
24th May 2018: one in Sillahertane/Grousemount area (probably same as previous)
11th July 2018: sub-adult in primary moult stage, Sillahertane/Grousemount area
22nd August 2018: sub-adult in primary moult stage, Sillahertane/Grousemount area
13th September 2018: sub-adult in primary moult stage, Sillahertane/Grousemount area.

From the pattern of records, it is considered that while white-tailed eagle has a presence in the wider area, however it is rare within the immediate Site area.

Hen harrier – Amber List; Annex 1

Hen harrier was recorded on-site at Inchamore and in the surrounding area during the winter survey periods (October-March). Both sexes, as well as ringtails (immatures) were observed, with birds either foraging or merely flying. There was no evidence of winter-roosting on site or in surrounding areas.

From the pattern of records, it is considered that hen harrier is an occasional winter visitor to the Site. The presence of hunting birds in winter in areas such as the Site is consistent with their dispersal from breeding areas (possibly though not necessarily from the Mullaghanish to Musheramore Mountains SPA).

Sparrowhawk – Green List

Sparrowhawk, a Green-listed species in Ireland, was observed in both summer and winter. Habitats suitable for breeding and foraging occur within the Site and in surrounding areas.

Buzzard – Green List

Buzzard, a Green-listed species in Ireland, was observed on only one occasion during the surveys and it is considered that this species is rare in the study area.

Kestrel – Red List

Kestrel was the most frequently encountered bird of prey, both in summer and winter, with individuals observed hunting regularly within the site.

The level of activity recorded for this species is indicative of a breeding territory in the vicinity (likely 1-2 km distance) of the Site.

Merlin – Amber List; Annex I

Merlin had a presence in the area during summers 2017 and 2018, with local breeding considered likely. However, there were no sightings at all in the 2020-21 surveys.

From the pattern of records, it is considered that a merlin territory overlaps with the western sector of the Site.

Peregrine – Green List; Annex I

The sightings of single birds as well as an interacting pair in the immediate area of the Site indicates that the Site is likely to be within a territory of a pair of peregrines.

Golden plover – Red List; Annex I

This Red-listed and Annex I species was noted primarily during winter surveys in 2017/18 and 2018/19. Records were concentrated in the western sector of the Site.

From the pattern of records, it is considered that Golden Plover is a visitor to the Site in winter and at times of spring and autumn migrations.

Snipe – Red List

Snipe was recorded on site in small numbers during winter. While there was no evidence of snipe breeding within the site, much of the bog and wet heath habitat is considered suitable for supporting breeding snipe.

Woodcock – Red List

Woodcock was recorded on one occasion in winter 2017/18. While there was no evidence of woodcock breeding within the site.

Grey Wagtail - Red List

Regular on site and considered to breed along streams downstream of the site.

Meadow Pipit – Red List

A widespread species on heath, bog and grassland habitats. Breeds on site and also present in winter (though scarcer then). Post-breeding flocks often seen in late summer and autumn.

Goldcrest – Amber List

A widespread breeding species within the conifer plantations on site. Scarce in winter.

Skylark – Amber List

A widespread breeding species of the open heath, bog and grassland habitats. Largely absent in winter.

Swallow – Amber List

Recorded feeding over site regularly in summer. Expected to nest in local farm buildings.

Willow Warbler - Amber List

A widespread breeding species within the conifer plantations on site and in areas of scrub.

Wheatear – Amber List

Passage migrant, mainly in spring. May breed locally.

Starling – Amber List

Observed mainly in winter. May breed in local farm buildings.

Linnet – Amber List

May breed on site. Scarce in winter.

7.3.11 Overview of conservation importance of the Site for birds

The Site supports a number of bird species characteristic of peatland habitats.

Merlin, an Annex I species, appears to have had a breeding territory which overlapped with the site area in both 2017 and 2018 and used the resources of the site for breeding. Although it was not recorded in summer surveys in 2020 or 2021, it is noted that merlin is a particularly difficult species to census and may be under-recorded using traditional survey methods (Lusby *et al.* 2011).

Hen harrier (Annex I species) is an occasional winter visitor to the site, with suitable foraging habitat available within the site and the surrounding areas. While the origin of the birds is unknown, it is possible that the birds may be associated with the breeding population in the Mullaghanish to Musheramore Mountains SPA. The population in the SPA had undergone a serious decline (1-2 pairs in 2015-2019 period) until a recovery in 2020 (5 confirmed pairs fledging 10 young). In 2021, there were three confirmed and one possible breeding pairs recorded within the SPA (Hen Harrier Project Monitoring Report, 2021).

White-tailed eagle (Red list & Annex I) was recorded within a kilometre distance of the site on two dates and has a scarce presence within the hinterland of the site.

Two Red-listed species, red grouse and meadow pipit, are resident in the western peatland sector of the site. A further Red-listed species, kestrel, utilises the site for hunting, while golden plover (Red listed & Annex I species) occurs within the site (peatland habitats) at times in winter and when on passage. Snipe and woodcock (both Red-listed) were recorded on site during winter.

A range of Amber-listed species breed within the site, including skylark, willow warbler and linnet.

Overall, on the basis of providing breeding, foraging and roosting habitat for several Annex I listed and Red-listed species, the bog and heath component of the site is rated as of County Importance for birds (following NRA 2009 Guidance). The afforested area of the site is of low importance for birds and is rated as Local Importance (low value).

7.4 ASSESSMENT OF EFFECTS

7.4.1 Do Nothing Impact

Without the Project proceeding, it is expected that the existing main land uses on site, namely forestry and livestock grazing, will continue.

The value of the site for birds would be expected to remain fairly similar as at present though any increase in grazing pressure could be detrimental to the quality of peatland habitats on site which could affect species such as red grouse. Also, any further afforestation on heath and bog habitats would be highly detrimental to peatland bird species, including red grouse, merlin, meadow pipit and skylark.

7.4.2 Construction Phase Potential Effects

7.4.2.1 Habitat loss

The permanent loss of habitat to facilitate the construction of the project is approximately 30.75 ha. The largest component of this is conifer plantation (26.13 ha). Whilst some birds of conservation importance which were recorded in the study area utilise conifer plantation, including merlin (if tree-nesting) and woodcock, there will still be an abundance of conifer plantation within the site and surrounding areas. From the perspective of birds, the effect by the loss of conifer plantation is rated as Not Significant.

The construction of T1 and T3 will result in the permanent loss of approximately 2.5 ha of wet heath and blanket bog habitat, with a further loss of 1.63 ha of cutover bog as a result of the construction of T3. These peatland habitats are utilised by bird species such as red grouse, merlin, kestrel, golden plover and meadow pipit (all Red-listed).

However, as wet heath, blanket bog and cutover bog are widespread habitats within the local area and in upland areas throughout much of the south-west region, the significance of the effect on birds by the loss of 4.1 ha of peatland habitat is considered to be a Moderate Adverse Effect of Long-term duration. It is expected that viable populations of the bird species which were recorded during the baseline surveys will remain on site after the project is complete.

The difference in dimensions within the Turbine Range will not result in a likely increased magnitude of impact on setting that would result in changes to predicted effects.

7.4.2.2 Disturbance to Breeding Birds During Construction

The construction phase for the Project is anticipated to last approximately 21 months, with commissioning taking a further 3 months. In this period, on-site activities, including tree felling, civil works and turbine erection works, have potential to cause significant disturbance effects on birds of conservation importance in adjoining areas.

In 2022 NatureScot published "*Disturbance Distances Review: An updated literature review of disturbance distances of selected bird species*" (NatureScot Research Report 1283) prepared by Goodship and Furness. The 2022 publication included 65 bird species.

It is noted that passerine species, such as meadow pipit and skylark, are not perceived as being prone to disturbance by wind farm construction (SNH 2017) and indeed Pearce

Higgins *et al*. (2012) found that densities of skylarks and stonechats increased on wind farms during construction.

Of the bird species which are identified as Important Ecological Features (IEFs) at the Development site, two were recorded breeding within 500 m of where construction works will occur – these are merlin and red grouse and potential disturbance effects are considered below. In addition, works for the laying of the grid connection cable will be within 500 m of suitable hen harrier breeding habitat.

As it is noted that potentially suitable breeding habitat occurs within or around the site for a number of species which have a presence in the area (as shown by the baseline surveys), namely sparrowhawk and kestrel and snipe, focused pre-construction surveys will be undertaken for these species to establish if the breeding status has changed by the time of construction. Pre-construction surveys will include search for breeding woodcock.

Should pre-construction surveys indicate a requirement for protection from construction-related disturbance of any relevant species, appropriate measures (as described in **section 7.5.2.3**) will be taken to comply with all relevant legislation and best practice guidance available at the time.

The baseline surveys carried out from 2017 to 2021 indicated that further target species may occur as non-breeding species within 500 m of where construction works will occur and could be affected by disturbance – these are white-tailed eagle and golden plover.

White-tailed eagle

White-tailed eagle is considered in the NatureScot (2022) review of disturbance distances in birds. The species is rated as of 'high sensitivity' to disturbance, with a buffer zone of 250-500 m suggested for both breeding and wintering birds.

While the species was recorded within the study area on two occasions, both off-site but within 500 m to 1,000 m distance of the redline boundary, there is no evidence to show that the site is within a regularly used feeding or roosting area by the birds (and there are no known nesting sites within at least a 5 km distance of the site).

On this basis, it is considered unlikely that construction works would have significant effects on foraging birds which may pass through the study area - significance of potential effect rated as Not significant.

Hen harrier

Hen harrier is considered in the NatureScot (2022) review of disturbance distances in birds. The species is rated as of 'medium sensitivity' to disturbance, with a buffer zone of 300-750 m suggested for both breeding and wintering birds.

A section of the grid connection route is located along the route of an existing forestry road which runs north of the Mullaghanish to Musheramore Mountain SPA. The closest distance between the cable route corridor and the SPA boundary is 170 m (chainage 9,600 m). Construction works carried out during the breeding season could cause significant disturbance to displaying, nesting and/or foraging hen harriers (Special Conservation Interest) within the sector of the SPA closest to the work area. In absence of mitigation, the potential disturbance effect on breeding hen harrier is considered to be a Significant Adverse Effect of Short-term duration.

While hen harriers were recorded during winter within the site for the wind farm and in surrounding areas, there was no evidence of a winter roost within at least a 2 km distance of the Redline boundary of the Site. It is considered unlikely that construction works would have significant effects on foraging birds which may pass through the study area during winter - significance of potential effect rated as Not significant.

Merlin

The habitats in the study area, *i.e.* bog/heath and conifer plantation, are suitable for supporting breeding merlin, with evidence of a merlin territory overlapping with the Redline Boundary in 2017 and 2018.

As merlin is a particularly difficult species to census and the traditionally used methods may not provide a true indication of the abundance, densities or distribution of the species (Lusby *et al.* 2011), it is possible that merlin may also have been present in summers 2020 and 2021.

Merlin is considered in the NatureScot (2022) review of disturbance distances in birds. The species is rated as of 'medium sensitivity' to disturbance, with a buffer zone of 300-500 m from construction works (including felling) suggested for breeding birds. For disturbance by forestry operations, Currie & Elliot (1997) gave a distance range of 200 m to 400 m for merlin.

Should merlin breed in future years within or close to the development area for the proposed wind farm, it is considered that the construction of the wind farm would likely have a potential disturbance effect on breeding birds within a distance of possibly up to 500 m from the construction area – this is rated as an Adverse Significant Effect of Short-term duration. Due to the high conservation status of merlin, pre-construction survey will take place in all suitable breeding habitat within the site and for a distance of at least 500 m from work areas. As required, mitigation will be undertaken to reduce the significance of this potential effect on breeding birds (see **section 7.5.2.3**).

It is considered unlikely that construction works would have effects on birds passing through the site in winter or during migration seasons as in these seasons the birds are highly mobile and tend to have large hunting ranges – significance of potential effect rated as Imperceptible or Not significant.

Red grouse

Habitat suitable for supporting red grouse occurs in the western sector of the site and continues westwards of the Redline boundary. The species was recorded breeding within the Site (though numbers of territories not established).

Red grouse is not considered in the NatureScot (2022) review of disturbance distances in birds. In a review of monitoring data from wind farms located on enclosed upland habitats in the UK, Pearce-Higgins et al. (2012) reported that densities of red grouse were significantly reduced at wind farms during construction but that the densities had recovered by the first-year post-construction. Owing to the high conservation status of red grouse and their sensitivity to disturbance, a precautionary buffer zone of 500 m is suggested. At the site for the Development, construction works, and especially works associated with T1, will take place within habitat which supports breeding red grouse.

From the above analysis, it is considered that the construction of the wind farm would likely have a potential disturbance effect on breeding red grouse within a distance of possibly up to 500 m from the site boundary – this is rated as an Adverse Significant Effect of Short-term duration. Due to the high conservation status of red grouse, a pre-construction survey will be carried out in all suitable breeding habitat within and adjoining the site and as required, mitigation will be undertaken to reduce the significance of this potential effect on breeding red grouse (see Section 7.5.2.3).

Golden plover

Golden plover is a winter / passage visitor to the study site. The birds were recorded within the western sector of the Site. Most of the records were of birds flying though some were of roosting birds on bog/heath.

Golden plover is considered in the NatureScot (2022) review of disturbance distances in birds. The species is rated as of 'medium sensitivity' to disturbance, with a buffer zone of 200-500 m suggested for both breeding and non-breeding birds.

It is considered unlikely that construction works would have a Significant adverse effect on birds landing on the bog in winter or during migration seasons as in these seasons the birds are highly mobile and tend to settle only for short periods in any one particular location – significance of potential adverse effect is rated as Slight.

7.4.2.3 Nest Damage or Destruction

Damage to, or destruction of, active nests during the construction phase, including tree felling, could contravene Section 22 of the Wildlife Acts 1976 to 2022 as amended.

The effects of loss of nests is rated as a potentially Significant Adverse Effect of Short-term Duration.

Mitigation will be implemented to ensure that loss of nests is avoided or minimised.

7.4.3 Operational Phase Potential Effects

The principal potential impacts on birds by the operation of a wind energy project are:

1. collision,
2. displacement,
3. barrier effects,

Disturbance from secondary operations, such as road maintenance, are also considered.

7.4.3.1 Collision

Collision risk posed to bird species is one of the main environmental concerns associated with wind energy developments (Drewitt & Langston 2006, Band et al. 2007, Drewitt & Langston 2008). However, bird species differ widely in their susceptibility to collision mortality. Essentially, birds are at risk of collision only when their flight path overlaps with the rotor blade sweep area of a turbine. It follows that birds whose flight heights coincide with the height of the turbine rotor sweep are most at risk. The assessment of potential impacts considers all scenarios within the range of turbine parameters proposed for the Development as shown in **Table 7.4** below.

Table 7.4: Turbine Parameters

Turbine Parameter	Assessment Envelope
Turbine Blade Tip Height	177 m to 185 m
Rotor Diameter	149 m to 155 m
Hub Height	102.5 m to 110.5 m

Collision Risk Modelling (CRM) is a method to estimate the number of birds likely to collide with turbines at the Site. This method uses vantage point data to calculate the risk of collision. In this case, the vantage point data collected over the two years 2017-2019 (two breeding seasons and two winter seasons) at the Site was used. There are three potential turbine models which may be used at the proposed wind farm, where appropriate calculations were run separately for each of the three models. Two stages are involved in the model:

Stage 1: Vantage point observations of birds flying within the study area are used to calculate the number of birds likely to fly through areas swept by the proposed turbine blades.

Stage 2: Calculation of the probability of a bird strike occurring.

Full details of the collision risk modelling carried out for the project are given in **Appendix 7.17**.

At the Site, the following species recorded flights within the rotor sweep height and inside the 2 km arc of the selected vantage points during the Vantage Point surveys:

Hen harrier
Buzzard
Kestrel
Peregrine
Golden plover

Other species of conservation concern were recorded in the vantage point surveys but were excluded from consideration in the collision risk analysis due to the following reasons:

White-tailed eagle – recorded within the potential collision risk height bands from VPs 1 & 2. However, the total flight time of these recordings did not exceed 70 seconds. Therefore, this species has been excluded from the analyses due to the low level of flight activity recorded.

Sparrowhawk – not recorded flying within the collision risk height band. Thus, for this species, the collision risk can be assumed to be effectively zero and the species is excluded from further consideration.

Merlin – recorded flying within the collision risk height band from VP 3. VP 3 has been excluded from the analysis as the viewshed does not include any of the proposed turbine locations. Since there are no turbines located within the viewshed, the predicted number of collisions is zero.

The mean number of collisions predicted for the five species subject to analyses (with the application of avoidance rates) is summarised in Table 7.5.

Table 7.5: Summary of estimated mean number of collisions (with avoidance rates) predicted for key ornithological receptors over the lifetime of the project.

Species	Mean no. of predicted collisions over lifetime of project (30 years)	Mean number of predicted collisions per year	One bird collision every 'x' years
Hen Harrier	0.046 birds	0.002	500 years
Buzzard	0.019 birds	0.006	166.6 years
Kestrel	6.25 birds	0.209	4.8 years
Peregrine	0.923 birds	0.031	32.6 years
Golden plover	688 birds	22.9	0.04 years

For hen harrier, buzzard and peregrine, the predicted number of collisions over the lifetime of the project is less than one bird, which is an effect rated as Imperceptible.

Two species are predicted to have more than one collision over the lifetime of the project – kestrel and, particularly, golden plover. The effect on these two species is considered further.

Kestrel

For kestrel, the collision risk modelling has calculated a rate of 6.25 collisions over the lifetime of the Project or 0.209 casualties per year. While these rates are negligible in the context of the estimated national population of 13,500 birds (Lewis *et al.* 2019), it is noted that kestrel, as well as lesser kestrel (*Falco naumanni*) and American kestrel (*Falco sparverius*), is a genus that is prone to collision (see for instance Barrios & Redrigues 2004, Hotker *et al*. 2006, Hotker 2008, Lucas *et al*. 2008, Marques *et al.* 2014). This is expected to be due to the hovering behaviour of the species. While birds are hunting and focusing on ground prey, they may be unaware of the turbine position or may suddenly change their position due to a gust of wind. The hovering height level is often within the rotor sweep of the turbines. Of eight casualties recorded at a wind farm in Cadiz Province, Spain, all were juveniles.

Taking into account the high conservation status (Red list) of the species and the known susceptibility of the genus to collision, the significance of collision risk for kestrel is rated as a Long-term Moderate Adverse effect.

Golden plover

Golden plover is a winter and passage visitor to the Site, with birds typically observed flying over the bog and heath habitats in the western sector of the site. The collision risk modelling has predicted a rate of 22.9 collisions and 688 over the lifetime of the project.

Golden plover is an Annex I listed species and a Red-listed species in Ireland. Burke *et al.* (2019) gave the All-Ireland wintering population at 92,060 birds for period 2011-12 to 2015/16, which is a 43.6% decline since the 1994/95-1988/99 period.

Hotker *et al*. (2006) cited four golden plover casualties (Netherlands, Sweden, Germany) in their review of all bird casualties at wind farms in Europe up to July 2004. In a study of collisions with turbines on the German island of Fehmarn, Grunkorn (2010) recorded 3 golden plover casualties during autumn 2009.

While the predicted collision rates are relatively low in the context of the estimated All-Ireland wintering population (92,060, Burke *et al.* 2019), the significance of the effect of the collision risk is rated as Long-term Adverse Effect of Moderate Significance due to the high conservation importance of the species and the recent significant long-term decline in the wintering population.

7.4.3.2 Displacement effect due to turbines

Displacement of birds from otherwise suitable habitat as a result of the presence of wind turbines has been reported as a potential impact of wind turbines (Drewitt & Langston 2006, de Lucas *et al.* 2007, Pearce-Higgins *et al.* 2009). The displacement occurs as a result of behavioural responses that prevent or decrease the use of an area for activities such as nesting or foraging. However, the results of studies on potential displacement have varied widely and in an overall review of the literature Madders & Whitfield (2006) concluded that displacement effects of wind turbines on raptors, including hen harrier, are negligible for the most part. Further evidence that hen harrier may not be displaced by the presence of turbines is from a study at the Derrybrien Wind Farm, Co. Galway (Madden & Porter 2007), where birds were observed flying close to wind turbines (<50 m) and on one occasion within 10 m of the base.

It is noted that passerine species, including species such as meadow pipit, are not perceived as being prone to displacement as a result of the presence of wind turbines (SNH 2017).

Consideration of potential for displacement is given for the following species which were recorded within the study area, and which mostly have a high conservation status:

Sparrowhawk

The baseline surveys showed that sparrowhawk is regular at the Development Site. While not proven during the baseline surveys, breeding is likely to occur in the local area.

There appears to be no data to show whether sparrowhawk is displaced from an area around turbines, though in the review of upland raptors and wind farms, for sharp-shinned hawk (*Accipiter striatus*) (same genus as sparrowhawk) Madders and Whitfield (2006) tentatively rated this North American hawk as having a 'low' sensitivity to displacement.

As sparrowhawk is a woodland species that nests in woodland and hunts largely along woodland margins and over scrub, it is expected that the species will not be displaced from suitable habitat in the vicinity of turbines at the Development Site - significance of potential effect rated as Imperceptible or Not significant.

Merlin

The evidence from the baseline surveys showed that there was a merlin breeding territory within the area of the site in 2017 and 2018.

There appears to be no data to show whether merlin is displaced from an area around turbines, though in the review of upland raptors and wind farms, for prairie falcon (*Falco mexicanus*) (same genus as merlin) Madders and Whitfield (2006) tentatively rated this North American falcon as having a 'low' sensitivity to displacement.

As merlin is a species that nests in trees or on open bog and hunts close to ground level, it is expected that the species will not be displaced from suitable habitat in the vicinity of turbines at the Development site - significance of potential effect rated as Not significant.

Kestrel

Kestrel was recorded regularly during the baseline surveys, with breeding expected to occur in the local area. At the least, the species uses the survey area for hunting purposes.

In the review of upland raptors and wind farms, Madders and Whitfield (2006) rated kestrel as having a 'low' sensitivity to displacement. The related American kestrel (*Falco sparverius*) was also given a rating of 'low' sensitivity. Pearce-Higgins *et al.* (2009) found equivocal evidence for weak avoidance of turbines by kestrel.

For kestrel, the significance of a potential displacement effect is rated as Not significant.

Hen harrier

The baseline survey data showed that hen harrier is an occasional winter visitor at the proposed wind farm site but there was no evidence of winter roosts.

There appears to be no data to show whether wintering hen harriers are displaced from an area around turbines, though for breeding birds Madders and Whitfield (2006) tentatively rated foraging hen harriers as having a 'low-medium' sensitivity to displacement.

As hen harrier is at most an occasional visitor to the Site for the Development site, it is expected that birds would still pass through the area when the turbines are in operation and that the potential for disturbance to foraging birds is low – this effect is rated as Not Significant.

Snipe

Snipe was not recorded breeding on site in the baseline surveys. In winter, snipe is expected to be a widespread species in bog and heath habitat in the vicinity of the proposed Development Site area.

It is considered unlikely that the presence of the Development would have adverse effects on snipe utilising the bog and heath outside of the breeding season, as snipe is a particularly widespread species during winter and may often occur in active agricultural lands - significance of potential effect on wintering birds rated as Not significant.

Red grouse

The baseline surveys showed that red grouse is resident in the western sector of the site.

Pearce-Higgins *et al.* (2009) found no evidence of turbine avoidance by red grouse and, indeed, the occurrence of red grouse was found to be greater close to the tracks. Reasons for the association between grouse and wind farm tracks are likely to include (i) supplies of grit on tracks which the birds need to ingest to aid digestion, and (ii) good growth of heather which often may be observed along the drier bog strips alongside the tracks. The present author has also observed grouse dust bathing on a dry track within a wind farm.

From the available information, it is considered that for red grouse the potential displacement effect is Not significant, and the presence of the Development is likely to be a Neutral or even Positive effect of Moderate Significance in the Long-term.

Golden plover

The baseline survey data showed that golden plover is a winter visitor and passage migrant in the western sector of the site.

There appears to be no data to show whether wintering golden plover are displaced from an area around turbines, though for breeding birds Pearce-Higgins *et al.* (2009) found that golden plover showed significant avoidance of turbines but that the avoidance was largely restricted to a distance of 200m.

It is considered unlikely that the presence of the wind farm would have adverse effects on golden plover landing on the local bog in winter or during migration seasons as in these seasons the birds are highly mobile and tend to settle only for short periods in any one particular location – significance of potential effect rated as Imperceptible or Not significant.

7.4.3.3 Barrier effect due to turbines

The potential impact of lines of wind turbines creating a barrier effect to passing birds is mostly relevant to locations where migratory species pass regularly. Rees (2012) cites eight published studies of flight behaviour which reported changes in flightlines for swans or geese initially seen heading towards turbines, at distances ranging from a few hundred metres to 5 km (the larger distances were by birds on migration); 50-100% of individuals/ groups avoided entering the area between turbines, but in some cases the sample sizes were small.

As the Development Site has not been identified through the baseline surveys or desk review as being along a migration route for birds, such as wetland species (swans, geese etc.) or birds of prey, there is not likely to be a barrier effect. Furthermore, the Development is of only five turbines which are not in proximity to any other group of turbines so there cannot be a barrier effect in combination with other projects.

7.4.3.4 Other wind farm activities impact

Other wind farm activities during the operational phase include turbine servicing are the maintenance and periodic upgrading of access tracks and substation inspection and maintenance.

Maintenance of access tracks within the wind farm would be an occasional activity and would be relatively minor in terms of construction. It is considered that track maintenance works would not have any measurable effect on the foraging potential of birds within the site, including species of high conservation value such as red grouse and kestrel.

Maintenance works at the turbines and the wind farm substation would not be expected to have any effects on local bird populations.

7.4.3.5 Potential effects on Birds of the Hinterland

While the hinterland surveys recorded a range of species of conservation importance, including wetland birds such as whooper swan at sites such as The Gearagh, Lough Allua and Gougane Barra Lough, none of these species were recorded in the vicinity of the site during the baseline surveys from 2017 to 2021.

It is concluded that the operational phase of the Project, as well as the decommissioning phase, would not have effects, including risk of collision, on birds associated with any of the hinterland sites surveyed.

7.4.4 Decommissioning Phase Potential Effects

During the decommissioning works there is a risk of disturbance and subsequent displacement to sensitive breeding species such as red grouse and merlin. As for the construction phase, appropriate mitigation will be implemented to ensure that disturbance to these species, as well as any other species which may have a high conservation status at the time of decommissioning, is minimised.

7.5 MITIGATION MEASURES

7.5.1 Construction Phase

7.5.1.1 Measures for Loss of Habitat

The implementation of the Habitat Enhancement Plan will enhance blanket bog habitat for bird species associated with peatland habitats, including red grouse, merlin and meadow pipit. The regrowth of ling heather in the eroded blanket bog habitat would be of particular benefit to the local red grouse population.

This Plan, which provides for the enhancement of approximately 10.8 ha of blanket bog habitat, will compensate for the loss of breeding bog and heath habitat for birds.

7.5.1.2 Measures to Prevent Disturbance to Breeding Hen Harriers

A section of the grid connection route is located along the route of an existing forestry road which runs north of the Mullaghanish to Musheramore Mountain SPA, with the closest distance between the cable route corridor and the SPA being 170 m. To prevent any potential disturbance to nesting and/or foraging hen harriers, works will be restricted along the identified section to the period outside of the breeding season (March-August). This will ensure that the breeding hen harrier population within the SPA is not disturbed by the Project.

7.5.1.3 Measures to Minimise Potential Disturbance to Sensitive Bird Species

The present assessment has identified the potential for significant disturbance effects on two breeding species of conservation interest as a result of the construction works (see **Section 7.4.2.2**). These species are merlin and red grouse. Best available evidence has been reviewed and it is suggested that these species could be disturbed by works, including tree felling, at the following distances:

Merlin	500 m
Red grouse	500 m

As noted in section 7.4.2.2, pre-construction breeding surveys for selected species are required on the basis of the following:

1. Suitable breeding habitat exists within and around the Site for sparrowhawk, kestrel and snipe, which were recorded as non-breeding during the baseline surveys but which could breed within the study area in future years;
2. Specific survey for the presence of woodcock in the study area was not carried out as part of the baseline surveys.

Should the pre-construction surveys indicate a requirement for protection from construction-related disturbance, including tree-felling, of any relevant species, appropriate measures will be taken in line with all relevant legislation and best practice guidance available at the time to ensure that breeding attempts are not disturbed by construction related works.

Best available evidence has been reviewed (Currie & Elliot 1997, NatureScot 2022, Pearce-Higgins *et al*. 2012, Scottish Natural Heritage 2016) and it is suggested that the following species could be disturbed by construction works, including tree felling, at the following distances:

Sparrowhawk	200 m
Kestrel	200 m
Snipe	400 m
Woodcock	200 m

Should any of these species be recorded breeding within the given distances of the works area through confirmatory surveys before and/or during construction, a buffer zone (using above distances) shall be established around the expected location of the nest (location identified as far as is possible without causing disturbance to the bird) and all works will be restricted within the zone until it can be demonstrated by an ornithologist that the species has completed the breeding cycle in the identified area. Any restricted area that is required to be set up will be marked clearly using hazard tape fencing and all site staff will be alerted through toolbox talks.

The above mitigation, if needed, will apply from March to August (inclusive) and will ensure that the works will not have an adverse effect on the identified species of conservation importance recorded during the baseline surveys or in pre-construction surveys.

7.5.1.4 Measures to Minimise Potential Disturbance to Nesting Passerine Species

A range of passerine bird species breed within the Site, including the Red-listed meadow pipit and the Amber-listed goldcrest and willow warbler. In compliance with Section 40 of the Wildlife Acts 1976 as amended, all vegetation required to be cleared to facilitate the works will be done outside of the restricted period from 1st March to 30th August.

Should it be necessary to remove vegetation during the breeding season, for instance where bramble and ephemeral plant species have become established on ground cleared earlier, this will be surveyed by an ornithologist up to 10 days before any clearance. Should an active nest be located, the area will be restricted from works by a distance where it is considered that the works would not cause disturbance or abandonment of the nest. Such distances, which will vary according to species and local topography, will be determined by the ornithologist. The restriction will be maintained until it is established that any young birds present have fledged. Should an instance arise where the placement of a restriction would have significant implications for the time frame of the Project, and where no alternative mitigation is available, the ornithologist will prepare a report (to include species, stage of breeding etc.) on the implications of removal of the nest in the context of the Wildlife Acts and consultation will be undertaken within the NPWS.

With the above mitigation implemented, the significance of the effect of disturbance to nesting passerine species can be reduced to a Slight Adverse Effect of Short-term Duration.

7.5.2 Operational Phase

7.5.2.1 Measures for White-Tailed Eagle

The present assessment has shown that the Site is within the known area of distribution for white-tailed eagle, with a bird recorded within 500 m of the Redline boundary.

While white-tailed eagle was excluded from collision risk analysis due to the low level of flight activity recorded, it is a species that is vulnerable to collision with wind turbines. Therefore, as a precautionary measure, mitigation will be implemented to minimise this risk.

It is noted that while the Site does not offer potential nesting sites to eagles, foraging birds could be attracted to the site to feed on carrion (as happened in the past close to Sillahertane Wind Farm where two eagle casualties occurred).

Once operational, a programme will be put in place to remove carcasses (mainly of sheep) from the site. This will involve search of the wind farm infrastructure area by site management for the presence of dead and/or injured animals (mostly lame sheep or animals caught in wire fencing). It is noted that such animals are usually identified by a concentration of corvids (ravens and hooded crows). Searches will be carried out on a weekly basis.

Should a carcass be located, this will be removed at the earliest opportunity by an appointed representative following standard practice for the disposal of carcasses (subject to Health and Safety issues). Injured or trapped animals will be reported to local landowners.

With mitigation in place, the significance of the effect of collision risk to white-tailed eagle as a result of the project is reduced to a Slight, Adverse, Long-term Effect.

7.5.2.2 Measures for Kestrel

Kestrel is regular at the Site, with birds using it for hunting purposes. As discussed in the impact section, kestrel is a species at risk of collision, as birds will be attracted to the ground around the turbines where prey items inhabit the low scrub type vegetation. As kestrel is a Red-list species, mitigation is proposed to avoid collisions.

Should monitoring during operation identify more than one kestrel casualty at a specific turbine(s), proactive measures will be taken to discourage the birds from hunting in the area of the relevant turbine(s).

This will involve clearing rank vegetation from around the relevant turbine(s) to make it less suitable for supporting prey items such as small mammals (mice, shrews, voles) and birds (meadow pipit, skylark etc). Vegetation clearing will be achieved by mowing and/or strimming. This approach has proved highly effective at several wind farms in central-eastern Spain where the number of collisions with lesser kestrel decreased by 75% to 100% after the ground was superficially tilled to a distance of 80m from the turbine base (Pescador *et al*. 2019). [It is noted that the maintenance of a low sward around the turbines during the operational phase is also required as mitigation to minimise bat collision].

With mitigation in place, the significance of the effect of collision risk to kestrel as a result of the project is reduced to a Slight, Adverse, Long-term Effect.

7.5.2.3 Monitoring

Pre-construction phase and construction phase monitoring

During the breeding season (March-August), bird monitoring surveys will take place to a distance of 500 m from the development area. The purpose of the monitoring will be to identify the presence of sensitive breeding species of conservation importance so that mitigation can be taken to avoid adverse effects on the breeding activities from the works.

The key species of concern at this site are red grouse and merlin, but with potential for breeding sparrowhawk, kestrel, snipe and woodcock. The monitoring surveys will be undertaken by a suitably qualified ornithologist.

Should the presence of any of these species be confirmed, the location of the nest will be identified (as far as is possible without causing disturbance to the birds) and a buffer zone of up to 500 m will be observed where works are restricted until the breeding activity is complete.

Post-construction monitoring

Post-construction bird monitoring is required to establish possible effects on bird species as a result of the project. The monitoring programme will comprise the following:

Flight activity surveys

Flight activity surveys will be undertaken using the Vantage Point method (Scottish Natural Heritage 2017). This will use the same 3 no. VPs as used for the baseline EIAR surveys. The surveys will be undertaken monthly in Years 1, 2, 3, 5, 10 and 15 of the life-time of the project (in accordance with Scottish Natural Heritage Guidance 2009). Usage of the site by, hen harrier, sparrowhawk, merlin, kestrel and golden plover will be of particular interest.

Distribution and abundance surveys

Distribution and abundance surveys will be undertaken to monitor short-term and long-term effects on bird populations within the site. Survey methodology will be similar to methods employed for baseline on-site EIAR surveys, which will allow a comparison of data to be made for each monitoring year. For merlin, best practice survey methodology as recommended at the time will be followed. Surveys will be undertaken in the same monitoring years as the vantage point surveys.

Red grouse survey

Repeat of the pre-construction red grouse survey (under licence) in Years 1, 2, 3 and 5 of operation. This will establish whether red grouse maintain a presence on site in the area of the wind farm infrastructure. Surveys will follow the standard methodology as used in the baseline EIAR survey.

Collision searches

The objective of collision monitoring and corpse search is to establish whether bird fatalities are occurring as a result of collision with turbine blades.

Carcass search was traditionally completed by human observers whose efficiency is influenced by several factors including carcass type, environmental conditions and observer competence. Numerous studies have been conducted demonstrating that dogs have a superior ability to detect bird and bat carcasses than humans, particularly with small carcasses or in dense vegetation (see for example Mathews 2013).

A standard plot size will be selected at each turbine location where search will occur. At the start of each survey, data recorded will include meteorological and ground cover information. The locations of any carcasses found will be recorded by GPS and will be photographed in-situ. The state of each carcass will be recorded on a corpse record card, using the following categories (after Johnson 2003):

- Intact - a carcass that is completely intact, is not badly decomposed, and shows no sign of being fed upon by a predator or scavenger
- Scavenged - an entire carcass which shows signs of being fed upon by a predator or scavenger, or a portion(s) of a carcass in one location such as wings, legs, skeletal remains or pieces of skin
- Feather Spot - ten or more feathers at one location indicating predation or scavenging. If only feathers are found, 10 or more total feathers or two or more primaries must be discovered to consider the observation a casualty.

Searcher efficiency and predation tests will be carried out at the commencement of the programme in order to calibrate the results to account for the search dog's ability to find bird corpses and to also account for scavenging of corpses by animals.

The collision searches will be carried out in Years 1, 2, 3, & 5 of the operational phase of the wind farm.

7.5.3 Cumulative Effects

There are 26 wind farms within 20 km[3] of the Inchamore proposed development (an area of 1,256 km^2). **Figure 2.2 in Chapter 2** shows the location of proposed, permitted and operational wind farms within a 20 km radius of the Inchamore site and further information on these wind farms is provided in the EIAR (**Appendix 2.3, Chapter 2**). Of the 26, 18 no.

[3] A distance of 20 km is taken as a precautionary distance for potential in-combination effects to occur – such a distance is beyond the normal foraging range of bird species associated with SPAs.

are operational (175 turbines total), 6 no. are permitted (25 turbines), 1 no. is at pre-planning stage (17 turbines) and 1 no. is proposed (14 turbines).

The nearest operational wind farms to the Inchamore site are Coomagearlaghy, Kilgarvan Wind Farm (15 turbines), which is located 2.7 km to the south-west, and Inchee, Poulbatha & Foilgreana (6 turbines), which is located 3.3 km to the south-west. The permitted Gortnakilla, Clonkeen, Killarney Wind Farm is located 1.87 km to the west of the Inchamore site.

Most of the wind farms are clustered to the north-east, south and south-west of the Inchamore site.

If permitted, the Inchamore project will add a further 5 turbines. Based on the locations of the 26 wind farms, it is expected that most are on heath and/or bog habitats and the construction of such projects would have (or will) caused loss and disturbance of peatland habitats which may support bird species such as red grouse and merlin. The construction of the Development will contribute to an existing and ongoing (unquantified) adverse effect on bird species associated with loss of peatland habitats.

All of the 26 wind farms are within the range of the Kestrel population and present (or will present when built) some risk of collision for this species. The operation of the Project will contribute to an existing collision risk for kestrel. However, with implementation of the mitigation as presented in this report, the risk from the Project is minimised.

All of the 26 wind farms are within the range of the wintering and migratory golden plover population and are likely to present (or will when built) some risk of collision for this species.

The operation of the Project is likely to contribute to an existing collision risk for these two species.

7.6 RESIDUAL EFFECTS OF THE DEVELOPMENT

With mitigation measures as presented in this report implemented in full, and specifically construction phase mitigation for breeding birds of peatland habitats, as well as precautionary measures during operation phase to discourage usage of the Site by white-tailed eagle and the areas close to turbines by kestrel (as required), it is considered that the significance of the predicted adverse effects on birds as a result of the Project will range from Imperceptible to Moderate.

Whilst loss of peatland habitat will reduce the area of suitable breeding habitat available for red grouse, merlin and meadow pipit (species of high conservation importance), it is not expected that this will have a significant adverse residual effect as the loss is a relatively small amount of the available peatland habitat in the local area*, i.e.,* extending westwards from the redline boundary. Also, the Habitat Enhancement Plan will compensate for the loss of peatland habitat. Similarly, the relatively small amount of habitat loss as a result of the Project is not expected to have any residual impact on species which use the site for feeding and/or roosting, including hen harrier, kestrel and golden plover.

The construction phase of the Project may result in disturbance to breeding birds within a distance of up to 500 m of the works boundary. In absence of mitigation, this is expected to have adverse effects on scarce species such as red grouse, merlin and hen harrier (latter along grid connection route). With mitigation in place, comprising the use of work restrictive zones around identified nests areas (if present) and a seasonal restriction on work along the grid connection route where hen harrier occurs, the Project is not expected to have any residual effect on these species.

During the operational phase of the Project, birds may show some avoidance of suitable habitat as a result of the presence of turbines. However, this effect is not likely to be significant.

During the operational phase of the Project, birds will be at some risk of collision with turbines. The significance of residual effects will range from Slight Adverse for kestrel to Moderate Adverse for golden plover.

The baseline surveys did not identify any regular migration routes or local movements of wetland bird species through the site. The project is not expected to have any residual effect on migrating species or local wetland bird populations.

With mitigation in place to prevent disturbance during the construction phase to breeding hen harriers within the Mullaghanish to Musheramore Mountains SPA (as detailed in the Natura Impact Statement), the Project is not expected to have any residual effects on the Special Conservation Interests of this SPA or the SCIs of any other Special Protection Area.

7.7 CONCLUSIONS

An assessment of effects on ornithology has been carried out at the site for the Project. This is based on detailed survey information from 2017 to 2021.

The study site supports species of conservation importance which are associated with peatland habitats – these include breeding merlin, red grouse and wintering golden plover. Overall, the site is rated as of County Importance for birds. The grid connection corridor passes close to the Mullaghanish to Musheramore Mountains SPA, with hen harrier the Special Conservation Interest.

The principal ornithological effects as a result of the proposed wind farm project at Inchamore are as follows:

- Loss of 4.1 ha of peatland habitat, which is rated as a Moderate Adverse Effect of Long-term duration. With compensation by implementation of a Habitat Enhancement Plan, effect reduced to Slight Adverse of Long-term duration.

- Likely construction related disturbance to hen harrier, merlin and red grouse, which is rated as a Significant Adverse Effect of Short-term duration. With mitigation by establishment of buffer zone where works will be restricted during the breeding season, effect reduced to Not Significant.

- Likely construction related disturbance to nests of passerine species, including Red-listed meadow pipit, which is rated as a Significant Adverse Effect of Short-term duration. With mitigation by clearing of vegetation outside of breeding season and ongoing monitoring during construction phase, effect reduced to Slight Significant Adverse Effect of Short-term duration.

- Collision risk to kestrel and golden plover, rated as Adverse Effect of Moderate Significance of Long-term Duration. With mitigation implemented for kestrel by discouraging birds from hunting at turbine locations, significance of effect is reduced to Slight. For white-tailed eagle (recorded within 500 m of Redline boundary of site), a precautionary approach is proposed to discourage birds from feeding in the area of the wind farm, as this species is sensitive to collision.

- The proposed Project includes rigorous ornithological monitoring (in line with best practice guidance) at pre-construction, construction, and operational phases.

7.8 REFERENCES

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8 SOILS AND GEOLOGY

8.1 INTRODUCTION

This chapter assesses the impacts of the Project (**Chapter 1: Introduction**) on soils and geology environment. The Project refers to all elements of the planning application for the construction of Inchamore Wind Farm (**Chapter 2: Project Description**). Where negative effects are predicted, the chapter identifies appropriate mitigation strategies therein. The assessment considers the potential effects during the following phases of the Project:

- Construction of the Project;
- Operation of the Project, and
- Decommissioning of the Project.

Common acronyms used throughout this EIAR can be found in **Appendix 1.2**. This chapter of the EIAR is supported by the Figures provided in **Volume III** and by the appended documents provided in **Volume IV** of this EIAR:

- **Figure 8.1(a) –** Site Location & Layout Wind Farm
- **Figure 8.1(b) –** Site Location & Layout Grid Connection Route
- **Figure 8.2(a) –** Land Use Wind Farm
- **Figure 8.2(b) –** Land Use Grid Connection Route
- **Figure 8.3(a) –** Geology Wind Farm
- **Figure 8.3(b) –** Geology Grid Connection Route
- **Figure 8.4(a) –** Soils Wind Farm
- **Figure 8.4(b) –** Soils Grid Connection Route
- **Figure 8.5(a) –** Subsoils Wind Farm
- **Figure 8.5(b) –** Subsoils Grid Connection Route
- **Figure 8.6(a) –** Landslide Risk & Events Wind Farm
- **Figure 8.6(b) –** Landslide Risk & Events Grid Connection Route
- **Figure 8.7 –** Geo-Hazards Constraints Map Wind Farm

- **Appendix 8.1 –** Site Investigation and Peat Slide Risk Assessment
- **Appendix 8.1 – App A1 –** IWF SI – Peat Depth Overview
- **Appendix 8.1 – App A2 –** IWF SI – Peat Depth – Tile 1
- **Appendix 8.1 – App A2 –** IWF SI – Peat Depth – Tile 2
- **Appendix 8.1 – App B –** Peat Database
- **Appendix 8.1 – App C –** IWF SI – Trial Pit and Borehole Locations
- **Appendix 8.1 – App D –** IWF SI – Trial Pit Logs
- **Appendix 8.1 – App E –** IWF SI – Trial Pit Photos

- **Appendix 8.1 – App F –** IWF SI –Borehole Log
- **Appendix 8.1 – App G –** IWF SI – Subsoil Laboratory Certificate
- **Appendix 8.1 – App H (a) –** IWF SI – Geohazards Overview
- **Appendix 8.1 – App H (b) –** IWF SI – Geohazards W NW
- **Appendix 8.1 – App H (c) –** IWF SI – Geohazards E SE
- **Appendix 8.1 – App I –** IWF SI – Stability Risk Matrices

A Construction and Environmental Management Plan (CEMP) is appended to the EIAR in **Appendix 2.1**. This document will be a key construction contract document, which will ensure that the mitigation measures, which are considered necessary to protect the environment are implemented. In the event that planning permission is granted for the Project, any condition(s) relating to a CEMP which will be attached to such a permission, will be implemented in accordance with the requirements of the condition. For the purpose of this application, a summary of the mitigation measures is included in **Appendix 17.1**.

8.1.1 Assessment Structure

In line with the EIA Directive, as amended and Guidelines on the information to be contained in Environmental Impact Assessment Reports (EPA, May 2022), the structure of this Soils and Geology chapter is as follows:

- Assessment Methodology and Significance Criteria.
- Description of baseline conditions at the Site.
- Identification and assessment of impacts to soils and geology associated with the Project, during the construction, operational and decommissioning phases..
- Mitigation measures to avoid or reduce the impacts identified.
- Identification and assessment of residual impact of the Project considering mitigation measures.
- Identification and assessment of cumulative impacts if and where applicable.

8.1.2 Project Description

The Project (**Figure 9.1a-b**) is described in **Chapter 2: Project Description**.

8.1.3 Statement of Authority

Minerex Environmental Ltd. (MEL), an RSK group company was commissioned to carry out this Chapter of the Environmental Impact Assessment Report. RSK Group, is a consultancy providing environmental services in the hydrological, hydrogeological and other environmental disciplines. The company and group provide consultancy to clients in both the public & private sectors. More information can be found at www.rskgroup.ie. The members of the RSK EIA team involved in this assessment include the following persons:

- Sven Klinkenbergh – B.Sc. (Environmental Science), P.G.Dip. (Environmental Protection) – Principal Environmental Consultant, Project Manager and EIA Lead Author with c. 10 years industry experience in the preparation of geological, hydrological and hydrogeological reports.
- Project Scientist: Jayne Stephens - B.Sc. (Environmental Science), PhD (Environmental and Infection Microbiology). Jayne is an Environmental consultant with c. 5 years' experience working in microbiology, water, and environmental disciplines. She graduated with a BSc in Environmental Science from National University of Ireland Galway in 2014, majoring in mammal ecology. Following this, Jayne was the successful Irish applicant to the Tropical Biological Association in Cambridge to complete a field course in tropical biodiversity and conservation in Tanzania. She holds a PhD in environmental microbiology, graduating in 2023. Jayne has worked on a large number of bathing water and surface water monitoring investigations, on project Acclimatize, an EU funded project which aimed to bridge the knowledge gap in relation to at-risk urban and rural bathing waters in Ireland and Wales. During this project, Jayne was team lead for site investigations and has a number of years' experience on microbial contamination and public involvement projects for better water quality.
- Lissa Colleen McClung - B.Sc. Environmental Studies (hons.), M.Sc. Environmental Science (hons.). Current Role: Graduate Project Scientist. Colleen has recently joined RSK Ireland as a Graduate Project Scientist under the Hydrology & Hydrogeology and Land, Soils & Geology Team. After attaining an MSc in Environmental Science, with 1.1 First Class Honours, from Trinity College Dublin in 2021. Since coming on board, Colleen has worked on a variety of projects for urban residential development schemes and renewable energy. As a Project Scientist, Colleen has undertaken technical report writing in many forms, such as: Flood Risk Assessments (Stage 1 and Stage 2) (ROI), Drainage Assessments (NI), Water Framework Directive Assessments, Environmental Impact Assessment Reports (ROI) and Environmental Statements (NI). She has also carried out extensive field work around the country. Key capabilities include preparation of Environmental Impact Assessment Reports and running software such as QGIS, Python and MATLAB coding languages.
- Mairéad Duffy - B.Sc. Environmental Management, M.Sc. Climate Change. Current Role: Graduate Project Scientist. Mairead has experience in technical report writing and field work surveying of hydrological and geological elements of the environment with associated proposed green energy projects around the country.

8.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

8.2.1 Assessment Methodology

The following calculations and assessments were undertaken in order to evaluate the potential impacts of the Project on the soils, geology and ground stability aspects of the environment at the Inchamore Site:

- Characterise the topographical, geological and geomorphological regime of the Site from the data acquired through desk study and onsite surveys.
- Undertake preliminary materials budget calculations in terms of volumetric peat / subsoil excavation and removal associated with Project design.
- Consider ground stability issues as a result of the Project, its design and methodology of construction.
- Assess the combined data acquired and evaluate any likely impacts on the soils, geology and ground stability aspects of the environment.
- If impacts are identified, consider measures that would mitigate or reduce the identified impact.
- Present and report these findings in a clear and logical format that complies with EIAR reporting requirements.

8.2.1.1 Assessment Principles

Direct impacts or effects on geological attributes or soils themselves are localised in the context of soils and geology (e.g., excavated soils from holes, stored and used as back fill). However, in many instances, these geological impacts give rise to the potential sources of contamination by water run off (i.e., indirect or secondary impacts) to ecological and hydrological receptors. For example: Contamination of soils / peat by cementitious material is considered a localised impact, however if cementitious contamination is intercepted by surface water features or groundwater bodies the impact is potentially regional depending in the environmental circumstances. Therefore, throughout this report references will be made to **Chapter 9: Hydrology and Hydrogeology,** for further detail and clarification on potential effects and mitigation measures of the Project.

8.2.2 Relevant Legislation and Guidance

This assessment complies with the EIA Directive, as amended, which requires Environmental Impact Assessment for certain types of development before development consent is granted. This assessment was undertaken in accordance with the following Irish legislation:

- Planning and Development Act 2000, as amended;
- Planning and Development Regulations 2001, as amended;

- Wildlife Act 1976, as amended;
- EC (Birds and Natural Habitats) Regulations 2011, as amended, and
- Heritage Act 1995, as amended.

The Cork County Development Plan (2022-2028) and Kerry County Development Plan (2022-2028) were also consulted as part of the EIA process.

This assessment has been prepared using, inter alia, the following guidance documents, which take account of the aforementioned legislation and policy:

- BSI (1999) Code of Practice for Site Investigations - BS 5930.
- CIRIA (2006) Control of Water Pollution from Linear Construction Projects – Technical Guidance (C649).
- Creighton, R. et al. (2006) Landslides of Ireland.
- Department of the Environment, Heritage and Local Government (DEHLG) (2006) Wind Energy Development Guidelines.
- Department of Housing, Planning, Community and Local Government (DHPLG) (2017) Interim Guidelines for Planning Authorities on Statutory Plans, Renewable Energy and Climate Change.
- Environmental Protection Agency (EPA) (2015) Advice Notes for Preparing Environmental Impact Statements – DRAFT September 2015 (will supersede 2003 version once finalised).
- Environmental Protection Agency (EPA) (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (supersedes 1997 and 2002 versions.)
- Environmental Protection Agency (EPA) (2022) EPA Map Viewer.
- Feehan, J. and O'Donovan, G. (1996) The bogs of Ireland.
- Geological Survey of Ireland (GSI) (2022) Geological Survey Ireland Spatial Resources.
- Gharedaghloo, B. (2018) Characterizing the transport of hydrocarbon contaminants in peat soils and peatlands.
- Institute of Geologists of Ireland (IGI) (2002) Geology in Environmental Impact Statements – A guide.
- IGI (2013) Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements.
- Irish National Seismic Network (INSN) (ND) Recent Earthquakes.
- Irish Wind Energy Association (IWEA) (2012) Best Practice Guidelines for the Irish Wind Energy Industry.
- Johnston, W. (2022) Physical Landforms of Ireland.

- National Roads Authority (NRA) (2008) Guidelines on Procedures for the Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.
- NRA (2008) Environmental Impact Assessment of National Road Schemes – A Practical Guide – Rev 1.
- NRA (2014) Guidelines for the Management of Waste from National Road Construction Projects
- NPWS (2017) Best practice in raised bog restoration in Ireland.
- NPWS (2015) National Peatlands Strategy.
- RSK (2022) Engineer's Quick Reference Guide for Ground Investigation.
- Scottish Forestry Commission (2006) "Guidelines for the Risk Management of Peat Slips on the Construction of Low Volume / Low-Cost Roads Over Peat".
- Scottish Government (2017) Peat Landslide Hazard and Risk Assessment: Best Practice Guide for Proposed Electricity Generation Developments.
- Scottish National Heritage (SNH) (2013) A Handbook on Environmental Impact Assessment.
- Teagasc (2022) Soil Map Viewer.

8.2.3 Desk Study

Desk top study assessments were undertaken (2020-2023) on the soils and geology aspects of the Project before and after field investigations. This involved the following components:

- Acquire and compile all available maps of the Project, November 2022.
- Study and assess the proposed locations of turbines, Site Access Roads relative to available data on Site topography and slope gradients, November 2022.
- Study and assess the proposed locations of turbines, Turbine Delivery Route and an assessment of the Grid Connection Route, connecting the Development to the national grid, substation and associated infrastructure (e.g., potential borrow pit locations, typical drainage infrastructure) relative to available data on Site soils, subsoil and bedrock geology, November 2022 – March 2023.
- Overlay Ordnance Survey of Ireland (OSI) 1:250,000, 1:50,000 and 1:10,560 (6") maps with AutoCAD plan drawings, November 2022.
- Overlay Geological Survey of Ireland (GSI) Geology maps (1:100,000) to determine Site bedrock geology and the presence of any major faults or other anomalies, November 2022.
- Overlay Geological Survey of Ireland (GSI) Groundwater Resources (Aquifers), Groundwater Vulnerability, and Groundwater Recharge maps to determine Site sensitivity in terms of groundwater, November 2022.

- Overlay Geological Survey of Ireland (GSI) Landslide Susceptibility maps to determine Site landslide susceptibility risk classification, November 2022.
- Overlay Environmental Protection Agency (EPA) and Teagasc (Agricultural Agriculture & Food Authority) Soils and Subsoil maps (1:50,000) to determine categories of soils and subsoil and indirectly the geochemical origin for the study area, November 2022.
- Search of the GSI databases and publications in relation to geological extractive resources and mineral localities in the region, November 2022.
- Search of the GSI landslide database for records of landslide mass movement events at and near the study area, November 2022.
- Search of the GSI karst database for records of karst features at and near the study area, November 2022.
- Search of the GSI wells and springs database for records of wells or springs at and near the study area, November 2022.
- Search of National Parks and Wildlife Service designated sites in the region, November 2022.

8.2.4 Field Work

8.2.4.1 Field Work Preliminary Geotechnical Investigations, Site Walk Over and Observations

EIA team personnel (Sven Klinkenbergh – Project Manager), carried out field investigations at the Site of the Project between January and February 2019, as well as September 2020 and November 2022. These works consisted of the following:

- Bedrock and mineral subsoil outcrop logging and characterisation.
- Confirm if peat is present at or near any Project locations.
- Peat depth probing if peat is present (depth to bedrock and/or competent subsoil).
- Gouge coring if peat is present (peat and subsoil characterisation to BS 5930 and Von Post Humification scale).
- Trial holes in mineral soil to validate desk study findings.
- Borehole in bedrock to validate to desk study findings.
- Slope measurements at proposed turbine locations to determine slope gradient.
- Recording of GPS co-ordinates for all investigation and monitoring points in the study.
- Digital photography of significant features.

Initial Site walk overs were carried out to assess general ground conditions including topographical characteristics, and to observe the existing Site including visual assessment of the receiving environment in terms of impacts arising from the existing infrastructure and practices at the Site.

8.2.5 Evaluation of Potential Effects

8.2.5.1 Sensitivity

Sensitivity is defined as the potential for a receptor to be significantly affected by a proposed development.[1] Potential affects arising by a proposed development in terms of soils and geology will be limited to a localised scale, and therefore in describing the sensitivity of soils and geology it is appropriate to rate such while considering the value of the receiving environment or site attributes.

The following table presents rated categories and criteria for rating site attributes. [2]

Table 8.1: Criteria for Rating Site Attributes – Soils and Geology Specific

Importance	Criteria
Extremely High	Attribute has a high quality or value on an international scale.
Very High	Attribute has a high quality, significance or value on a regional or national scale.
High	Attribute has a high quality, significance or value on a local scale.
Medium	Attribute has a medium quality, significance or value on a local scale.
Low	Attribute has a low quality, significance or value on a local scale.

Considering the above categories of rating importance and associated criteria, the following table presents rated sensitivity categories. [3]

Table 8.2: Criteria for Rating Site Sensitivity – Landscape Character Specific

Importance	Criteria
High Sensitivity	Key characteristics and features which contribute significantly to the distinctiveness and character of the landscape character type. Designated landscapes e.g., National Parks, Natural Heritage Areas (NHAs) and Special Areas of Conservation (SACs) and landscapes identified as having low capacity to accommodate proposed form of change, that is, sites with attributes of **Very High Importance**.
Medium Sensitivity	Other characteristics or features of the landscape that contribute to the character of the landscape locally. Locally valued landscapes which are not designated. Landscapes identified as having some tolerance of the proposed change subject to design and mitigation etc., that is, sites with attributes of **Medium to High Importance**.
Low Sensitivity	Landscape characteristics and features that do not make a significant contribution to landscape character or distinctiveness locally, or which are untypical or uncharacteristic of the landscape type. Landscapes identified as being generally tolerant of the proposed change subject to design and mitigation etc, that is, sites with attributes of **Low Importance**.

[1] Environmental Protection Agency (EPA) (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (supersedes 1997 and 2002 versions)
[2] NRA (2008) Environmental Impact Assessment of National Road Schemes – A Practical Guide – Rev 1
[3] Scottish National Heritage (SNH) (2013) A handbook on environmental impact assessment

8.2.5.2 Magnitude

The magnitude of potential impacts arising as a product of the Project are defined in accordance with the criteria provided by the EPA, as presented in the following table. [4]

Table 8.3: Describing the Magnitude of Impacts

Magnitude of Impact	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 Effects	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate Effects	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
Significant Effects	An effect which, by its character, magnitude, duration or intensity, alters a sensitive aspect of the environment.
Very Significant Effects	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.

In terms of soils and geology, magnitude is qualified in line with relevant guidance, as presented in **Table 8.4**. [5]

Table 8.4: Qualifying the Magnitude of Impact on Soil and Geological Attributes

Magnitude of Impact	Description	Example
Large Adverse	Results in a loss of attribute.	Removal of the majority (>50%) of geological heritage feature.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute.	Removal of part (15-50%) of geological heritage feature.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute.	Removal of small part (<15%) of geological heritage feature.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity.	No measurable changes in attributes.
Minor Beneficial	Results in minor improvement of attribute quality.	Minor enhancement of geological heritage feature.
Moderate Beneficial	Results in moderate improvement of attribute quality.	Moderate enhancement of geological heritage feature.
Major Beneficial	Results in major improvement of attribute quality.	Major enhancement of geological heritage feature.

[4] Environmental Protection Agency (EPA) (2022) Guidelines on the information to be contained in Environmental Impact Assessment Reports
[5] NRA (2008) Environmental Impact Assessment of National Road Schemes – A Practical Guide – Rev 1

8.2.5.3 *Significance Criteria*

Considering the above definitions and rating structures associated with sensitivity, attribute importance, and magnitude of potential impacts, rating of significant environmental impacts is done in accordance with relevant guidance as presented in the Table below.[6] This matrix qualifies the magnitude of potential effects based on weighting same depending on the importance and/or sensitivity of the receiving environment. In terms of Hydrology and Hydrogeology, the general terms for describing potential effects (**Table 8.3: Describing the Magnitude of Impacts**) are linked directly with the Project specific terms for qualifying potential impacts (**Table 8.4: Qualifying the Magnitude of Impact on Geological Attributes**) therefore, qualifying terms (**Table 8.5**) are used in describing potential impacts of the Project. This is largely driven by the likely far reaching impact which is characteristic of potential effects arising as a product of the Project in terms of the Geological and Soil environment. Far reaching impacts in terms of geology include impacts on the receiving surface water or groundwater bodies where impacts can occur downstream of the site, including at a catchment scale (**EIAR Chapter 9: Hydrology & Hydrogeology**).

Table 8.5: Sensitivity (Importance of Attribute) & Magnitude of Impact Matrix

Sensitivity (Importance of Attribute)	Magnitude of Impact			
	Negligible (Imperceptible)	**Small Adverse (Slight)**	**Moderate Adverse (Moderate)**	**Large Adverse (Significant to Profound)**
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant / Moderate	Profound / Significant	Profound
High	Imperceptible	Moderate / Slight	Significant / Moderate	Profound / Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

8.2.5.4 *Consultation*

A full list of scoping responses is set out in **Appendix 1.1: Consultation Responses**. A Scoping Report Consultation was made to Inland Fisheries Ireland in November 2020 in regards to contaminated site run-off and subsequent polluting of surface waters. Consultations were also undertaken at the same time with the Geological Survey Ireland in relation to geohazards and peat stability. Proposed mitigation measures in response to these potentials impacts are outlined in **Section 8.5** of this Chapter.

[6] NRA (2008) Environmental Impact Assessment of National Road Schemes – A Practical Guide – Rev 1

8.3 BASELINE DESCRIPTION

8.3.1 Introduction

An investigation of the existing land, soils and geology characteristics of the Study Area was conducted by undertaking a desk study (as set out in **Section 8.3),** consultation with relevant authorities(as set out in **Appendix 1.1** and **Section 8.2.5.2),** and Site-based fieldwork surveys(as set out in **Section 8.6**). All data collected has been interpreted to establish the baseline conditions within the Study Area and the significance of potential adverse effects have been assessed. These elements are discussed in detail in the following sections.

8.3.2 Site Description

The Site is located 5.9 km west of Ballyvourney, Co. Cork and shares the county boundary between Cork and Kerry. It is 54 km west of Cork City, and 23 km north-east of Kenmare, Co. Kerry. The Project is located within the townlands of Inchamore, Mileeny Derryreag and Derreenaling. The Site is characterised by relatively complex (hilly) topography with associated elevations ranging between 460 metres Above Ordnance Datum (m AOD) in the north-western side of the Site to 350 m AOD towards the eastern side of the Site. The Project is in contrast to on-going Site practices. The Site is characterised as being rural agricultural land generally, however there are a number of established wind farms in the region including Coomagearlahy Wind Farm, Coolknoohil Kilgarvan Wind Farm, Glanlee Wind Farm and Grousemount Wind Farm c. 2.7 km, 4.4 km 4.9 km, and 7.5 km southwest of the Site, respectively (**Appendix 2.3: Wind Farms within 20 km of Proposed Turbines**).

The Site extends to approximately 170 ha of which (c. 145.4 ha) largely consists of low yielding, commercial forestry owned by Coillte. The remaining land (24.6 ha) is third party property and the principal land use in the general area consists of a mix of agricultural sheep and cattle grazing, farmland, residential properties, agricultural structures and open mountain heath.

8.3.3 Land Use

Mapped land uses for the Wind Farm, Underground Cable Route and Turbine Delivery Route are presented in **Figure 8.2 a-b.**Error! Reference source not found.

Consultation with Corine (2018) Land Use maps (EPA) determined that the Site is mainly comprised of combination of '*Coniferous forests*' and '*Transitional woodland scrub*'. The Site is otherwise comprised of '*Land principally occupied by agriculture with significant areas of natural vegetation*' and '*Peat bogs*'. While the Site is principally used for commercial forestry along with areas of peat bogs, these spaces have been noted as being significantly impacted by agricultural practices including extensive land improvement works involving drainage and excavation and manipulation of natural soil profiles or horizons. For further information on extent of drainage see **Chapter 9: Hydrology and Hydrogeology**.

The Grid Connection Route traverses land principally classified as '*Forest and semi-natural areas'* along with '*Land principally occupied by agriculture and areas of natural vegetation',* within the Site redline boundary (c. 1.3 km). The remaining 18.6 km is located off-road and in third-party lands mapped as '*Conifer forests',* **(Figure 8.2b)** (Corine, 2018).

The Turbine Delivery Route from its origin in Ringaskiddy Port to the Project site crosses countless land uses, including: seaports, industrial and commercial units and discontinuous urban fabric near Cork city and transitions to pastures, arable land, stream courses, heterogeneous agricultural areas, coniferous forests and woodland scrub upon nearing the Project site.

8.3.4 Bedrock Geology

Mapped geology is presented in **Figure 8.3 (a).**Error! Reference source not found.

The mapped (GSI, Bedrock 100 k[7]) geological formation underlying the Site is classified as the Gun Point Formation (DUGNPT) **–** which is comprised of Green-grey sandstone & Purple siltstone.

Ranges of unconfined compressive strength of rock[8]:

- Sandstone is usually within the range of Weak (5-25 MPa) to Medium Strong (25-50 Mpa)
- Siltstone is usually within the range of Very Weak (1-5 Mpa) to Weak (5-25 Mpa).

Rock strength is strongly correlated to grain size but is affected by other characteristics such as layering and weathering. Sandstone is considered a relatively fine-grained rock; siltstone is comprised of finer constituents than sandstone.

There are a number of recorded faults associated with the underlying geological formation, however none of these faults are mapped as underlying the redline boundary of the Site.

[7] Geological Survey of Ireland (GSI) Spatial Resources. Online: https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228. Accessed: May 2021
[8] Norbury D. (2010) *Soil and Rock Description in Engineering Practice*. Whittles Publishing, Scotland, UK.

Similarly, there are several strikes and dips of structural bedding with 'way up unknown'. Consultation with GSI Geotechnical database indicates there is no available data for the underlying formations or in the general area of the Project.

Site investigation data, including drill logs are presented in **Appendix 8.1 IWF SI Report - Stability and Geotechnical Assessment.** Summary of bedrock data taken from **Appendix F 3188-A1 IWF SI – Borehole Log** is presented in **Table 8.6**. It is noted that the bedrock underlying the Site (Siltstone) is comprised by mainly silt sized particles (0.002 - 0.063 mm) (BS 5930).

Table 8.6: Summary Borehole Data

Parameter	(Ref. / Unit)	BH01
Geology	*Drill Log*	Red moderately weak SILTSTONE
Weathering	*Drill Log*	Relatively unweathered
UCS Results	*Kn*	56.7
UCS Results	*MPa*	12.57
Rock Strength (UCS MPa)	*BS EN ISO 14689*	Weak

8.3.5 Seismic Activity

The island of Ireland does experience, monitor and record seismic activity, although the magnitude of such occurrences is generally low and do not generally pose as a risk to infrastructure or human health. Seismic activity is monitored on an ongoing basis by the Irish National Seismic Network (INSN). Since 1980, a low number of earthquakes of <M5.0 (Richter magnitude scale (M)) have been detected in the Atlantic close to Ireland. Some relatively recent earthquakes detected on or near the mainland of Ireland include:

- An M2.4 earthquake which occurred on 07/04/19, the epicentre for which was located within Donegal Bay, and at a depth of 4 km.
- An M2.0 earthquake which occurred on 29/04/19, the epicentre for which was located approximately midway between Donegal Town and Lough Derg, and at 16 km depth.
- An M0.9 earthquake that occurred 20/08/21, the epicentre of which was located near the townlands of Lambstown at a depth of 8 km.

Although earthquakes are considered a triggering mechanism for landslides, given the low magnitude experienced in Ireland earthquakes are not considered an important triggering factor in terms of stability risks.[9]

8.3.6 Soils and Subsoils

Consultation with available soil maps (SIS, EPA, Teagasc) indicate the primary soil type across the Site is that of 'Blanket Peat' while smaller areas of the Site are classified as 'Peaty Gleys - Acid Poorly Drained Mineral Soils with Peaty Topsoil'; 'Acid Brown Earths / Brown Podzolics - Acid Deep Well Drained Mineral'; and 'Podzols (Peaty), Lithosols, Peats with some outcropping rock – Acid Shallow, lithosolic or podzolic type soils potentially with peaty topsoil' (**Figure 8.4a)**.

Consultation with available subsoil maps (GSI) indicate that subsoil types across the Site include mainly 'Blanket Peat' with small-scale portions of Sandstone Till and areas of Bedrock at or near the surface (**Figure 8.5a)**. Soils and subsoils across the entire Grid Connection Route are those of Blanket Peat, **Figure 8.4b** and **Figure 8.5b.** The Turbine Delivery Route traverses various soil types from the port in Ringaskiddy, however where works will be carried out **(Figure 8.4a Figure 8.5a),** soils and subsoils have been mapped as 'Blanket Peat'.

Several rocky outcrops have been mapped by the GSI, particularly at higher elevations - i.e., the north-western corner of the Site boundary and along the norther and eastern boundary of the Site. Furthermore, many minor rocky outcrops were also observed across the Site during Site walkovers. Thin peat and exposed rock were observed at existing cut and fill locations, in particular along the existing Site Access Roads associated with agricultural and forestry practices in the area **(Appendix 9.2 -** Error! Reference source not found.**IWF Photographs).**

Site investigation data, including Peat depths, trial pit logs and photographs are presented in the SI Report in **Appendix 8.1**. Summary of peat depths (refer to **Appendix A**) and subsoil particle size distribution (PSD) data (refer to **Appendix G**) are presented in **Table 8.8** and **Table 8.9,** respectively.

[9] Creighton, R., Doyle, A., Farrell, E. R., Fealy, R., Gavin, K., Henry, T., Johnston, T., Long, M., McKeown, C., Pellicer, X., Verbruggen, K. (2006) "Landslides in Ireland" *Geological Survey Ireland: Irish Landslides Working Group.*

Table 8.7: Reported Subsoil Description (Appendix G 3188-A1 IWF SI- Subsoils Lab Certs).

Sample ID	Reported Description (PSD)
TP03-A2 (SS1)	Very clayey very sandy GRAVEL
TP08-A2 (SS1)	Slightly sandy gravelly CLAY
TP11-A2 (SS1)	Very clayey very sandy GRAVEL

8.3.6.1 Peat Depth

The results of the Peat Depth Probing and Gouge Coring surveys are presented in the SI Report of **Appendix 8.1** as well as **Appendix A** and **Appendix B**.

Peat depths at survey points (150 No.) range from 0.00 m to >3.00 m. Peat depths were generally shallow. Isolated minor areas of moderately deep peat were observed at some locations, particularly in the northwest corner of the Site near the proposed location of T1.

Peat depths have been mapped by category (**Table 8.9**) and presented in **Appendix A.** Certain peat depths are associated with particular hazards and constraining characteristics in terms of infrastructure construction methodology. Peat depth of 2.0 m or greater is considered '*deep*' or '*deeper*' peat, and in extensive areas of peat which is >2.0 m depth excavation and construction activities become greatly more complicated and present greater risk.

Table 8.8: Peat Depth Distribution by Peat Depth Category (Appendix A-1 to A-5: 3188-A1 IWF SI - Peat Depth)

Peat Depth Category	No.	%
A - Rock (0.00 - 0.01 m)	16	11%
B - Very Shallow (0.01 - 0.5 m)	80	53%
C - Shallow (0.5 - 2.0 m)	42	28%
D - Moderately Deep (2.0 - 3.5 m)	11	7%
E - Deep (3.5 - 5.0 m)	1	1%
F - Very Deep (>5.0 m)	0	0%
Total	150	

8.3.7 Geological Resource Importance

Consultation with available maps (GSI) indicates that there are no recorded 'Geoheritage' sites located within the redline boundary of the Site or within the near vicinity. Furthermore, the GSI database does not indicate any Mineral Localities or Quarries within or near the vicinity of the Site.

8.3.8 Landslide Susceptibility

Peat, subsoil and slope stability assessments for the Site including the Wind Farm and Underground Cable Route are presented in **Figures 8.6 (a - b) Landslide Risk and Events**. The majority of the Turbine Delivery Route (TDR), traverses existing national and regional roads and is generally mapped as 'Low' risk to landslide susceptibility. The area of proposed works along the Turbine Delivery Route, involving approximately 1,870 m^2 of upgrading off the N22, is mapped over areas of 'Moderately High' and 'Moderately Low' Landslide susceptibility as mapped by the GSI (2023) (**Figure 8.6a**).

Geo-Hazards in relation to the Project are detailed in **Appendix 8.1** and presented in **Appendix 8.1 - Appendix H (a - c) as well as Figure 8.7.** Conclusions are summarised in the following sections.

8.3.9 Peat Slide Risk Assessment

Conclusions made here are drawn with reference to Error! Reference source not found.**Appendix A** and **Appendix I**. For further information and context in regard to methodology and definitions, refer to **Section 2** of **Appendix 8.1**.

Peat depth across the Site is generally shallow with the exception of minor isolated areas of deeper peat delineated by shallow subsoils and/or bedrock at or near the surface (**Appendix A of Appendix 8.1**). There was no very deep peat observed at the Site (>5.0 m). Considering this, there remains a residual risk at the Site, it is also important to distinguish between types of landslides, the material in question and associated receptor. With reference to **Appendix 8.1**, the risk of significant peat landslide events occurring at the Site is low given the depth of peat at the Site. However, the Site also possesses a degree of elevated risk in terms of subsoil stability . Subsoil, or till landslide events are generally characterised as relatively isolated, see **Plate 1** below, in comparison to the fluid nature of peat landslides. Nonetheless, a significant movement of subsoils at the Site, if intercepted by the downgradient surface water network at the Site can have similarly devastating consequences to that of a significant peat landslide.

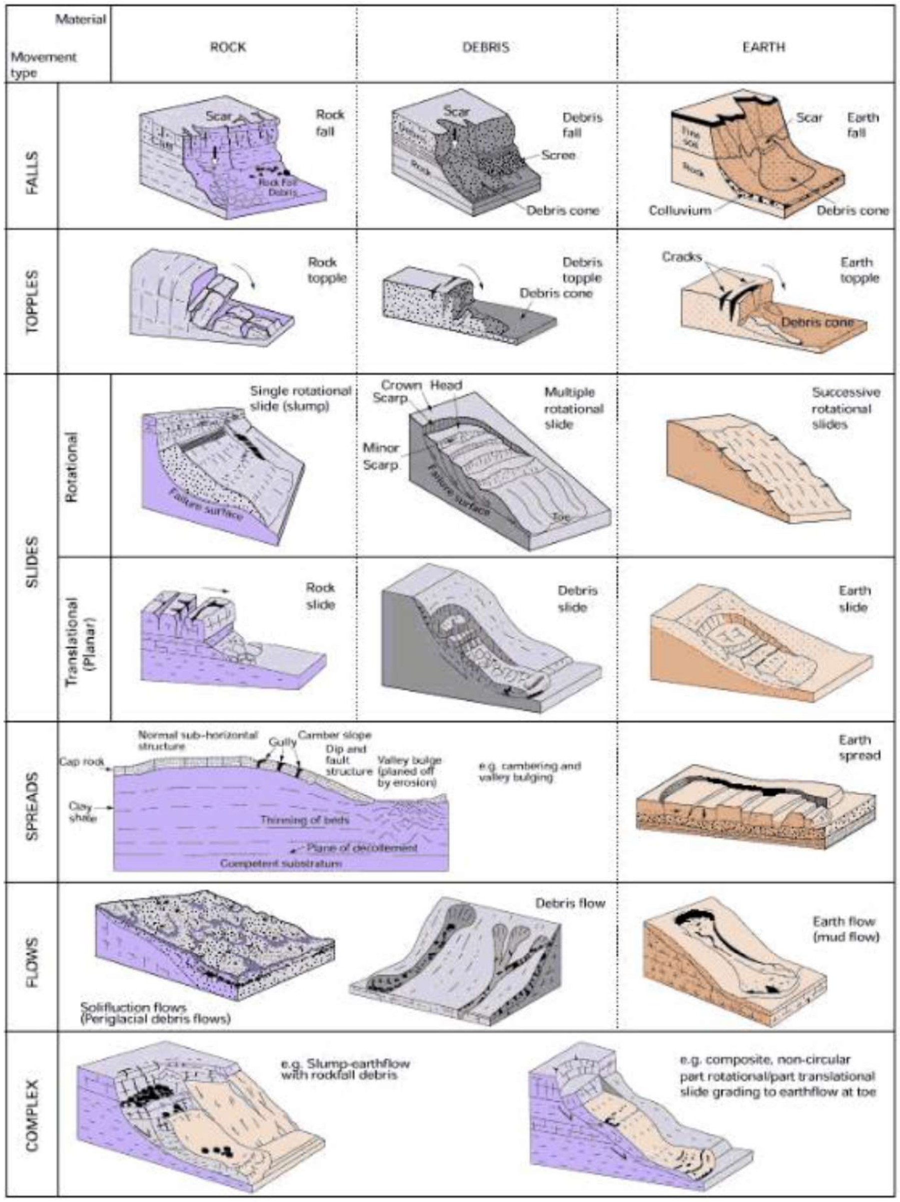

Plate 1: Illustration classifying types of landslides. Image from Razin, 2012.[10]

The Factor of Safety (Adjusted) (Conservative approach*: Scenario B i.e., +1 m surcharge relative to baseline conditions, or Scenario A) at peat probe locations is generally Acceptable with the exception of one marginally stable point location associated with deeper peat and/or steeper inclines.

* This conservative approach, in combination with conservative values used in the stability risk assessment (e.g., conservative values for moisture content, shear strength etc)

[10] Bazin, S. (2012) "SafeLand guidelines for landslide monitoring and early warning systems in Europe- Design and required technology" *ResearchGate.*

(**Appendix 8.1, Section 2.2.5**) is highly sensitive to and bias towards worst case environmental conditions in terms of peat or slope stability. This gives added confidence in sample locations which are classified as acceptable, and marginally stable or unacceptable stability sample points can be identified, interrogated and further risk assessed.

The Risk Ranking (Distance) Scenario B i.e., +1 m surcharge) at peat probe locations is generally Very Low to Low with the exception of Moderate or High-risk point locations associated with deeper peat and/or steeper inclines and/or close proximity (within a receptor buffer zone) to sensitive receptors.

Refer to **Appendix 8.1 – Stability & Geotechnical Assessment – Section 4** for full risk assessment results.

Factor of Safety (FoS) at all trial pit locations are 'Acceptable'. Note: Trial pit locations are limited relative to extent of Project footprint. Subsoil stability is considered to be acceptable across the Site with the exception of areas with all or a combination of the following factors: steep incline, deep till deposits, iron pan, high risk landslide susceptibility, potential for impacted hydrogeological conditions. These Geo-Hazards are identified in the following table/s and a register of Geo-Hazards is presented in **Appendix H (a – c)**. The term "Inferred" which accompanies some risk assessment conclusions is associated with areas with limited data due to access (excavator carrying out trial pits) or inferring hazards such as the presence of iron pan in subsoils from near adjoining trial pits (**Appendix H**). This is in line with the interpretation of survey and available site investigation (SI) data, particularly in preliminary SI phases (**Appendix 8.1**).

8.3.10 Subsoil Slide Risk Assessment

With reference to **Appendix 8.1, Table 15 and Table16** and **Appendix 8.1 – App B Peat Database,** subsoils underlying the Site are characterized generally as 'Clayey, silty, sandy, GRAVEL (or TILL) with cobbles and boulders'.

The Factor of Safety (Adjusted) (Scenario B i.e., 1 m surcharge) at trial pit locations is generally 'Acceptable' with two recorded marginally stable point locations at TP04 near the proposed location of T4, and TP11 near the proposed location of T2, **Plate 7 – Appendix 8.1.**

The Risk Ranking (Distance) (Scenario B i.e., 1 m surcharge) at trial pit locations is generally Very Low to Low with the exception of two Moderate risk point locations at TP10 and TP11, near the proposed location of T2, **Plate 7 – Appendix 8.1.**

Refer to **Appendix 8.1 – Stability & Geotechnical Assessment – Section 4** for full risk assessment results. **SI Appendix H (a – c),** details elevated risk identified (inferred) in areas possessing deeper tills and steep inclines, particularly in areas with potential for iron pan and hydrogeological impacts. Iron pan formations are associated with impervious layers within the subsoil profile. Where water would normally freely drain, percolating to groundwater, upon encountering an iron pan formation, would then either be deflected laterally or have the potential to develop a perched or high-water table.[11] [12]

8.3.11 Designated & Protected Areas

The Project is not within any designated or protected areas **(Figure 9.11a**). Any potential impacts to Soils or Geology are not considered to have direct impacts to downgradient designated sites, however entrainment of soils in runoff is a potential impact of the Project covered under **EIAR Chapter 9: Hydrology and Hydrology.** Stockpiling of material along the proposed Grid Connection Route will require particular attention in terms of the placement and management of runoff and construction water, as the route runs parallel to the designated Natural Heritage Areas (NHA) and Special Areas of Conservation (SAC) of Killarney National Park, approximately 40 m from proposed works in some areas (**Figure 9.11b**).

8.4 ASSESSMENT OF POTENTIAL EFFECTS

8.4.1 Significance Rating

Given the condition of the Site in terms of land use practices, peat and soil quality, bedrock quality etc., Land, Soils and Geology as environmental attributes at the Site are considered to be of Medium Importance i.e., *Attribute has a medium quality, significance or value on a local scale* (**Section 8.3.5**). The Grid Connection Route (GCR) and Turbine Delivery Route (TDR) are similar; however, these features generally follow existing or proposed roads / tracks.

[11] Teagasc (1982) "Some Relationships of Drainage Problems in Ireland to Solid and Glacial Geology, Geomorphology and Soil Types", *The Agriculture and Food Development Authority*.
[12] Waddington, J., Rotenberg, P. and Warren, F. (2001) "Peat CO2 production in a natural and cutover peatland: Implications for restoration", *Biogeochemistry* 54, pp. 115–130.

With reference to **Section 8.2.5** of this report and as summarised in **Table 8.9: Weighted Rating of Significant Environmental Impacts – Within the Footprint of the Site**, the geological attributes within the Site are considered to be of **Low to Medium Importance** and **Low to Medium Sensitivity**, and therefore classification of any potential impacts associated with the Project will be limited to Magnitudes associated with **Medium Importance**, where by the Site attributes (Land, Soils and Geology) are considered to be of "*medium quality, significance or value on a local scale*".

Table 8.9: Weighted Rating of Significant Environmental Impacts – Within the Footprint of the Site

Sensitivity (Importance of Attribute)	Magnitude of Impact			
	Negligible (Imperceptible)	**Small Adverse (Slight)**	**Moderate Adverse (Moderate)**	**Large Adverse (Significant to Profound)**
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

In terms of determining and assessing the magnitude of impacts, categories of magnitude relate to the scale of the attribute, that is the attribute/s driving the classification of sensitivity is the area of the Site, and therefore scale is relative to the area of the Site itself. That is, the area of the Site is approximately 170 ha, and the area of the footprint of the Development is approximately 31 ha(approximately 17.1%) of the area of the Site. This means that the land take associated with the Project is considered a negative, Moderate Adverse magnitude (Moderate (15- 50% area) impact on attribute with Medium importance), localised impact of the Project.

8.4.2 Do Nothing Impact

Site investigations of the baseline geological and geotechnical conditions of the Site indicate the following:

The Site has already experienced impacts to baseline conditions due to the land use practices **(Figure 8.2a** and **Appendix 9.2)** including agricultural (pastures, extensive drainage) and commercial afforestation activities (**Section 8.4).**

- There is no indication that current land use practices have had adverse impacts in terms of ground stability, with the exception of enhanced erosion in underlying tills at a localised scale.
- The cumulative impact of afforestation on the Site appears to be the excavation of soil to construct drainage ditches and localised drainage of the soil, and varying degrees of

soil erosion due to constructed roads and tracks, constructed drainage, vehicular movements, livestock movements etc.

Should the Project not proceed, the existing land-use practices will continue with associated modification of the existing environment.

8.4.3 Construction Phase Potential Effects

8.4.3.1 Typical Sequence of Events in Wind Farm Construction on the Receiving Environment

The following sections outline and summarise the general stages and elements of construction related to the Project. Detailed assessment of effects follow in the subsequent headings.

8.4.3.1.1 Activities – Premitigation

1. Site Investigation

2. Site Preparation:
   - Install Surface Water Monitoring Equipment.
   - Install Silt Screens, Interceptor Drains, and SuDS.
   - Prepare construction areas for compounds and facilities.
   - Clear Vegetation and Topsoil.
   - Excavate and grade the area for the construction of access tracks, hardstand areas, foundations, and other significant infrastructure units.

3. Access Track and Hardstand Areas:
   - Install silt screens, interceptor drains, and SuDS
   - Clear vegetation and excavate topsoil, subsoil, and bedrock.
   - Temporarily stockpile arisings.
   - Install drainage structures and erosion control measures, such as culverts and SuDS
   - Construct the road base and hardstand using suitable materials, such as crushed rock or concrete.
   - Construct hardstand areas for the installation and maintenance of wind turbines.
   - Use designated temporary stockpile areas and segregation of materials for different types of material, including materials arising at the Site, and being imported to the Site.

4. Drainage & Sustainable Drainage Systems (SuDS):
    - Install drainage and Sustainable Drainage Systems (SuDS)
    - SuDS maintenance, including during construction phase.

5. Watercourse crossings and culverts:
    - Design and plan the culvert to meet the required hydraulic capacity and align with the watercourse's natural flow pattern.
    - Install silt screens and sediment traps upstream of the construction area to intercept, manage, and divert runoff, reduce entrainment of solids and capture sediment, and prevent it from entering the watercourse.
    - Excavate the area for the culvert installation.
    - Construct the culvert.
    - Backfill the area around the culvert
    - Install headwalls or other associated infrastructure.
    - Restore the natural watercourse flow.

6. Clear Span Bridges:
    - Design and plan the clear span bridge to meet the required hydraulic capacity and align with the watercourse's natural flow pattern.
    - Prepare the area for the bridge construction.
    - Construct the bridge abutments and piers using suitable materials.
    - Install the bridge beams or arches using suitable materials.
    - Backfill the areas around the abutments and piers with suitable materials.
    - Restore the area.

7. Foundations:
    - Excavate and Backfill: To construct the wind turbine foundation, the area will be excavated to the required depth and diameter. Turbine foundation locations will be excavated to dimensions: 2.8 m to 3.2 m depth, 22 m to 25.5 m diameter The area around and above the Turbine Foundation will be backfilled with compacted stone or crushed rock.
    - Form and Pour Foundation: Shuttering and membranes are used to form the foundation pour structure, and foundation reinforcement steel rebar is installed and formed. Concrete is then poured into the foundation structure.

8. Other Significant Infrastructure Units:
    - Construct Infrastructure Units: Other significant infrastructure units, such as substation buildings, electrical cabling, and meteorological masts, will be constructed using suitable materials such as concrete or steel. Temporary infrastructure units such as temporary stockpile areas are also included here.
    - Install Drainage Structures and Erosion Control Measures: As with access track and hardstand areas, drainage structures and erosion control measures such as culverts and erosion control blankets will be installed for other significant infrastructure units.

9. Site Restoration:
    - Backfilling: Excavation areas, such as those where wind turbine foundations were installed, will be backfilled with suitable materials.
    - Soil and Vegetation: Topsoil that was removed during the Site preparation phase will be redistributed.
    - Waste Management: Waste arising from construction activities, including general construction waste and/or excess soils will be removed from site to a licenced waste management facility. The nearest licenced waste facility is over 20 km south-east of the Site in Codrum, Macroom, Co. Cork (Civic Amenity Services).

8.4.3.2 Land Take

Land take will be required during the construction and operation of the wind farm. This will be required for the construction of site access roads, turbine foundations, the onsite substation and the meteorological mast. Temporary land take will be required to facilitate the laying of grid connection cable ducting both on and off the Site. Long-term land take associated with the Wind Farm Development are covered in **Section 8.5.4 Operational Phase Potential Effects**.

8.4.3.2.1 Land Take Turbine Delivery Route

Land take will be required for the Turbine Delivery Route, although a majority of the Turbine Delivery Route will traverse already existing roadways (i.e., existing access tracks, public and local road networks from Ringaskiddy.

Works are required for road strengthening and widening along the Turbine Delivery Route at the existing forest road off the N22 and the temporary access road off the N22 to facilitate a 180-degree turning manoeuvre. Typical widening and strengthening work generally involve digging out road verges to c. 0.4 m and replacing them with compact stone to support heavy plant machinery. Topsoil will be used to dress the top of stone upon completion of construction deliveries.

Considering the scale of disturbance (relatively small area and shallow excavation along with superficial paving) at the N22 turning point location and Site Entrance, the effect is considered to be **small-scaled, direct, adverse, slight, localised, and permanent but reversible.** The probability of this effect occurring is **unavoidable** during the construction phase but conforms to baseline conditions e.g. existing public roads. With appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

Land take associated with the Turbine Delivery Route and Grid Connection Route will be limited to the Construction Phase of the Project.

8.4.3.2.2 Land Take Grid Connection Route

Minimal land take is required for the Grid Connection Route considering the line will principally be buried in or directly adjacent to existing roadways, totalling 19.9 km. The proposed grid route will follow the old route of the N22 before following forestry tracks to the existing Ballyvouskill Substation. Any potential effects are described similarly to general land take, however considering the small scale of disturbance, shallow cable trench (c. 1.22 mbGL by 600 mm wide), the effect is considered to be **small-scaled, direct, adverse, localised, permanent but reversible and slight**. The probability of this effect occurring is **unavoidable** during the construction phase but conforms to Baseline conditions e.g., existing public roads and services. With appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

8.4.3.3 Clear Fell of Afforested Areas

Felling of forestry at the Site will be necessary for areas of the Project in afforested sections within the Redline Boundary. This is an **unavoidable** consequence of the Project during the construction phase. The Site contains 145.4 ha of commercial forestry. Turbines T2, T3, T4 and T5 are within afforested areas. Subsequently, tree felling will be required as part of the Project To facilitate the construction of access roads, civil works, site compounds, borrow pits and Turbine Hardstands, 25.68 ha coniferous forestry will need to be clear-felled. The likely felled area of approximately 25.68 ha will represent approximately 15.11% of the proposed Site area (170 ha). In a spatial or land use context this is considered a **slight** to **moderate** scale impact, limited to the extent of the Project footprint and turbine buffer felling zones.

The clear fell of afforested areas is **in line with baseline conditions** and future activities as part of Do-Nothing impact. Therefore, in the context of the Project, the clear fell of forestry overall is considered **neutral**, however there is a range of potential **direct**, **adverse** impacts associated with the activity which will require management and mitigation. Potential effects include:

1. Soil erosion, compaction and degradation: The removal of trees and underbrush during clear-felling can expose soils to wind and water erosion, leading to soil loss, compaction and degradation. This is mainly caused by vehicular movements (**Section 8.4.3.8 Vehicular Movements**).
2. Geology: Clear-felling can cause changes in the geology of an area, leading to soil instability, landslides, and other geological hazards (**Section 8.4.3.6 Ground Stability** .
3. Hydrology & Hydrogeology: The removal of trees and vegetation can lead to changes in hydrological processes, causing changes in water flow rates and patterns, such as the lowering of water tables (**Chapter 9: Hydrology and Hydrogeology)**.
4. Water quality: Clear-felling can cause increased sediment runoff and nutrient pollution in waterways, which can impact water quality, negatively affecting aquatic ecosystems and downstream water users.
5. Soil nutrient loss and nutrient loading of receiving waters: Clear-felling removes vegetation and leaves soil bare, exposing it to weathering, which can cause the entrainment of solids and/or the loss of soil nutrients, essential for plant growth. This in turn will lead to an increase in nutrients i.e., Nitrogen and Phosphorous compounds, dissolved organic carbon, potassium etc. in receiving waters flowing from the Site, which is considered a negative impact of the Project (this is discussed in greater detail in **Chapter 9: Hydrology and Hydrogeology**).

Mechanism/s:	• Construction activities; Excavation, handling/transport, temporary storage of soils / subsoils / bedrock, vehicle tracking. • Erosion in areas impacted by construction activities. • Erosion in areas with newly formed preferential pathways for water runoff. • Peat / slope stability, significant or localised. • Reinstatement activities; similar to construction.
Impact	• Erosion of soils and release of suspended solids entrained in runoff, intercepted by surface water network.

	• Compaction of soils, potentially reducing recharge capacity etc.
Receptor/s:	• Soil and subsoil structure and lithology. • Surface Water. Surface water quality, ecological sensitivities and WFD status.

The overall potential effects here are considered to be of **moderate** significance**, permanent but reversible**, and **adverse**, though this is of a minor scale in comparison to the normal forestry activities taking place at the Site (i.e., small-scale felling proposed). If the Project does not take place, it is likely that the forestry at the Site will eventually either be clear felled or felled in larger volumes than the amount proposed as a function of this Project. Therefore, the resulting incremental felling of the afforested area will benefit the receiving environment, namely the receiving surface water network by means of reducing the potential magnitude of impacts, namely erosion, solids entrainment, and shock nutrient and sediment loading. With appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

8.4.3.4 Subsoil and Bedrock Removal

Subsoil and bedrock removal will occur during construction excavations and is an **unavoidable** consequence of the Project for turbine bases or other foundations, as well as the removal of bedrock material from the Site borrow pit. Removal of the soil and bedrock is considered to be a **permanent** effect if breaking into competent bedrock.

The removal of soils and bedrock has the potential to result in the release of contaminants, particularly suspended solids to the receiving environment during the construction phase of the project, and to a lesser extent during the operational phase relative to baseline conditions. No further subsoil or bedrock removal will be required during operation. However, to note this effect conforms to baseline conditions in terms of the development of forestry track operations.

The amounts of subsoil and bedrock to be removed are laid out in construction and excavation plans, specified in **EIAR Chapter 2: Project Description** and **Appendix 2.1: Construction Environmental Management Plan (CEMP), Management Plan 4.** The volume of excavated material which is to be stored in the on-site borrow pit is 81,215 m³ and considered to be **large-scale** when considering the footprint of the Development.

Although there is the potential for **direct**, **adverse, slight to moderate** significance effects on the local geology, there are a number of indirect or secondary effects including the potential for entrainment of suspended solids in runoff and increasing groundwater vulnerability by decreasing the depth to the water table. These effects are discussed further under **EIAR Chapter 9: Hydrology and Hydrogeology.**

Subsoils and weathered bedrock, when segregated and managed, will be reinstated similar to baseline conditions, and therefore effects are **temporary**, however breaking of competent bedrock cannot be reinstated to baseline conditions.

Worst case scenarios include the triggering of a significant localised peat-landslide or mass movement event, a potentially profound if in close proximity to receptors, and permanent adverse impact, refer to **Appendix 8.1: Site Investigation & Stability Risk Assessment Report.**

The approach and methodology in which excavation of in-situ earth materials is undertaken is very important for ground stability in any environment. Excavation has the potential to cause slippage or mass failure under certain geotechnical and hydrological conditions, for example excavating in deep saturated peat on, above or below steep inclines in peatland areas during periods of extensive rainfall.[13] The proposed location of turbines avoids areas with steep to severe inclines. **(Appendix H)**. Nonetheless, the degree of slope steepness will be considered when excavating material i.e., cut and fill, sidewalls of open excavations, movement and management of material etc. Refer to **Appendix I** and **Appendix 2.1**: **CEMP, Management Plan 4 Peat and Spoil Management Plan.**

Mitigative and reductive measures with regard to materials budget handling and potential indirect impact on water quality from mineral subsoil and bedrock excavation activities are outlined in the mitigation section of this report. With these applied mitigation measures, planning and management this effect and disturbance can be minimised.

Mechanism/s:

- Construction activities; Excavation, handling/transport, temporary storage of soils / subsoils / bedrock, vehicle tracking.
- Erosion in areas impacted by construction activities.
- Erosion in areas with newly formed preferential pathways for water runoff.

[13] Feehan, J. and O'Donovan, G. (1996) "The bod of Ireland: an introduction to the natural, cultural and industrial heritage of Irish peatland" *University College Dublin – The Environmental Institute*.

	• Peat / slope stability, significant or localised. • Reinstatement activities; similar to construction.
Impact	• Erosion of soils and release of suspended solids entrained in runoff, intercepted by surface water network. • Compaction of soils, potentially reducing recharge capacity etc.
Receptor/s:	• Soil, subsoil and bedrock structure and lithology. • Surface Water. Surface water quality, ecological sensitivities and Water Framework Directive status.

8.4.3.4.1 Excavations

Excavations will be required for most aspects of the Project including for turbines, Turbine Hardstands, Site Access Roads, works along the turning point (off the N22), temporary construction compound, cable trenches, Met Mast, and Grid Connection Route. Estimates of excavation volumes are presented in **Table 2.5 and Table 2.6 of EIAR Chapter 2: Project Description**.

Increased excavation and peat / soil / subsoil / bedrock removal activity will be concentrated to particular locations of the Project during the construction phase, including the site entrance, load bearing portions of turbine hardstands, turbine foundations, site borrow pit, and works associated with the improvement or construction of watercourse crossings and culverts. All the above combined are considered to be **moderate to large in scale**, however, conforms to baseline conditions at the Site with forestry operations.

The excavation and removal of soils and bedrock to facilitate construction is a **direct, unavoidable, adverse, slight to moderate significance, localised** impact of the Project, and is considered **permanent but reversible,** in instances where reinstatement is proposed (i.e., Borrow pit location). However it is important to note that excavation activities, in particular spoil management / temporary or permanent stockpiles, and vehicular movements can trigger indirect or secondary impacts such as localised stability issues and / or impacts on the receiving surface water or drainage network, leading to a **potentially profound**, and **permanent adverse** impact, refer to **Appendix 8.1 – SI Report, Appendix H (a – c) IWF SI Geo-Hazards,** and **Appendix I (a – c) Peat and Subsoil Stability Risk Assessments**. These impacts are discussed in the following sections. With appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

8.4.3.4.2 Site Access Roads

Site Access Roads are required to accommodate the construction works and to provide access to the turbine locations for the whole life cycle of the wind farm. According to **Table 2.3** of **EIAR Chapter 2: Project Description**, 3,102 m of the existing Site Access Road will be upgraded during the construction phase, involving widening the roads to cater for larger vehicles and loads. Upgraded Site Access Roads will be approximately 6,203 m^2 in surface area and will require approximately 1,400 m^3 of crushed stone material.

There will also be 3,555 m of new Site Access Roads required for the Project. These will be constructed to provide a width of 4.5 m and 5.5 m at bends and will cover an area of 15,998 m^2 and require 1,700 m^3 of crushed rock. In total the construction of Site Access Roads is considered to be **moderate to large scale** effect.

These roads will be excavated to a level where the underlying soil or rock that can bear the weight of traffic without shifting or compressing. They will be constructed using rock from the on-site borrow pits and capping stone from nearby quarries listed in section. All imported stone to the Site will undergo appropriate quality testing. When weathered, the stone will not contain any constituents which may be harmful to the environment, surface and groundwater in particular. Permeable geotextile will be placed at the base of access tracks, as part of their design.

The formation of Site Access Roads will have a **slight to moderate**, **adverse, direct**, **permanent but reversible** effect of the Project This effect will be limited to the footprint of the Project and is considered **unavoidable**, while conforming to baseline conditions of forestry operations. With appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

8.4.3.4.3 Turbine Foundations and Turbine Hardstands

The material encountered at each turbine and infrastructure location is considered to be mostly shallow peat overlying bedrock, with some moderately deep peat near the proposed T1 location, **Appendix 8.1 - App A1**. Minor areas of glacial till may also be encountered locally, as presented in **Figure 8.4a**. It is likely that excavations for the majority of infrastructure will be taken down to bedrock; the depth of the excavation required for the Turbine Foundations will range from 2.8 m to 3.2 mbGL).

Excavations will require granular fill material to upfill the excavation to the levels required for construction. It is proposed that the granular fill material will be obtained from the Borrow Pit i.e., maintaining local geo and hydro chemistry. Ground investigations in the form of peat probing and gouge coring has been carried out along the proposed Turbine Hardstand locations to inform the depth of excavation and upfill required. As set out in **Table 2.6** of **EIAR Chapter 2: Project Description,** approximately 7,250 m^3 of material will be excavated for turbine foundations. Of this 1,562 m^3 will be peat, 3,083 m^3 will be subsoils and 2,605 m^3 will be bedrock.

Excavated rock will be reused as hardcore at hardstanding areas and Site access tracks. Subsoils facilitate the construction of soil berms and reinstating the Borrow Pit post construction and peat will be used as backfill to foundations and to reinstate the borrow pit post construction.

Any imported material, if necessary, will be fully tested in accordance with industry standards. Only verified clean, inert material will used.

The Temporary Construction Compound and Electrical Sub-Station will measure approximately 9,907 m^3 and will require similar foundations to those of Turbine Hardstands. Substation southern portion of the Development. Of this excavated material approximately 1,385 m^3 will be peat and 8,522 m^3 will be subsoils.

The likely effects associated with excavations at hardstand areas are considered to be **direct**, **slight to moderate, adverse** (in terms of overall project scale), **permanent** (life of project) and **reversible** through reinstatement during the decommissioning phase of the Project. With appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

8.4.3.4.4 Borrow Pit

One borrow pit will be constructed as part of the Project . The proposed borrow pit is located c. 20 m to the east of T5 hardstand and will measure 38,674 m^2. The borrow pit will provide 50,276 m^3 excavated material to be used as fill for roads, hardstands, backfill for foundations and the temporary compound.

The borrow pit will be excavated only as required to reduce the need to transport material to the Site. Where rock and fill material are available from the excavation of Turbine Foundations this hardcore material will be used first.

The likely effects associated with the removal and replacement of subsoil and bedrock at excavations for the on-site Borrow Pit are considered to be **unavoidable**, **direct, adverse** and **moderate to large** (in terms of overall project scale), **slight to moderate**

significance, permanent and **reversible** in terms of geology e.g., replacing competent bedrock, but impacts to ground levels will be **reversible** through reinstatement with fill. This effect is considered to be limited to the footprint of the Project and with appropriate mitigation measures, planning and management the effect and disturbance can be minimised.

8.4.3.4.5 Site Cable Trenches

There will be circa 4,743 m of internal cabling. Cable trenches throughout the Site will be excavated to an anticipated depth of approximately 1.220 mm and will contain the electrical and fibre-optic cables running from the turbines to the substation compound within the Site Roads and/or their verges. Excavation of peat, bedrock and inferred locally glacial till will be required. Granular fill, from the Borrow Pit, will be used to surround the cables, however the majority of the excavated soils will be used for backfilling with the potential for minor amounts being removed and used elsewhere for example, berm landscaping.

The likely effects associated with shallow excavations for Site Cable trenches are considered to be **unavoidable**, **direct, adverse** and **small to moderate** (in terms of overall project scale), **slight significance, permanent** (life of project) and **reversible** through reinstatement during the decommissioning phase of the Project. This effect is considered to be limited to the Project and conforms to existing Baseline (e.g., public roads and services). With appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

8.4.3.4.6 Turbine Delivery Route

The Turbine Delivery Route will use existing roadways between Ringaskiddy Port and the Site. Works at an entrance to an existing forest road off the N22 will include the widening of the road and creation of a splayed entrance. Additionally, the construction of a temporary access road off the N22 in the townland of Cummeenavrick to facilitate 180 degrees turning manoeuvre by construction vehicles is also proposed. The Turbine Delivery Route will require an area of upgrading totalling 1,870 m^2.

The likely impacts associated with excavations on the Turbine Delivery Route are considered to be relatively **small** in scale, **direct, localised, slight significance**, **adverse**, **long term to permanent** (life of project) and **reversible** through reinstatement during the decommissioning phase of the Project. This effect is considered to be localised and conforms to Baseline (e.g., public roads and services). With appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

8.4.3.4.7 Grid Connection Cable

The overall length of the grid connection between the substation and the existing 220 kV GIS substation is 19.9 km, following the old route of the N22 for a short distance (c.0.469 km) before following forestry tracks to the existing Ballyvouskill Substation. Grid Connection trenches will be excavated along the Grid Connection route, predominantly within tracks and verges, to the Ballyvouskill Substation.

The 38 kV cable trenches will be excavated to an anticipated depth of approximately 1.22 m, and to a width of 0.6 m. Depending on the detailed design and excavation of road aggregates, peat, bedrock and inferred local glacial till will be required. The trenches will be backfilled using granular material. The excavated material will be disposed of offsite as inert landfill at a licenced facility or recycled for use elsewhere.

Joint Bays are pre-cast concrete chambers along the Grid Connection Route where individual lengths of cables will be joined to form one continuous cable. A joint bay is constructed in a pit. Each joint bay will be 6 m long x 2.5 m x 2.3 m deep. A reinforced concreted slab will be constructed on top of the bay.

The impacts associated with excavations for cable trenches are considered to be **unavoidable**, **direct, adverse, moderate** in scale**, slight in significance, permanent** and reversible through reinstatement during the decommissioning phase of the Project **and adverse.** This effect is considered to be localised and conforms to Baseline (e.g., public roads and services). With appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

8.4.3.4.8 Total Volume to be Excavated

Indicative total volumes of material to be excavated are presented in **Table 2.6 of EIAR Chapter 2: Project Description**.

8.4.3.5 Storage of Stockpiles

8.4.3.5.1 Overview

The majority of spoil generated on Site will be peat and subsoils with some rock excavated at Turbine and Sub-Station Foundations.

It is expected that the majority of rock will be reused for the construction of Site Access Tracks and/or Turbine Hardstands.

Material to be temporarily stored for a period during the construction phase will be placed adjacent to excavation areas, at a distance of at least 20 m from any drainage feature. These short-term temporary stockpiles, if located near T1 (i.e., Moderately Deep peat), **Appendix 8.1 – App A – Peat Depth Overview,** will be limited to 1 m in height. This material will be used for later reinstatement of the Borrow Pit.

Once the required rock has been extracted from the borrow pit, it will be reinstated using any surplus inert material from the Site, that way the size of the Temporary Spoil storage areas is minimised. As a worst case, stockpiling of peat can give rise to increased pore pressures and the possibility of a bog burst or peat slide. Careful management of the spoil and ongoing landslide risk assessments will minimise the possibility of a landslide or stability issue occurring.

8.4.3.5.2 Spoil Management

Increased excavation and peat / soil / subsoil / bedrock removal activity will be concentrated to particular locations of the Project, including the site entrance, load bearing portions of turbine hardstands, turbine foundations, site borrow pit, and works associated with the improvement or construction of watercourse crossings and culverts, works along the Turbine Delivery Route and proposed works along the Grid Connection Route.

Therefore, of significance, during the construction phase of the Project, is the management of excavated materials handling, storage and re-use. There is potential for **direct, negative** impact on localised ground stability particularly in the vicinity of ongoing excavation works. For example, loading or surcharging of ground in proximity to open excavations is considered in good practices and health and safety procedures associated with excavation works, as presented in **Plate 2**. Direct and indirect negative impacts on surface water quality can also occur **(EIAR Chapter 9: Hydrology & Hydrogeology**). However, such impacts are considered temporary and reversible.

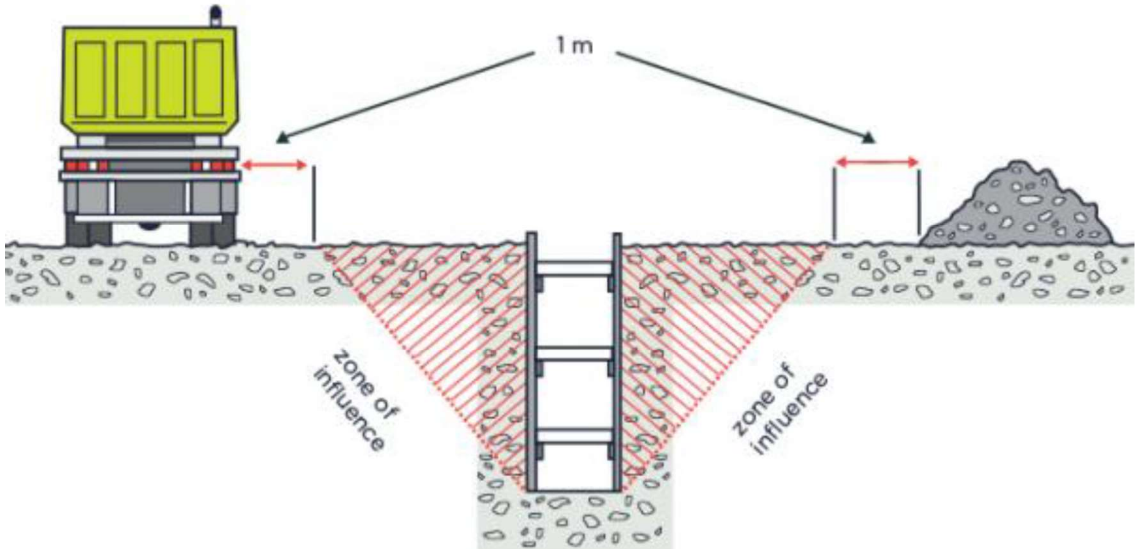

Plate 2: Examples impact of loading or surcharge on ground in proximity to open excavations.[14]

The potential impact by construction works activity on water quality is discussed in **Chapter 9: Hydrology and Hydrogeology**.

The handling, management and re-use of excavated materials are of importance during the construction phase of the Project. It is envisaged that excavated material (i.e., soils, subsoils and peat) totalling 81,215 m^3 will be used as back fill and for reinstatement purposes, that is reused on site as appropriate, and any surplus material will be transported to the on-site borrow pit for reinstatementt and will be capped to a level of 0.8 m above the existing ground level. The management of the above quantities is considered to be on **moderate to large** in scale. Peat will be stockpiled no higher than 2 m and follow the guidelines and recommendations set out by the National Roads Authority (2014), **Section 8.2**. The reinstatement of the borrow pit has been further detailed in **Chapter 2: Project Description and Appendix 2.1: Construction Environmental Management Plan, Management Plan 4: Peat and Spoil Management Plan**.

With relation to excavated material removed during the Grid Connection network installation, any earthen (sod) banks to be excavated will be carefully removed and stored separately, maintained and used during reinstatement. Any surplus excavated material from roadways will be disposed of to a licenced facility.

[14] New Zealand Government (2016) Good Practice Guidelines – Excavation Safety

There is potential for a moderate adverse effect on soil due to erosion of inappropriately handled excavated materials. However, any effects from the handling of excavated materials will be managed through good Site practice.

Organic matter loss can occur when wet peat is excavated and allowed to dry in the open air. Peat material is a major source of carbon, and the loss of organic matter leads to an emission source of carbon dioxide (CO2) and nitrogen dioxide (NO2). Furthermore, excavated forestry material can also contribute to Nutrient Enrichment from historical site practices, refer to **EIAR Chapter 9: Hydrology and Hydrogeology.**

The process of spoil management is expected to have a **likely, direct, slight to moderate, adverse** effect of the Project on the receiving environment and is considered **permanent but reversible**. This effect is considered to be restricted to the footprint of the Project but can have indirect / secondary impacts to the surrounding area (i.e., localised extent). This effect conforms to baseline (e.g., forestry operations, public roads and services). With appropriate mitigation measures, planning and management this effect and disturbance can be minimised. Ground stability on a larger scale is discussed further in the following section.

8.4.3.5.3 Peat Stability and Slope Failure

8.4.3.6 Ground Stability

Ground stability, as discussed in the baseline section of this report, is not considered an impact with significant potential under the footprint of the Project, that is the potential for slope stability issues arising or landslides to occur is generally considered Low. Some areas possess elevated risk on a localised scale (isolated areas of moderately deep peat, high/moderately high risk to landslide susceptibility). Some areas possessing elevated risk on a larger scale within the Project footprint (elevated risk associated with deep till deposits, iron pan and steep inclines; and elevated risk associated with proximity of receptors with varying sensitivity). All proposed turbine hardstand areas are located outside of these elevated risk areas, with the exception of three No. points at T3, and the proposed hardstand area of T5 which unearthed iron pan deposits at TP003, (**Appendix 8.1 – App C).**

The designed Turbine Delivery Route traverses' areas of 'Low' Landslide Susceptibility from the Inchamore Wind Farm to the N22 along the existing third-class road as mapped by GSI (2022), with the exception of the first 1.3 km which traverses moderately high and high risk. The remaining extent of the Turbine Delivery Route, c. 80 km, will utilise pre-existing third-class road infrastructure between the N22 and Ringaskiddy. While this stretch of area varies in degrees of Landslide Susceptibility ('Low' to 'Moderately High'), it is an existing piece of infrastructure with no planned modifications to alter its design, therefore the risk of a Landslide Event is considered low. Furthermore, there have been no recorded landslide events within the immediate vicinity of the Turbine Delivery Route.

The entire length of the Grid Connection Route (19.9 km) varies in scale of Landslide Susceptibility, ranging from 'Low', 'Moderately Low' to 'Moderately High' with only minor pockets of 'High' risk, relative to the length of the route. Considering works necessary for the cable trenching will consist of slight excavations (1.5 mbGL, with the potential for deeper excavations up to 2.0 mbGL), and that works will be carried out along existing tracks, the risk of ground stability issues arising is considered low. However, it must be noted, there have been seven recorded Landslide Events (OBJECTIDs: 7517, 7518, 7519, 7520, 7521, 7524, 8079) within c. 500 m of the northern portion of the Grid Connection Route, documented by GSI (2022). Each landslide event took place north of the route in both coniferous forests and peat bogs with 'No Apparent Impact'. The appointed ontractor will confirm highlighted work areas with a competent geotechnical engineer ahead of commencing scheduled construction.

The potential for soil stability issues to arise during the construction phase of the Project is largely dependent on vehicular movement and operation during excavation works, or vehicular movements over areas with an increased or severe slope incline, and likely in combination with severe weather conditions. In terms of peat, potential impacts to hydrology can also play a large role in stability issues.

Soil stability issues brought about by excavation or vehicular movement activities on Site have the potential to lead to open excavation side wall collapse, which in turn will potentially compromise ground stability in the vicinity of the works, thus increasing the effective footprint of the Project. This is considered a **likely**, **direct, adverse, slight to profound significance, small to moderate** in scale**, localised (potentially regional), temporary but reversible** impact. This effect is considered to contrast to Baseline. With appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

Potential indirect soil stability issues including downgradient of the Project footprint brought about by construction activities are considered to be **unlikely**, **direct, adverse, significant to profound significance, small to moderate** in scale**, localised (potentially regional), permanent** effect**.** This effect is considered to contrast to baseline. With appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

8.4.3.7 Geological Stability

Conclusions made here are drawn with reference to **Appendix 8.1** and associated **Appendices A - I**. For further information and context in regard to methodology and definitions, refer to **Appendix 8.1**.

Geological stability will be limited to the management, excavation and breaking of weathered and competent bedrock and boulders where required. This will include a number of proposed Turbine Hardstand locations as well as the Onsite Substation and Control Building and borrow pit.

Construction activities can give rise to localised stability issues. Localised stability issues arising during construction activities, namely excavation activities include a range of key issues, for example:

- Collapse of excavations, or sidewall collapse. This is particularly prevalent in soils with low cohesive strength and / or high groundwater levels, such as peat.
- Falling or dislodging of material.
- Operatives falling into open excavations.
- Undermining nearby structures, underground and overhead services.
- Inflow of groundwater and surface runoff.
- Damage to nearby trees.

Considering the complex topography at the Site, including steep inclines, some over sensitive receptors including rivers, there is potential for geological stability issues to impact downgradient receptors in terms of the sliding of excavation arisings towards receptors. Worst case scenarios include construction activity and the movement of excavated material triggering landslide events, for example spread or flow of stockpiled material down steep slopes outside of the Project footprint.

When considering the Grid Connection Route, shallow excavations, (c. 1.3 mbGL along the cabling route and 1.75 mbGL at cable joint bay locations), do not raise concern in terms of geological stability, for they are shallow in nature. Furthermore, the Grid Connection Route will follow constructed Site Access Tracks (1.3 km) and pre-existing forestry tracks to the existing Ballyvouskill Substation (18.6 km).

Potential geological stability issues brought about by construction activities are considered to be **unlikely**, **direct, adverse, slight significance, small to large** in scale**, localised** and **permanent** effects**.** This effect is considered to contrast to Baseline but with appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

8.4.3.8 Vehicular Movements

8.4.3.8.1 Overview

Vehicle movement will occur primarily during the construction phase of the wind farm. Construction vehicles will include cranes, excavators, dumper trucks, concrete trucks, private cars (construction personnel). During the operation phase, vehicles will be limited to occasional maintenance vehicles only.

8.4.3.8.2 Compact, Erosion and Degradation

Compaction of soils may occur during construction and to a limited extent during operation and Decommissioning. In general, compacted soils will be excavated during construction, and access to soils away from hardstanding areas will be prevented. Ongoing compaction of soils will occur in areas of site access road construction, which will continue during operation and Decommissioning. Compaction effects are considered to be **likely, direct, adverse, slight to moderate significance, moderate to large** in scale**, permanent** and limited to the footprint of the Project. This effect conforms to Baseline (e.g., forestry) and with appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

Erosion and degradation of exposed soils will also occur, primarily during construction, which will potentially lead to loading of runoff with solids and other contaminants. With reference to **Section 8.3.4**, the entrainment of solids in storm or construction water runoff is of particular concern considering the underlying bedrock geology is comprised of (weak) SILTSTONE bedrock, **Appendix 8.1**. Entrainment of soils are further assessed under **EIAR Chapter 9: Hydrology & Hydrogeology.**

8.4.3.8.3 Peat Stability and Slope Failure

As discussed under **Section 8.4.3.4.3** and in the **Appendix 2.1, Management Plan 4:** Peat and Spoil Management Plan, vehicular movements on Site have the potential to trigger soil or slope stability.

8.4.3.8.4 Turbine Delivery Route and Site Access Roads

The delivery and connection routes will utilise existing roadways and infrastructure along the majority of the routes and therefore, the impacts associated with vehicle movements along the Turbine Delivery Route is considered to be **direct, adverse, small** in scale**, not significant to slight, permanent but reversible.** This effect is considered to be localised and conforms to Baseline (e.g., public roads and services) and with appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

8.4.3.9 Soil Contamination

8.4.3.9.1 Overview

Construction activities associated with the Project have the potential to introduce a number of contaminants in a number of ways. Potential causing activities and associated contaminants include:

- Operation of plant vehicles and other petrol / diesel driven equipment - Hydrocarbons e.g., diesel, oil, grease.
- Wastewater sanitation – Sewage
- Construction materials – e.g., concrete or cement, bentonite clay from HDD
- General waste – e.g., plastic

Use of waste materials during construction, operation and decommissioning will be minimised by good site practices and waste management plans. The following sections present the possible impacts primarily associated with the use of construction plant.

8.4.3.9.2 Hydrocarbons

Wherever there are vehicles and plant in use, there is the potential for a direct hydro-carbon release which have the capacity to contaminate soils and subsoils. Furthermore, a spill has the potential to indirectly pollute water, if the soil and subsoil act as a pathway from any source of pollution.

Hydrocarbon is a pollutant risk due to its toxicity to all flora and fauna organisms. Hydrocarbons adsorb (stick) onto the majority of natural solid objects it encounters, such as vegetation, animals, and earth materials such as peat. From a land and soils perspective, the naturally occurring chemical in crude oil and gasoline products-Polycyclic Aromatic Hydrocarbons or (PAHs), can burn most living organic tissue, such as vegetation, due to their volatile chemistry. It is also a nutrient supply for adapted micro-organisms, which can deplete dissolved oxygen at a rapid rate and thus kill off water based vertebrate and invertebrate life.

The hazard posed by hydrocarbon contamination to soil is significant in terms of adversely impacting on the health of the soils associated with the proposed Site and the flora and fauna it supports, however the risk is considered limited considering the movement of same is limited. The more significant risk of hydrocarbons contamination of soils is the eventual and likely migration to surface water systems, a potentially significant negative impact - this is covered in **Chapter 9: Hydrology and Hydrogeology**.

Any accidental contaminant spillage of fuel or oil, depending on the volume, would potentially present a **significant, direct, adverse, small-scale long term to permanent**, effect on the soil and geological environment on the Site, which contrasts to Baseline. However, this potential impact is considered to be **localised** (if contained, **EIAR Chapter 9: Hydrology & Hydrogeology**), naturally **reversible** (natural attenuation over a relatively medium to long term period of time), or immediately reversible (through remediation and restoration activities over a relatively short to medium term period of time). With appropriate environmental engineering controls and measures, this potential risk can be significantly reduced.

8.4.3.9.3 Horizontal Directional Drilling

In terms of the HDD process, drilling will involve plant machinery which will be powered by hydrocarbons, therefore risk during the refuelling process as stated previously remains the same. The risk of hydrocarbon spills stems primarily from broken hydraulic hoses used during the drilling/boring process. Small-scale quantities of greases known as 'drilling fluids' are also commonly used during the drilling process to keep components of the drill rig cool and lubricated. These drilling fluids are commonly composed of a mixture of bentonite clay, which can be harmful to the environment. Therefore, there is a risk of a potential oil leak from horizontal directional drilling (HDD) along the Grid Connection Route. It is unspecified at this time which drilling lubricant will be used during Grid Connection Route works. From experience in the industry the use of Clearbore is recommended, and this or a similar product will be used. Clearbore is a single component polymer-based product that is designed to instantly break down and become chemically destroyed in the presence of small quantities of calcium hypochlorite. The product is not toxic to aquatic organisms and is biodegradable.

8.4.3.9.3.1 Drill Arisings

Spoil arising from drilling activities will require temporary stockpiling and has the potential to be entrained by surface water runoff (suspended solids). Potential effects involving drill arisings are similar to those outlined in Spoil Management **Section 8.3.4.3.5.2.** For instance, spoil arising from drilling activities could be mobilised by large volumes of water which would rapidly traverse overland if not managed appropriately and has the potential to mobilise additional solids via eroding soils, or other contaminants, and infiltrate the receiving surface water bodies, or groundwater bodies.

8.4.3.9.3.2 Breakouts and Drilling Fluid Returns

Generally speaking, drilling fluids used in HDD practices are released at the beginning (launch) and termination (reception) sites of a borehole path, collected and disposed of properly. However, breakouts can in theory occur as a result of unstable conditions within the drilled bore due to low cohesion; for example;

1) the swelling and hydration of clay materials,
2) the movement and dispersion of clay minerals,
3) water blocks, and
4) low permeability of mud cakes.[15]

Potential effects involving drilling fluid returns are similar to those outlined in Hydrocarbon Contamination **Section 8.4.3.9.2.** For instance, drill fluid returns/frack outs can occur as a result of poor drilling methods, and/or improper mud formulation used in bore drilling which can cause stability issues within the bore. Given the local lithology of the Site with underlying sandy, clayey gravel and tills, potentials for breakouts must be considered. Breakouts can lead to failure in returns at either end of the bore path and subsequent drill mud being released outside the bore to the receiving environment (i.e., soils, subsoils, ground and/or surface waters).

8.4.3.9.3.3 Drilling Fluid Disposal

Drilling mud containing spoil recovered from the bored path can be retrieved at the launch and reception sites of the bore. This bentonite contaminated spoil can be treated in one of two ways. It can either be transferred off-site to an approved and authorized EPA license facility (in accordance with the Waste Management Act 1996, as amended) to be properly disposed of; or the spoil can be pumped to a mechanical separation container. This involves drill mud being stored within a holding tank until separation of particulates can be achieve only then can the fluid be discharged to the surrounding area.

8.4.3.9.3.4 Horizontal Directional Drilling Potential Effects

A worst-case scenario could possibly occur whereby the proposed works of HDD could result in an accidental contaminant spillage with a **likely**, **direct, adverse, slight to moderate, small** in scale **short term** effect on the soil quality of the Site. This impact could result from any number of indirect anthropogenic sources, most commonly would be from: inadvertent drill returns containing bentonite clay, as mentioned above or by spillages of oil,

[15] Willoughby, D. A. (2005) "Horizontal Direction Drilling Utility and Pipeline Applications" *McGraw-Hill Civil Engineering Series,* ISBN: 978-0-07-150213-9.

fuel, or drilling fluid disposal. Such spillages could potentially affect the local land and soil environment, depending on the nature of the contamination issue, and to varying degrees depending on the characteristics of the Site area. Considering the proximity to surface water associated with this type of infrastructure (i.e., directly below watercourses), the risk is elevated. However, this potential impact is considered to be **localised**, naturally **reversible** (natural attenuation over a relatively medium to long term period of time), or theoretically reversible (through remediation and restoration activities over a relatively short to medium term period of time). With appropriate environmental engineering controls and measures, this potential risk can be significantly reduced.

While the Grid Connection Route traverses ground rated at 'X' and 'Extreme Vulnerability' (i.e., high risk) categories, this risk can be deescalated due to the lack of karst features present and baseline description of the underlying bedrock aquifer. There are no karst features associated with the Project.

Further information and mitigation in relation to the management of potential contaminants is provided in **Chapter 9: Hydrology and Hydrogeology**.

8.4.3.9.4 Wastewater and Sanitation

The Project includes temporary sanitation facilities for site workers during the construction and therefore has the potential to result in the accidental leakage of wastewater or chemicals associated with wastewater sanitation onto soils, and into the drainage network during the construction and operational phases of the project.

Wastewater and wastewater sanitation chemicals are pollutant risks due to their potential impact on the ecological productivity or chemical status of surface water systems, and toxicity to water-based flora and fauna.

The worst-case scenario/s associated with wastewater sanitation is the potential for sanitation chemical, particularly related to porta-loos, accidentally spilling or leaking and being intercepted by surface water drainage features and in turn surface water networks associated with the proposed development.

Potential incidents related to the release of waste and chemicals from wastewater sanitation facilities at the Site will be **likely, direct, adverse, small** in scale**, moderate to significant** effects which contrast to Baseline. This effect is considered to be localised in terms of the soil and geological environment. However, the potential impacts to downstream receptors can be **long term to permanent**. With appropriate environmental engineering controls and mitigation measures these potential impacts can be significantly reduced.

8.4.3.9.5 Construction or Cementitious Materials

The Project will require concrete for the formation of turbine bases, including in locations which are in proximity to receptors e.g., drains and surface waterbodies. This could potentially give rise to or result in the accidental spillage or deposition of construction waste into soils and in turn impact on surface water runoff, or accidental spillages directly intercepted by drainage or surface water networks associated with the Project.

Depending on the chemistry of the material in question, the introduction of such materials can lead to a local change in hydrochemistry and impact on sensitive attributes e.g., ecology. For example, the introduction of cementitious material (concrete / cement / lean mix etc.) can lead to changes in soil and water pH, and increased concentrations of sulphates and other constituents of concrete can further impact water quality. Fresh or wet concrete is a much more significant hazard when compared to set or precast concrete which is considered inert omparisonn, however it is noted that any construction materials or waste deposited, even if inert, is considered contamination.

Surface water runoff, or groundwater coming into contact with concrete will be impacted to a degree, however water percolating through lean mix concrete will be impacted significantly. Therefore, the production / acquisition, transport of material and management of plant machinery must also be considered.

The worst-case impacts associated with a release of wet or lean mix cementitious materials is considered to be potentially **likely**, **localised**, **direct, adverse, slight to significant, small** in scale**, long-term to permanent** effect, particularly in terms of potential indirect or secondary effects on the receiving surface water system. The use of cementitious material is in contrast to Baseline conditions at the Site. With appropriate environmental engineering controls and measures, this potential risk can be significantly reduced.

8.4.3.9.6 General Waste

The construction phase of the Project has the potential to generate excess general wastes from construction personnel such as organic food waste, plastics (bottles and/or packaging), metals (aluminium cans and/or tins) and cardboard waste (Tetra Pak cartons, newspaper, wastepaper). This is a **likely** effect of theProject, but every effort will be made to ensure that every piece of general waste will be disposed of properly and removed from Site. The impacts associated with waste materials is considered to be **direct, adverse, slight significance, small** in scale**, localised, long term to permanent** effect which contrasts to Baseline**.** With appropriate environmental engineering controls and measures, this potential risk can be significantly reduced.

8.4.4 Operational Phase Potential Effects

8.4.4.1 Land Take Wind farm

Land take will be required during the construction and operation of the wind farm. This will be required for construction of Site Access Roads, Turbine Foundations, Onsite Substation, Met Mast and for temporary land take the facilitate the laying of grid connection cable ducting both on and off the Site.

Land take is a Moderate (Site footprint = 28.79 ha, Site area = c. 167 ha, land take equates to 17.24% relative to the scale of the Site) direct impact of the Project, that is land being used as forestry and agricultural pastures currently will be replaced by the Project. The extent of land take will correlate with the footprint of the Project with the exception of some existing track ways, however there is also additional land take considering required cut and fill, drainage and cable trench infrastructure, and the increased excavation footprint required for safe excavation practices (e.g., batter back, discussed in the following sections).

Excavation, deposition and ground sealing activities associated with land take required for the Project will lead to disturbance of otherwise generally greenfield, undisturbed land, in the absence of commercial forestry practices, that is, the natural soil profile, important for the purpose of facilitating current land use practices, namely forestry and agriculture, will be directly affected under the footprint of the Project.

The overall potential effects here are considered to be of **unavoidable, direct, adverse, slight to moderate significance and scale, long term to permanent** (life of project), but **reversable** through the decommissioning and restoration phase of the Project. This effect is considered to be limited to the footprint of the Project and conforms to baseline (e.g., forestry operations). With appropriate mitigation measures, planning and management this impact can be reversed, and disturbance minimised.

Land take associated with the Turbine Delivery Route and Grid Connection Route will be limited to the Construction Phase of the Project **Section 8.4.3.2**.

8.4.5 Decommissioning Phase Potential Effects

In general, the potential effects associated with decommissioning will be similar to those associated with construction but of reduced magnitude because extensive excavation, and wet concrete handling will not be required. The potential environmental effect of soil storage and stockpiling and contamination by fuel leaks will remain during decommissioning.

On the basis that a Decommissioning plan has been established, **Appendix 2.1**, and will be implemented during the Decommissioning works associated with the Project, potential issues arising giving cause to residual impacts are likely to be **infrequent**, **imperceptible** to **slight, direct, adverse, localised** and **reversible**.

8.5 MITIGATION MEASURES AND RESIDUAL EFFECTS

This section of the chapter outlines the main mitigation measures which will be applied to the wind farm in order to reduce the effects of the impacts outlined previously.

8.5.1 Design Phase

8.5.1.1 Mitigation by Avoidance

The opportunity to mitigate any effect is greatest at the design phase. In this respect, a detailed Site selection process was carried out by the design team. A process of "mitigation by avoidance" was undertaken by the EIA team during the design of the turbine and associated infrastructure layout.

- At the start of project commencement, indicative turbine locations were issued, and through a desktop assessment the most significant environment constraints (in the context of land, soils and geology and sensitive receptors) were identified on a constraints map.
- From this a new layout was issued, during the detailed design stage. With the new layout iteration, peat probing was then carried out on Site. Once peat data was processed a further constraints map produced and issue to the Client.
- Off the back of this, an additional turbine layout iteration was issued avoiding all the sensitivities highlighted.

Arising from the results of this study, a constraints map was produced that identifies areas where geotechnical constraints (deep peat, steep inclines and shallow bedrock) could make parts of the Site less suitable for development. Furthermore, within the chosen Site, areas of deep peat and shallow bedrock were identified, and the infrastructure design sought to avoid those areas as much as possible. The layout plan was reviewed and the most appropriate design available for protecting the Site's existing geotechnical (and hydrological) regime was identified, whilst avoiding other environmental constraints. The Geo-Hazard constraints are assessed and presented in **Appendix 8.1 – IWF SI Report-Stability and Geotechnical Assessment,** and the **Peat and Subsoil Stability Risk Assessments (Appendix I (a – c)).**

8.5.2 Construction Phase

Any and all direct impacts on soils/peat and bedrock arising from the Development are considered to be either localised (i.e., land take and soil and subsoils removal for the Grid Connection Route, Turbine Delivery Route or stability risks) or within the development footprint (i.e., land take for the wind farm, clear felling of forestry, soils compaction and vehicular movements). Therefore, impacts assessed and classified in the following section/s are considered at the localised scale, **Table 8.11,** including the potential indirect impacts on downgradient receptors, for example associated with surface water as introduce in **Section 8.2.1.1.**

8.5.2.1 Felling of Afforested Areas

Best practice working in specific environments such as forested areas will be adhered to including working outside of surface water or other buffer zones, and risk assessing on a case-by-case basis in terms of drainage intercepting run off, ecological and other sensitive environmental attributes.

Proposed mitigation measures regarding the management of forestry operations are described below,

- Phased felling approach (**Chapter 2: Project Description**, Section 2.3.2),
- Minimise erosion by using existing tracks and use of brash for off track areas,
- The following forestry guidance and policies;
    - Forest Protection Guidelines
    - Forestry and Water Quality Guidelines
    - Forest Harvesting and Environmental Guidelines
    - Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures
    - Forest Biodiversity Guidelines
    - Forestry and The Landscape Guidelines
    - Forestry and Archaeology Guidelines
- Maintaining a 25 m (minimum) buffer at felling locations near surface water receptors, for instance at the proposed location of T2, T4 and along Site Access Roads near the prosed location of Watercourse Crossing 3 (WC3).

Proposed mitigation measures outlined above, i.e., phased felling approaches will lessen impacts to the surrounding landscape and important surface water receptors by limiting the amount of soils, vehicular movements, soil compaction, etc. introduced to the Site at one time. This in turn can be seen as a **direct**, **slight to beneficial** effect.

8.5.2.2 Subsoil and Bedrock Removal

The removal of peat and mineral subsoil / bedrock is an unavoidable impact of the Project, but every effort will be made to ensure that the amount of earth materials excavated is kept to a minimum in order to limit the impact on the geotechnical and hydrological balance of the Site. The impacts associated with this removal will be minimised using the following practices.

8.5.2.2.1 Mitigation by Good Practices

Best practice will be applied during construction which will minimise the amount of soil and rock excavation. All works will be managed and carried out in accordance with the Construction Environmental Management Plan (CEMP), which will be updated by the civil engineering contractor in accordance with the conditions of any permission granted and agreed prior to any works commencing on Site.

Excavation of peat in areas where there is >1.0 m in peat depth, for instance at T1, T3 and T5 (**Appendix 8.1 – App A**) will follow appropriate engineering controls (**Section 9.5.2.3, Chapter 9: Hydrology and Hydrogeology)**, such as the drainage of the peat along the proposed Site tracks in advance of excavation activity (1 month in advance where possible) so as to reduce pore water content and thus instability of the peat substrate prior to excavation. Such drains will be positioned at an oblique angle to slope contours to ensure ground stability. Drains will not be positioned parallel to slope contours, that is, a gradient more than zero. It is noted that some drains will be close to parallel with elevation contours. This drainage will be attenuated prior to outfall (**Chapter 9: Hydrology and Hydrogeology** and **Management Plan 3: Surface Water Management Plan 3, Appendix 2.1: CEMP**). It is noted that peat depth at the Site is generally shallow, and management of saturated peat will be required at relatively few locations of 'Moderately Deep' peat, mainly at the proposed location of T1, **Appendix 8.1: App A**.

In those parts of the Site where excavation will intercept areas of peat that are >1.0 m depth (proposed locations T1, T3 and T5), a geotechnical engineer/engineering geologist will be onsite to supervise and manage the excavation works and confirm the necessity for supporting newly excavated peat exposures or redirect initial construction phase drainage to maintain ground stability.

For side walls in all excavations a safe angle of repose will be established. This will ensure the potential for side wall collapse will be minimised. For peat, the safe angle of repose is approximately 15°, which equates to a c. 10 m horizontal distance if excavating to 2.5 m depth, however given the quality of the peat, and the potential residual water content after pre-excavation drainage works, or increased water content following heavy rainfall events, there remains a risk of localised stability issues arising in areas of deeper peat. Therefore, for excavation in areas of deeper peat (>2.0 m), particularly at proposed location of T1, excavation supports will be used, for example temporary sheet piling, or similar. This will minimise the effect of excavation to the minimum required. Areas of the Site where deeper (>2.0 m) peat was detected during Site surveys are presented in geo-constraint maps (**Appendix 8.1),** proposed hardstand areas have avoided these areas of deep peat. Similarly, the safe angle of repose for subsoils at the Site (GRAVELS), or any other material (e.g., crushed rock) arising at the Site have also been considered and similar consideration and mitigation applied respectively. Example soil types and respective critical angle of repose under varying conditions is presented in **Error! Reference source not found.**However, in terms of peat or loamy soils the critical angle of repose will vary greatly depending on a range of factors (peat quality, fibre content, water content, etc.). For example, the friction angle of peat varies significantly due to associated shear strengths, and undrained friction angle of amorphous peat and fibrous peat is typically in the range of 27 to 32 degrees under a normal pressure, however in some regions (West Malaysia) the friction angle is in the range 3 to 25 degrees [17].

Table 8.10: Critical Angle of Repose for Various Soil Types [18]

Soil Type	Critical Angle of Repose (Degrees)		
	Dry	**Moist**	**Wet**
Topsoil (Loose)	35-40		45
Loam (Loose)	40-45		20-25
Peat (Loose) *NOTE*	15	45	
Clay/Silt (Solid)		40-50	
Clay/Silt (Firm)		17-19	
Clay/Silt (Loose)		20-25	
Puddle Clay			15-19
Silt		19	
Sandy Clay		15	
Sand (Compact)		35-40	
Sand (Loose)	30-35		25
Sandy Gravel (Compact)		40-45	

[17] Kazemian S et al (2011) A state of art review of peat: Geotechnical engineering perspective. International Journal of the Physical Sciences Vol. 6(8), pp. 1974-1981
[18] StructX (25/04/2022) Critical Angle of Repose - Typical Angle of Repose Values for Various Soil Types [Online] Available at: https://structx.com/Soil_Properties_005.html [Accessed 01/06/2022]

Soil Type	Critical Angle of Repose (Degrees)		
Sandy Gravel (Loose)	35-45		
Sandy Gravel (Natural)	25-30		
Gravel (Medium Coarse)	25-30		25-30
Shingle (Loose)	40		
Shale (Hard)	19-22		
Broken Rock	35		45
NOTE: Angle of repose for peat will be highly variable depending on in situ site conditions.			

Adopting good practices, planning ahead and real time monitoring in more sensitive (>1.0 m peat depth) areas will ensure that any excavations associated with the Project will have minimal impact, that is the risk of the activity of excavation having an increasing or variable impact will be reduced. Similarly, application of the above mitigation measures will reduce the risk of stability issues arising at a localised scale.

8.5.2.2.2 Mitigation by Reuse

Bedrock will be re-used for construction of Site Access Tracks and/or Turbine Hardstands wherever possible. The bedrock will comprise predominantly sandstone and siltstone which, when crushed and graded, will provide a good sub-base for Site Access Track construction.

Similarly, the subsoil (GRAVELS) or till at the Site possess a relatively high proportion of clay and sand particles (**Appendix 8.1, Appendix D, Appendix F** and **Appendix G**), which can enhance the entrainment of solids in runoff relative to other soils/materials. Therefore, similar precautions will be implemented when handling and reusing subsoil materials on Site.

Excess bedrock will be reused as backfill in areas previously excavated, or as backfill in cut and fill operations, for example, Site Access Roads and Turbine Hardstands. If additional hardcore material is necessary to import during the construction phase, using the local bedrock as fill will ensure that impacts to hydrochemistry are minimised. Geotechnical testing on imported material will be carried out prior to its reuse onsite particularly for reuse as a running or load bearing surface and will only be reused for those purposes if the suitability of same is conforms to relevant standards. Guidance which will be applied is as follows:

- Good Practice during Wind Farm Construction (SNH, 2015)
- Notes for Guidance on the Specification for Road Works Series NG 600 – Earthworks (TII, 2013)

- Constructed tracks in the Scottish Uplands (SNH, 2015)

Peat material excavated will be reused as backfill in areas previously excavated as much as possible, and/or for reinstatement works elsewhere on the Site. To facilitate this the acrotelm (living layer) and the catotelm (lower layer) will be treated as two separate materials. Catotelm peat will be used to backfill, for example around turbine foundation pads once established. Acrotelm peat will be used as a dressing on top of deposited catotelm peat in order to promote and re-establish flora and ensure the acrotelm layer becomes relatively cohesive in terms of localised peat stability (vegetated), refer to **Management Plan 4 of the CEMP, Appendix 2.1.**

Similarly, all soil and subsoil types or horizons identified during site investigations and during actual construction, (summary provided in **Appendix 8.1**, data presented in **Appendix D, Appendix F** and **Appendix G),** will be treated as separate materials and arisings separated accordingly. This includes, for example Acrotelm peat, catotelm pet, clays, subsoils (GRAVEL / TILL), weathered rock.

The management, movement, and temporary stockpiling of material on Site, including a materials balance assessment and plan is detailed in the CEMP, this includes identification of suitable temporary set down areas which will be located within the Project footprint and will consider and avoid geo-constraints identified in this report (**Appendix H a - c**). Temporary set down / stockpile areas will be considered similarly to active excavation areas in terms of applying precautionary measures and good practices, and mitigation measures, including those relating to control of runoff and entrapment of suspended solids (**Chapter 9: Hydrology & Hydrogeology**).

8.5.2.2.3 Mitigation by Remediation

On completion of the construction stage, any areas not required for operation will be reinstated. This will include the Temporary Construction Compound, turning areas and the Borrow Pit location. Granular material will be removed as required and reinstated with peat or other soils in keeping with the adjacent soils. Drainage measures will be reinstated as required in order to minimise future erosion of the soils. The mitigation measures listed above, namely backfilling with peat in layers, are in effect remediation measures, whereby the impact of required excavation works is remediated and limited to the extent of the actual proposed infrastructure. This will be carried out at the designated reinstatement locations, infilling with material in identified soil horizons as mentioned above to revert these areas to baseline levels.

Mitigation measures outlined here as well as in **Management Plan 4 Peat and Spoil Management Plan** in **Appendix 2.1** of the CEMP will ensure the impacts arising from excavation activities are minimised to the footprint of the Project and improve degraded areas of the Site, thus offsetting the adverse impacts of the Project.

8.5.2.3 Storage of Stockpiles

8.5.2.3.1 Mitigation by Avoidance and Good Practice

Best practice will be applied during construction which will minimise the amount of soil and rock excavation and therefore also reduce storage and stockpile requirements. All works will be managed and carried out in accordance with the Construction and Environmental Management Plan (CEMP), which will be updated by the civil engineering contractor in accordance with the conditions of any grant of permission and agreed prior to any Site works commencing.

No permanent stockpiles will remain on the Site. All excavated materials from the Site or introduced materials for construction will be either used for infilling/ reinstatement purposes or removed from the Site.

No temporary stockpiles will be positioned or placed on areas of peat which have not been assessed or are indicated as being geo-hazards, particularly in areas of unacceptable factor of safety / stability (**Appendix B, Appendix I, Appendix 8.1**). All temporary stockpiles will be positioned on established and existing hardstand areas or in designated areas which are appropriate for short term storage. No temporary stockpile placed on established hardstands or within the Project footprint in areas of peat (**Appendix 8.1 – App B Peat Database**) will be in excess of 1 m in height. This is due to potential localised stability and subsidence issues in relation to the peat under and in vicinity of the hardstand and stockpile.

Mitigation measures to address the entrainment of solids in runoff are detailed in **Chapter 9: Hydrology and Hydrogeology**, and in **Appendix 2.1**, **Management Plan 4 Peat and Spoil Management Plan** which provides for the near immediate reuse of material in so far as practical, thus reducing the potential for temporary stockpiles in general. For example, the material arising from the first excavation is deposited in areas identified as having potential for restoration or requiring fill, the material arising from the second excavation is used as fill and reinstatement material in the first excavation location, etc.

8.5.2.3.2 Mitigation by Reduction

The volume of material to be managed including temporary stockpiling is directly proportional to the volumes of material required to be excavated, in total the volume of material (35,504 m^3), however when managed appropriately (ongoing reinstatement) the volume of material to be managed at any particular time will be minimised. Whenever possible, soil and rock will be re-used on the Site immediately, thereby reducing the need for double handling, reducing the requirements of stockpiles. Generally excavated rock will be used immediately for Site Access Track construction. Topsoil and peat will be transported to the designated spoil storage areas. Peat will only be stockpiled temporarily in areas of thin or absent peat (generally towards the eastern end of the Site, **Appendix 8.1 – App A**), and only in areas which have been assessed for stability by a suitably experienced geotechnical engineer.

The Peat and Spoil Management Plan (**Management Plan 4, CEMP Appendix 2.1**) forming part of the CEMP, identifies volumes and types of materials arising, temporary stockpiling locations, routes for reuse and remediation, requirements in terms of logistics and considerations in terms of timing and planning of movements of material. The Peat and Spoil Management Plan ensures that the material arising from any excavation will have a predetermined plan and route for re-use / remediation, or disposal if all potential for reuse / remediation have been exhausted.

Mitigation measures for stockpiles related to the Grid Connection Route are as follows: stockpiles will be restricted to less than 1 m in height and will be subject to approval by the Site Manager and Environmental Clerk of Works (EnvCoW). Additionally, any excavated material will be later used to backfill the trench where appropriate, any surplus material will be transported to a licensed facility.

8.5.2.4 Ground Stability

8.5.2.4.1 Mitigation by Avoidance and Good Practice

Peat and slope stability investigations at the Site (**Appendix 8.1**) indicate that the Site has a generally low risk probability with respect to peat slippage and slope failure under the footprint of the Project. Nonetheless, the following mitigation measures will also be applied as described in the PSRA (included as **Appendix 8.1**):

- Short term temporary stockpiles will be limited to 1 m height and removed for reuse/remediation purposes or transported to the Borrow Pit as fill. It is proposed that all material will be reused on Site, unless contaminated (for example, due to accidental hydrocarbon/fuel spill). Therefore, the risk posed by the management of material in terms of peat and slope stability is dramatically reduced.

Furthermore, with a view to applying the precautionary principle, the following procedures will be adopted as best practice mitigation measures at the Site:

- All Site excavations and construction will be supervised by a geotechnical engineer/engineering geologist.
- The Contractor's * methodology statement and risk assessment will be in line with the Construction Environmental Management Plan and will be reviewed and approved by a suitably qualified geotechnical engineer/engineering geologist prior to Site operations. (* Contractor here refers to the chosen or contracted construction company at the commencement stage of the Development).
- Particular attention and pre-construction assessment (developer / sub-contractor site specific risk assessment and method statement (RAMS) and on-site toolbox talks etc.) and mitigation measures will be implemented for all phases and locations for construction of new infrastructure, for example:

  a. All works in close proximity to sensitive receptors, that is; any works with receptor buffer zones, for example, works associated with watercourse crossings. With very little distance between works and receptor, minor or localised stability issues can lead to significant consequences.
     This includes, but us not limited to:
     - Watercourse Crossings WC1, WC2 and WC3, and associated access tracks works within Surface Water buffers.

  b. Hardstands and access tacks in close proximity to relatively deep peat and/or steep inclines, that is; works associated with or proximal to geo-hazards.
     This includes, but us not limited to;
     - Areas adjacent to T1, in particular deep peat to the north / northwest, and relatively steep inclines to the south.
     - Areas adjacent to T3, in particular deep peat to the north / northeast, and relatively steep inclines and elevated landslide susceptibility (GSI) to the south / southeast / east.
     - Areas adjacent to T4, in particular relatively steep inclines and elevated landslide susceptibility (GSI) to the south / southeast / east.
     - Areas adjacent to access tracks leading to T1/T2/T3, in particular deep peat to the north, and steep inclines and elevated landslide susceptibility (GSI) to south of T1 to T3 access track.

c. Where the previous two points occur in combination, that is; geohazards which are above or upgradient of particularly sensitive areas of the Site as discussed in the attached SI report (**Appendix 8.1**), and as presented in the constraints maps (**Appendices H (a – c)** as well as **Figure 8.7**, are the most important locations to advance with due care and consideration.

- Groundwater level (pore water pressure) will be kept low at all times (excavation dewatering) to avoid ground stability risks (subsidence) associated with peat and careful attention will be given to the existing drainage and how structures might affect it (**Appendix 9.6 – Tile 11**). Draining water from the construction area will be done through advanced dewatering techniques. In particular, ponding of water will not be allowed to occur in recent excavations, particularly in any areas encountered where peat is >1 m (proposed locations of T1 and T3). All deliberate or incidental sumps will be drained to carry water away from the sump following rainfall. Otherwise, this water will increase hydraulic heads locally and in turn increase pore water pressure which can potentially lead to instability.
- Peat will be carefully managed particularly when in temporary storage. Due to peat's fluid-like properties, all peat excavated will be immediately removed from sloping areas. Temporary storage areas will be isolated from the receiving environment by means of temporary infrastructure such as boundary berms comprised of subsoils sourced at the Site, or similar material (**Appendix 9.6 – Tile 12**). There is potential for large volumes of bog water draining from new stockpiles which will also be managed. Mitigation will include removal of gross solids from runoff prior to bog water intercepting the wind farm drainage network **(Appendix 9.6 – Tile 11, Tile 14)**. Temporary measures such as dewatering and pumping through silt bags (**Appendix 9.6 – Tile 15),** will be employed to assist this process. Draining of stockpiled peat, in a controlled manner is proposed (**Management Plan 4 CEMP Appendix 2.1),** with a view to reducing the weight and mobility of the material, therefore reducing risk in terms of localised stability. These measures will also be applied to the management of subsoil arisings at the Site.
- Peat is required for reinstatement, therefore acrotelm peat (top living layer, c. 0.5 m) will be stripped off the surface of the bog, segregated, and placed carefully at the margins of the Project along the Site Access Roads and Turbine Hardstand margins that are characterised by near-horizontal slopes (<6°), (**Appendix 9.6 – Tile 23).**
- Relatively high impact construction activities (e.g., excavations, movement of soils / subsoils / rock) will be carried out throughout the year, while taking into account the various restrictions of the Project, (for example, breeding bird seasons). However, considering the variability of metrological conditions and the potential for significant events to occur at any stage of the year, the construction phase will be limited to

favourable meteorological conditions. In order to mitigate for particular earth works tasks and suitable meteorological conditions, construction activities will not occur during periods of sustained significant rainfall events, or directly after such events (allowing time for work areas to drain excessive surface water loading and discharge rates reduce).

- From examination of factual evidence to date, the majority of landslides occur after an intense period of rainfall. Stability issues at a localised scale will be similarly impacted by rainfall events, particularly when dealing with exposed soils or open excavations. An emergency response system has been developed for the construction phase of the Project (**Appendix 2.1: CEMP, Management Plan 1: Emergency Response Plan**), particularly during the early excavation phase. This, at a minimum, will involve 24-hour advance meteorological forecasting (Met Éireann) linked to a trigger-response system. When a pre-determined rainfall trigger level is exceeded (e.g., one in a 100-year storm event or very heavy rainfall at >25 mm/hr), planned responses will be undertaken. These responses will include; cessation of construction until the storm event including storm runoff has passed over. Following heavy rainfall events, and before construction works recommence, the Site will be inspected and corrective measures implemented to ensure safe working conditions, for example dewatering of standing water in open excavations, etc.
- Any impact to the hydrological and/or hydrogeological regime will be avoided as far as practical in relation to identified Geo-Hazards and receptors (**Appendix H**) where the presence of steep inclines (T2, T3, T4 and T5), deep till deposits and iron pan (T2, T3, T5) give rise to elevated ground stability (T3, T4, T5), particularly where the potential for impacts to hydrogeology in those area / subsoils exists. For example, runoff from constructed hardstands will not be diverted and discharged (**Appendix 9.6 – Tile 11, Tile 15, Tile 16)** near / towards Geo-Hazard areas where possible. If unavoidable, due to slope direction etc., attenuation and erosion control will be implemented, as discussed under **Chapter 9: Hydrology and Hydrogeology**. Consequences of impacting, diverting and/or concentrating runoff in or towards geo-hazard constraints will potentially impact on stability at the Site.

Vehicular movements will be restricted to the footprint of the Project, and advancing ahead of any constructed hardstand will be minimised in so far as practical, for example; excavation ahead of established hardstands will be in line with expected phases of hardstand and track construction in terms of both delivery of and installation of material and Site activity periods whereby excavations will not be opened ahead of Site shut down periods. This will be done with a view to minimising soils / subsoils exposure to rain and runoff.

Ancillary machinery will be kept on established hardstands, no vehicles will be permitted outside of the footprint of the Project and will not move onto land that is not proposed for the Project.. Vehicular access to any areas of deep peat (>1 m), i.e., the vicinity of T1, during construction will be restricted to low ground pressure vehicles, with all construction vehicles travelling on existing access tracks whenever possible.

Best practice will be applied during construction which will minimise the risk of ground instability. All works will be managed and carried out in accordance with the Construction Environmental Management Plan (CEMP, **Appendix 2.1**), which will be updated by the civil engineering contractor in accordance with the conditions of any grant of permission and agreed prior to any Site works commencing.

A Geotechnical Clerk of Works will be employed during the construction phase in order to continuously monitor areas of peat. Ongoing physical stability checks and calculations will be undertaken in order to verify that safety standards are being met.

Adhering to the mitigation measures described herewith will minimise the adverse impacts posed by vehicular movements, and ultimately any impacts arising will be temporary considering the initial decommissioning and construction of the Project will in effect reverse any impact by vehicular movement within the footprint of the Project.

8.5.2.4.2 Mitigation by Reduction

The temporary storage of construction materials, equipment, and earth materials will be kept to an absolute minimum during the construction phase of the Project. This will be achieved by means of appropriate planning and logistical considerations forming part of the CEMP (**Appendix 2.1**), these measures will also be applied in relation to the management of spoil on the Site.

For example, the excavation material for the construction of access track will not progress ahead of actual track construction (as discussed under mitigation addressing vehicular movements), therefore minimising the volume of arisings to be managed. Areas for permanent deposit of material e.g., backfill adjacent to constructed infrastructure, will be identified and suitable material deposited as it becomes available. These efficiencies will be designed into the detailed CEMP (**Appendix 2.1**).

8.5.2.4.3 Mitigation by Remediation

There are no indications of significant issues on the Site in terms of ground stability, however excavation and construction activities will lead to some potential impacts with respect to the immediate area adjacent to the Project and areas impacted by potential localised stability issues. In these instances, remediation of soils will include the deposit of suitable material where required. This will include replacement of soils / subsoils in line with baseline conditions and soils horizons. For example, the three principal materials excavated in order of depth will include peat / peat soil (including segregated acrotelm (top living layer) and catotelm peat or topsoil at the surface, till, and crushed rock, **Appendix 9.6 – Tile 22 and Tile 23.** Remediated areas will be managed and monitored in terms of reestablishment of vegetated cover.

In the unlikely event that a peat or slope stability issue does arise on the Site during the construction or operational phases of the Project, emergency response measures have been prescribed below and as part of the Construction Environment Management Plan, **Appendix 2.1 - Management Plan 1.**

8.5.2.4.4 Emergency Response and Monitoring

Mitigation measures as outlined in the previous sections will reduce the potential for stability issues arising during the decommissioning and construction phase of the Project. However, there remains a low risk of stability issues arising, particularly at a localised scale.

Emergency responses to potential stability incidents have been assessed (**EIAR Chapter 16: Major Accidents and Natural Disasters**) and established to form part of the CEMP, **Management Plan 1, Emergency Response Plan** before construction works initiate. The following potential emergencies and respective emergency responses are addressed under **Section 6.1: Procedures to be followed in the event of an incident** in **Management Plan 1 of the CEMP**:

- Peat stability issues at a localised scale during excavation works – In the event that soil stability issues arise during construction activities, all ongoing construction activities at the particular area of the Site will cease immediately, the assigned geotechnical supervisor will inspect and characterise the issue at hand, corrective measures will be prescribed. Localised stability issues will likely occur with a broad range in severity including; minor side will collapse with no significant impact, to relatively significant areas of peat being impacted by excavation activities, or in worst case scenarios localised stability at one location triggering a chain of events leading to significant peat or slope stability issue arising. The assigned geotechnical engineer will assess each scenario and will implement the following measures as the need arises.

- Provision for a peat stability monitoring programme to identify early signs of potential bog slides (pre-failure indicators, for example cracks forming). This will be done in line with Scottish Governments' "Peat Landslide Hazard and Risk Assessments".[19]
- Significant peat or slope stability issues during construction activities **–** In the unlikely event that soil and slope stability issues arise during construction activities, all ongoing activities in the vicinity will cease immediately, all operators will evacuate the area by foot, if safe to do so, until the area is assessed by competent person/s, the assigned geotechnical supervisor will inspect and characterise the issue at hand, corrective measures will be prescribed. The area impacted will be characterised fully and risk assessments completed prior to any further works commencing at or near the location. This assessment will be phased including initial rapid response Phase 1 Assessment which will include at a minimum the prescription of exclusion zones and preliminary mitigation steps to be taken, for example, the management of runoff in or from the affected area.

Considering the highly dynamic nature of peat or soil stability issues at any particular site, an equally dynamic yet robust framework to follow in the event of an incident has been established. Establishment of an emergency framework will follow relevant guidance (e.g. SNH (2015) Good Practice during Wind Farm Construction) and standard practices, including for health and safety risk assessment to initially qualify any incident (by on site competent geotechnical engineer) and risk assess the area, and to then apply initial measures and design a complete emergency / contingency plan in line with an established structured emergency response. Relevant guidance as presented in **Section 8.3** will be adhered to.

Emergency response will prioritise isolating and containing any materials which is being or will be intercepted by the established drainage network or receiving surface water network. Emergency materials and equipment requirements will be identified, incorporated in the CEMP, and will be managed on Site with a view to be being easily accessible and readily available.

Onsite training and toolbox talks will ensure any response to any potential incident is mobilised quickly and efficiently.

[19] Scottish Government (2017) "Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Developments" *Energy Consents Unit Scottish Government.*

This is in combination with mitigation measures as described under EIAR **Chapter 9: Hydrology and Hydrogeology** whereby precautionary measures e.g., silt screen fencing etc. will be in place. Emergency response above existing or in place measures might include crudely building dams with an excavator to attenuate or direct flow until conditions stabilise, depositing subsoil or crushed rock material to dam drainage channels, and reactionary dewatering through silt bags to appropriate areas of the Site i.e., vegetated area and without impacting on problem area in terms of stability.

8.5.2.5 Vehicular Movements

Vehicular movements will be restricted to the Project footprint (**Figure 8.7**) and advancing ahead of any constructed hardstand will be minimised in so far as practical. This will include any temporary stockpiling. For example, excavation ahead of established hardstands will be in line with expected phases of Turbine Hardstand and Site Access Track construction in terms of both delivery of and installation of material and site activity periods whereby excavations will not be opened ahead of site shut down periods. This approach to limiting vehicular movements and temporary handling of arisings to the Project footprint is very important in the context and scope of peat and slope stability risk assessment and its conclusions (**Appendix 8.1**) and limiting other potential impacts including soil compaction and degradation.

The only exception to limiting vehicular movements to the footprint of the Project will be for forestry clear felling (Tree Felling areas presented in **Figure 8.7**). Clear felling of forestry is in line with baseline conditions / Do Nothing impact, will be carried out in line with forestry operations best practice guidance, and in line with relevant mitigation measures set out in this report in terms of monitoring ground stability locally and managing potential sources of contamination. No intrusive or excavation works are anticipated as part of tree felling activities. The management vehicles used for tree felling will align with measures set out in this report, for example; spill kits to hand, etc. During construction down time / overnight, vehicles will be stored in suitable locations on the Project footprint and not left un-manned on vegetated / tree felling / soils areas, or within sensitive areas / receptor buffers.

Where vehicular movements are necessary outside of the Project footprint, ground conditions will be maintained and reinstated. This includes for example replacing sods, smoothing over with excavator bucket etc. Where ground conditions are poor, or prolonged works, temporary access measures will be deployed, for example floating platforms / floating access track.

For the Grid Connection route, before starting construction, the area around the edge of each joint bay which will be used by heavy vehicles will be surfaced with a terram cover (if required) and stone aggregate to minimise ground damage.

Implementation of proposed mitigation measures described will minimise the adverse impacts posed by vehicular movements, and any localised unforeseen impacts will trigger escalation of response ensuring locations are restored and any potential pathways to receptors are isolated.

8.5.2.6 Soil Contamination

Any accidental spillage of introduced materials, such as concrete, will be removed from the Site.

Soil contamination, or the potential for same, is an inherent risk associated with any development. As such, good practice during construction activities, as detailed in the CEMP **(Appendix 2.1),** will address and minimise the potential for soil contamination to occur. The CEMP will be developed to include the scheduled checks of assets (plant, vehicles, fuel bowsers) on a regular basis during the construction phase of the Project. The purpose of this management control is to ensure that the measures in place are operating effectively, prevent accidental leakages, and identify potential breaches in the protective retention and attenuation network during earthworks operations. In addition, all such management plans will be revised as 'live' documents, so that lessons learned, and improvements will be made over course of the Project.

8.5.2.6.1 Mitigation by Avoidance and Good Practice

8.5.2.6.1.1 Release of Hydrocarbons

Contaminants which pose the most significant risk to soils, namely hydrocarbons and construction materials such as cement / concrete, pose an even greater risk to surface waters and groundwaters. In the event an accidental discharge was to occur without mitigation, contaminates will likely leak or be spilled on soils initially. Protecting soils from such will in turn mitigate against the potential for contaminates reaching the hydrological network associated with the Site, however given that such features are fundamental to the potential effect of contaminants down gradient of surface water receptors, mitigation measures for contaminants are presented in detail in **Chapter 9: Hydrology and Hydrogeology.** To control and contain any potential hydrocarbon or other harmful substance spillages by vehicles during construction. Plant equipment will be refuelled off the development Site, thus mitigating this potential impact by avoidance.

Where fuelling offsite is impractical (e.g., bulldozers, cranes, etc.) and fuelling must occur on Site, all oil and chemical storage facilities will be bunded to 110% volume capacity of fuels stored at the Site, **Appendix 9.6 – Tile 19**. A "fuel station" will be designated for the purpose of safe fuel storage and fuel transfer to vehicles, located at the Temporary Contractor's Compound. Furthermore, an Emergency Response Plan will be in place as part of the Construction and Environment Management Plan (**Appendix 2.1**) before consented works are carried out.

As discussed, construction activities will be restricted to the footprint of the Project, therefore the potential for contaminants reaching soils is likely limited to the footprint of the Project or construction area. There remains the potential for contaminant migration through soils however, scope for migration is limited considering the Site geology i.e., peat / loamy soil with low permeability and transmissivity rates, and similarly poorly productive bedrock aquifers with only localised connectivity. The highest permeability and transmissivity rates at the Site are attributed to the underlying till / gravels. It is also noted that the scale of any potential contamination impact will likely be minor in scale, for example; plant machinery leak (on exposed ground), as opposed to a fuel tank rupture (in bunded structure).

A fuel management plan will be prepared (and included in the CEMP) which will incorporate the following elements:

- Mobile bowsers, tanks and drums will be stored in secure, impermeable storage area, away from drains and open water;
- Fuel containers will be stored within a secondary containment system e.g., bund for static tanks or a drip tray for mobile stores
- Ancillary equipment such as hoses, pipes will be contained within the bund
- Taps, nozzles or valves will be fitted with a lock system
- Fuel and oil stores including tanks and drums will be regularly inspected for leaks and signs of damage
- Only designated trained operators will be authorised to refuel plant on Site.

In the event of an accidental spill during the construction, operational or decommissioning phase of the Project, contamination occurrences will be addressed immediately, this includes the cessation of works in the area of the spillage until the issue is resolved. In this regard, appropriate spill kits, **Appendix 9.6 – Tile 20**, will be provided across the Site to deal with the event of a spillage and made available at all times. Spill kits will contain a minimum of; oil absorbent granules, oil absorbent pads, oil absorbent booms, and heavy-duty refuse bags (for collection and appropriate disposal of contaminated matter). Staff will be trained in their use and details of personnel and location and type of spill kits will be listed in the CEMP (**Appendix 2.1**), which will be updated by the selected site Contractor. No materials contaminated or otherwise will be left on the Site. Suitable receptacles for hydrocarbon contaminated materials will also be at hand. Upon usage, spill kits will be promptly replaced.

In the event of a significant or catastrophic hydrocarbon spillage, emergency responses will be escalated accordingly. Escalation will include measures such as the installation of temporary sumps, drains or dykes to control the flow or migration of hydrocarbons, excavation and disposal of contaminated material. Emergency contact numbers for the Local Authority Environmental Section, Inland Fisheries Ireland, the Environmental Protection Agency and the National Parks and Wildlife Service will be displayed in a prominent position within the vicinity of works.

The mitigated impacts associated with hydrocarbons is considered to be **neutral to slight and temporary.**

8.5.2.6.1.2 Release of Horizontal Drilling Fluid and Material

In order to mitigate the potential impact posed by the use of drilling fluid material and the associated effects on the receiving environment, the following precautions and mitigation measures are recommended:

- Spoil from drill arisings will be managed akin to mitigation measures outlined in **EIAR Chapter 9: Hydrology and Hydrogeology** for the release of suspended solids, in that arising will require temporary stockpiling which the potential to be entrained by surface water runoff. This includes but is not limited to: stockpiling out of designated surface water buffer zones and the utilisation of silt fencing around stockpiles to contain sediment laden runoff.
- In the case of a major spill or a breakout and drilling fluid return, the leak will be stopped if safe to do so, contained and prevented from entering drains or water courses. Any recoverable product will be collected, similar in means of a hydrocarbon spill, and disposed of properly. If a significant quantity of material enters drains or watercourses, emergency services will be advised immediately.
- In terms of drilling fluid disposal, very fine solids, or colloidal particles, are very slow to settle out of waters and the finest of particles require near still water and relatively long periods of time to settle, therefore, such particles are unlikely to settle at sufficient rates. To address this, flocculant will be used to promote the settlement of finer solids prior to discharging to surface water networks, **Appendix 9.6 – Tile 14**. Flocculant 'gel blocks'

are passive systems, self-dosing and self-limiting, however they still require management as per the manufactures instructions. Flocculants are made from ionic polymers. Cation polymers (positive charge) are effective flocculants; however, their positive charge makes them toxic to aquatic organisms. Anionic polymers (negative charge) are also effective flocculants, and are not toxic i.e., environmentally friendly.[20] Therefore, if flocculants are deployed the material used must be made from anionic polymers. Flocculants are discussed in greater detail in **EIAR Chapter 9: Hydrology and Hydrogeology.**

The mitigated impacts associated with HDD arisings is considered to be **not significant.**

8.5.2.6.1.3 Release of Wastewater and Sanitation Contaminants

A temporary compound area will be constructed on-site to contain temporary facilities for the construction phase including 'port-a-cabin' structures. The temporary compound will be constructed on a base of geo-textile matting laid at ground level. This will be stabilized with the laying of hardcore material on top. During the construction phase, foul effluent will be periodically removed for offsite disposal.

Wastewater/sewerage from the staff welfare facilities located in the Temporary Construction Compound will be collected and held in a sealed storage holding tank, fitted with a high-level alarm. The high-level alarm is a device installed in the storage tank that is capable of sounding an alarm during a filling operation when the liquid level nears the top of the tank. Chemicals are likely to be used to reduce odours.

All wastewaters will be emptied periodically, tankered off-site by a licensed waste collector to the local wastewater sanitation plant for treatment. There will be no onsite treatment of wastewater. A wastewater or sewerage leakage is not anticipated in a properly managed Site.

The mitigated impacts associated with wastewater and sewerage is considered to be **temporary and neutral to slight.**

[20] USEPA (2013) "Stormwater Best Management Practice: Polymer Flocculation" *United States Environmental Protection Agency: Office of Water*, 4203 M.

8.5.2.6.1.4 Release of Construction and Cementitious Materials

In order to mitigate the potential impact posed by the use of concrete and the associated effects on the receiving environment, the following precautions and mitigation measures will be implemented, as set out in the CEMP **(Appendix 2.1):**

- Precast concrete will be used wherever possible i.e., formed offsite. Elements of the Project where the use of precast concrete is not possible includes turbine foundations. Where the use of precast concrete is not possible the following mitigation measures will apply:
- Lean mix concrete, often used to provide protection to main foundations of infrastructure from soil biome, will be minimized, limited to the requirement of turbine foundations if necessary. Lean mix concrete can alter the pH of water if introduced, which would then require the treatment of acid before being discharged to the surrounding environment. The risk of runoff will be minimal, as concrete will be contained in an enclosed, excavated area
- The acquisition, transport and use of any cement or concrete on Site will be planned fully in advance of commencing works by the Contractor's Environmental Manager and supervised at all times by the Developer appointed Environmental Clerk of Works (EnvCoW).
- There will be no excess cementitious material on the vehicle which could be deposited on trackways or anywhere else on Site. To this end, delivery trucks, tools and equipment will be cleaned at designated washout areas located conveniently and within a controlled area of the Site. Vehicles will undergo a visual inspection prior to being permitted to drive onto the proposed Site or progress beyond the contractor's yard.

In addition, the following drainage measures will apply;

- Any shuttering installed to contain the concrete during pouring will be installed to a high standard with minimal potential for leaks. Additional measures will be taken to ensure this, for example the use of plastic sheeting or other sealing products at joints.
- Concrete will be poured during periods of minimal precipitation. This will reduce the potential for surface water run off being significantly affected by freshly poured concrete. This will require limiting these works to dry meteorological conditions i.e., avoid foreseen sustained rainfall (any foreseen rainfall event longer than 4-hour duration) and/or any foreseen intense rainfall event (>3 mm/hour). This also will avoid such conditions while concrete is curing, in so far as practical.
- Ground crew will have a spill kit readily available, and any spillages or deposits will be cleaned/removed as soon as possible and disposed of in accordance with the Waste Management Plan (see **Appendix 2.1; CEMP, Management Plan 5: Waste Management Plan**).

- Pouring of concrete into standing water within excavations will not be undertaken. Excavations will be prepared before pouring of concrete by pumping standing water out of excavations to the buffered surface water discharge systems in place.
- No surplus concrete will be stored or deposited anywhere on Site. Such material will be returned to the source location or disposed of off-site appropriately.

Elements of the Project where precast concrete will be used will be identified in the CEMP. Elements of the Project where the use of precast concrete will be used include e.g., structural elements of watercourse crossings (single span / closed culverts) as well as cable joint bay structures.

Supplementary mitigation measures outlined in **Chapter 9: Hydrology and Hydrogeology** to surface water receptors will also apply. The mitigated impacts associated with construction waste is considered to be **neutral to slight.**

8.5.2.7 General Waste

All construction and operation waste materials will be correctly sorted, recycled or disposed of in accordance with good site practice described in Management Plan 5 of the CEMP, a policy of Reduce, Reuse and Recycle will apply. The mitigated impacts associated with general waste is considered to be **temporary** and **neutral to slight.**

8.5.2.8 Material and Waste Management

A site-specific Peat and Spoil Management Plan and a Waste Management Plan have been prepared as part of **Appendix 2.1, Management Plan 4**. All excavated earth materials will either be re-used in an environmentally appropriate and safe manner e.g., landscaping and bog restoration or removed from the Site at the end of the construction phase. No permeant stockpiles will be left on the site.

Any surplus of natural materials (e.g., peat) to be used as backfill or deposited elsewhere in the Site will not be deposited to above existing ground level for the area in question. This ensures that peat used as backfill around newly established turbine foundations will not exceed local ground level, and any peat or natural materials deposited elsewhere will not exceed original ground level. In essence, no permanent stockpiles will be established as a product of the construction phase of the Project, or associated restoration activities as all materials will be re-used as much as possible on-site.

Excavated materials onsite will be reused and recycled according to the Waste Hierarchy as much as possible. Where it is not possible to do so, any excess materials (road building materials) or artificial (PVC piping, cement materials, electrical wiring etc.) will be taken offsite and disposed of at a licensed facility at the end of the construction phase, refer to **EIAR Appendix 2.1**, Management Plan 5: Waste Management. In the event of waste arising at the Site, management of waste arising from the construction phase of the Project will require classification, appropriate transfer, and appropriate disposal. Waste streams will vary and will include the following potential categories:

- Inert / Non-Hazardous Soils & Stones (EWC Code: 17 05 04) **–** greenfield subsoils and bedrock is likely to be Inert. This could include surplus coarse / hardcore aggregate contaminated with soils remaining at the end of the construction phase of the development.
- Hazardous Soils & Stones (EWC Code: 17 05 03*) or oily waste (spill kit consumables) **–** Soils or any materials with significant hydrocarbon contamination will likely be hazardous due to Total Petroleum Hydrocarbon concentrations. Soils impacted by significantly by cementitious material contamination will likely be hazardous due to elevated pH concentrations

All materials used on Site and wastes generated on Site will be reduced by good Site practice. Mitigation by remediation, for example, housekeeping, maintenance etc., in terms of waste or contaminants will be an ongoing measure throughout the construction phase of the Project, that is any and all contaminants will be removed from the Site in an appropriate manner when ever produced or observed.

Waste management measures to avoid Site pollution are specified in the **CEMP Appendix 2.1** and **Chapter 13: Material Assets**. A policy of reduce, re-use and recycle will apply. All waste will be segregated and re-used where possible or removed from Site for recycling. Any waste which is not recyclable or compostable will be properly disposed of to landfill.

8.5.2.9 Mitigated Sequence of Events During Wind Farm Construction on the Receiving Environment

The following sections outlines and summarises the general stages or elements of construction related to the Project. In contrast to **Section 8.4.3.1 Typical Sequence of Events in Wind Farm Construction on the Receiving Environment,** the following sequence includes a high level description of mitigation which is relevant to the respective steps. Specific details and important design considerations for mitigation measures prescribed in response to each activity type are discussed in the previous sections. Cross referencing to **EIAR Chapter 9: Hydrology and Hydrogeology** is included due to the consistent relationship between disciplines, namely; hydrology, hydrogeology, geology.

8.5.2.9.1 Activities – With Mitigation

1. General Site Preparation:

- Install Surface Water Monitoring Equipment: It's important to install surface water monitoring equipment in downstream rivers to monitor the impact of construction activities on water quality. This equipment can include water quality sensors, flow meters, and sediment samplers, among others. The monitoring equipment will be installed prior to works commencing construction activities to establish baseline data and will continue to be monitored throughout the construction process to ensure compliance with environmental quality standards.
- Install Silt Screens, Interceptor Drains, and SuDS: To manage runoff and sediment control during the initial phases of construction, it's important to install silt screens, interceptor drains, and SuDS. Silt screens will be installed along the perimeter of the Site to capture sediment and prevent it from entering watercourses. Interceptor drains will be installed to divert runoff away from construction areas and towards designated settling ponds or treatment systems. SuDS, such as permeable pavement or infiltration trenches, will also be installed to manage runoff and reduce the impact of construction on the Site's hydrology. This work involves excavation activities and spoil management.
- Prepare Temporary Stockpile Areas: It's important to prepare designated temporary stockpile areas for the different types of waste generated during the construction process. This includes separate areas for vegetation, topsoil, subsoil, and other types of waste. These areas will be prepared in a location that minimizes the potential for runoff and erosion.
- Clear Vegetation and Soils: As part of site preparation, it's important to clear the vegetation and topsoil to prepare the area for construction. This will include cutting down trees and removing all vegetation from the Site, including grass, shrubs, and bushes. The vegetation and topsoil are temporarily stockpiled in designated areas in addition, the subsoil is also removed to the required depth to prepare the area for construction, and it's also stockpiled in a designated area for later use in the restoration of the Site.
- Excavate and grade the area for the construction of access tracks, hardstand areas, foundations, and other significant infrastructure units. This work involves excavation activities and spoil management.

2. Access Track and Hardstand Areas:

- Install silt screens, interceptor drains, and temporary SuDS:
    - Install silt screens along the perimeter of the Site to capture sediment and prevent it from entering watercourses.
    - Install interceptor drains to divert runoff away from construction areas and towards designated settling ponds or treatment systems.
    - Install SuDS, such as permeable pavement or infiltration trenches, to manage runoff and reduce the impact of construction on the Site's hydrology.
    - Ensure that all drainage structures and SuDS are regularly inspected and maintained to prevent blockages and ensure proper functioning.
    - Monitor water quality downstream of the construction Site to assess the effectiveness of these measures in managing runoff and sediment control.
- Clear vegetation and soil layers:
    - Cut down trees and remove all vegetation from the Site where relevant, including grass, shrubs, and bushes.
    - Stockpile vegetation in a designated area for later removal or use in the restoration of the Site.
    - Remove the acrotelm peat and/or topsoil to the required depth to prepare the area for construction.
    - Stockpile the acrotelm peat and/or topsoil in a designated area for later use in the restoration of the Site.
    - Remove the catotelm peat and/or subsoil to the required depth to prepare the area for construction.
    - Stockpile the catotelm peat and/or subsoil in a designated area for later use in the restoration of the Site.
    - Use silt screens and other temporary measures to manage runoff and prevent sediment from entering watercourses or drains.
- Install drainage structures and erosion control measures, such as culverts and Permanent SuDS.
- Construct the road base and hardstand using suitable materials, such as crushed rock or concrete.
- Construct hardstand areas for the installation and maintenance of wind turbines.
- Use designated temporary stockpile areas and segregation of materials for different types of material, including materials arising at the Site, and being imported to the Site. Types of material to be segregated and managed separately;
    1. Topsoil
    2. Acrotelm Peat

3. Catotelm Peat
4. Subsoil – this can be subdivided between material suitable or unsuitable for engineering fill etc.
5. Weathered or crushed rock
6. Specific waste streams including contaminated soil is it arises.

3. Drainage & Sustainable Drainage Systems (SuDS)

- Sustainable Drainage Systems (SuDS): SuDS are a set of techniques that are designed to manage surface water runoff in a more sustainable way than traditional drainage systems. SuDS mimic natural drainage processes by promoting infiltration, evapotranspiration, and the use of storage and delayed release systems. They can include a range of features such as permeable paving, green roofs, and rain gardens.
- Designing SuDS: The design of SuDS will be site-specific and tailored to local conditions. It will consider the Site's topography, soil type, rainfall intensity, and available space. The design will also incorporate a range of techniques to manage runoff, such as infiltration, storage, and conveyance. The aim of SuDS is to reduce the volume and rate of runoff, improve water quality, and provide amenity and biodiversity benefits.
- Benefits of SuDS: The benefits of SuDS are numerous, including reducing the risk of flooding, improving water quality, enhancing biodiversity, and creating green spaces. SuDS can also provide additional benefits, such as reducing urban heat island effects, improving air quality, and enhancing the visual amenity of an area.
- SuDS maintenance: SuDS require regular maintenance to ensure they continue to function effectively. This includes regular inspections, cleaning of drainage systems, and the removal of debris and sediment. Maintenance is essential to ensure that the SuDS system continues to provide the intended benefits and meets regulatory requirements. Maintenance will be carried out by a trained and experienced professional, and a maintenance plan will be developed for each individual SuDS system.
- Construction of Drainage Channel: The drainage channel will be constructed with a lining of coarse aggregate to reduce erosion and promote infiltration. The channel will be graded appropriately to ensure proper flow, and regular outfalls will be included to promote diffuse discharge to vegetated (low risk) areas where possible.
- Installation of Check Dams: In line check dams will be installed in a continuous manner along the drainage network to slow down the flow of water, reduce erosion, and promote sediment deposition. The design, placement, and construction of check dams

will be carefully considered to ensure that they are effective in reducing the velocity of runoff while not impeding the flow of water.

- Purpose of SuDS: The use of SuDS, including coarse drainage, check dams, and stilling ponds, serves several purposes. They attenuate runoff by slowing down the flow of water, settling out gross solids, promoting recharge by allowing water to infiltrate into the soil, reducing the hydrological response to rainfall at the Site, and supporting potential biodiversity gains by creating suitable habitat for certain plant and animal species.
- Installation of outfalls: Once the drainage channel is constructed, outfalls will be installed at regular intervals to manage runoff and prevent erosion. Stilling ponds will be installed at the base of the outfall to slow down the flow of water and allow sediment to settle out. Buffered outfalls will be used where the drainage channel discharges into sensitive receiving waters, and outfalls will be directed towards vegetated areas where possible.
- Maintenance: A regular maintenance program will be established for the drainage system to ensure that it continues to function effectively. This will include regular inspections of the drainage channel and outfalls to identify any erosion or damage, as well as routine cleaning and removal of accumulated sediment.

4. Watercourse crossings and culverts:

- Culverts:
  - In line with, inter alia, SEPA (2010) Engineering in the Water Environment Good Practice Guide for River Crossings, design and plan the culvert to meet the required hydraulic capacity and align with the watercourse's natural flow pattern.
  - Install silt screens and sediment traps upgradient of the construction area to intercept, manage and divert runoff, reduce entrainment of solids and capture sediment and prevent it from entering the watercourse.
  - Divert the watercourse flow, if necessary, to facilitate the construction of the culvert. This will involve temporarily diverting the watercourse or over-pumping the water to a temporary diversion channel.
  - Excavate the area for the culvert installation, taking care to prevent sediment from entering the watercourse.
  - Use Active Construction Water Management techniques to remove silt/solid laden waters and sludges/slurries. This will include excavation dewatering and pumping of construction waters to a treatment tank / settlement tank, equipped with monitoring and treatment equipment as required.

- Construct the culvert using suitable materials, such as precast concrete segments, to the required size and shape.
- Backfill the area around the culvert with suitable materials to ensure the culvert is properly supported and to prevent settlement.
- Install headwalls at the inlet and outlet of the culvert to protect the culvert and prevent erosion.
- Restore the natural watercourse flow and conduct any necessary erosion control measures, such as seeding or installing erosion control blankets.
- Maintaining or improving ecological value at each culvert crossing will be achieved.

- Clear Span Bridges:
  - In line with, inter alia, OPW (2019) (05-3) A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act 1945, design and plan the clear span bridge to meet the required hydraulic capacity and align with the watercourse's natural flow pattern. Abutments will be positioned as far back as reasonably practical; it is proposed to maximise the width in nearly all circumstances. The indicative max width of a clear span bridge is 10-12 m.
  - Prepare the area for the bridge construction, taking care to prevent sediment from entering the watercourse.
  - Install silt screens and sediment traps upstream of the construction area to capture sediment and prevent it from entering the watercourse.
  - Diversion of the watercourse flow will not be required as part of the construction of single span structures. Single span structures are proposed mainly due to the fact there are no in stream structures or works required.
  - Construct the bridge abutments and piers using suitable materials, such as concrete or steel, to the required size and shape.
  - Install the bridge beams or arches using suitable materials, such as steel or composite materials, to span the watercourse.
  - Backfill the areas around the abutments and piers with suitable materials to ensure they are properly supported and to prevent settlement.
  - Install any necessary guardrails or barriers to protect the bridge users.
  - Restore the area and conduct any necessary erosion control measures, such as seeding or installing erosion control blankets.

5. Foundations:

- Excavate the area to the required depth and diameter for the wind turbine foundation. Foundation dimensions: 2.8 m to 3.2 m depth, 22 m to 22.5 m diameter.

- Excavate and Backfill: To construct the wind turbine foundation, the area will be excavated to the required depth ranging from 2.8 m to 3.2 m and diameter ranging from 22 m to 22.5 m. The excavation volume for Turbine Foundations and Met Mast Foundations will range from 1,938 m^3 to 3,601 m^3 (see **Appendix 2.1: CEMP, Management Plan 4: Peat and Spoil Management Plan**). Foundation locations will be excavated to a greater depth, such as 4.0 m depth, and backfilled to around 2.5 m below ground level with crushed rock.
- Form and Pour Foundation: Shuttering and membranes are used to form the foundation pour structure, and foundation reinforcement steel rebar is installed and formed. Concrete is then poured into the foundation structure.

6. Other Significant Infrastructure Units:

- Construct Infrastructure Units: Other significant infrastructure units, such as substation buildings, electrical cabling, and meteorological masts, will be constructed using suitable materials such as concrete or steel.
- Install Drainage Structures and Erosion Control Measures: As with access track and hardstand areas, drainage structures and erosion control measures such as culverts and erosion control blankets will be installed for other significant infrastructure units.

7. Site Restoration:

- Backfilling: Excavation areas, such as those where wind turbine foundations were installed, will be backfilled with suitable soil or subsoil materials to restore the land's natural contours and soil properties. The backfilling process will be done in such a way that it mirrors the baseline conditions of the Site, including the depths of the subsoil and topsoil layers. This will help to restore the land's original drainage patterns and prevent erosion.
- Soil and Vegetation: Topsoil / Catotelm Peat that was removed during the Site preparation phase will be redistributed and seeded with appropriate vegetation to help stabilize the soil and prevent erosion. The soil (topsoil) will be tested for its nutrient content, and appropriate soil amendments will be used as needed to encourage healthy vegetation growth.
- Erosion Control: Measures such as seeding, mulching, or installing erosion control blankets will be necessary in areas where vegetation is slow to establish, or in areas with steep slopes or exposed soil. These measures will be implemented as required and will help to stabilize the soil and prevent erosion.
- Landscaping: Landscaping will be necessary to restore the Site to its original state. This will be limited to the development footprint where excavations and associated vehicular

movements are limited to. This will include as necessary planting suitable vegetation e.g. trees/hedge/shrubs in agricultural settings, sphagnum in peat settings..

- Monitoring: Post-construction monitoring of soil and water quality will be conducted to ensure that the Site is returning to its pre-construction state. This will involve testing for pollutants or other contaminants that could have been introduced during the construction phase, and taking corrective measures as needed.
- Waste Management: Waste, including waste soil/subsoil, will be minimised. This will be achieved by means of a robust and efficient **Peat and Spoil Management Plan** and **Waste Management Plan** (**Appendix 2.1 CEMP**; Management Plan 4 and 5, respectively). Any remaining construction materials or waste will be properly disposed of or recycled, in accordance with local regulations. This will include materials such as soil, rock, concrete, metal, or plastic, as well as hazardous waste such as batteries or oils.

Overall, the restoration phase is an important part of the wind farm construction process, as it ensures that the land is returned to its original state and can continue to support the ecosystem and local communities. A positive commitment to achieve neutral impacts at a minimum and to promote beneficial impacts where possible will inform the setting of objectives. It is important to carefully plan and execute this phase to ensure that the restoration is successful and meets the objectives which will incorporate all relevant environmental objectives, standards and targets.

8.5.2.10 Construction Phase Residual Effects

Mitigation measures outlined in this report lay down the framework to avoid and minimise all potential impacts of the Project on Geological receptors. Geological mitigation measures and impacts are strongly connected to those related to Hydrology and Hydrogeology. Furthermore, the mitigation laid out in this chapter provides mitigation by avoidance measures for hydrology and hydrogeology impacts. The mtigated potential impacts lay down the achievable benchmarks provided measures are considered and implemented adequately, including adequate monitoring, and escalation of emergency responses if required.

The residual impacts after implementation of all mitigation measures for the construction phase of the development are summarised and presented in **Table 8.11.**

8.5.2.11 Operational Phase Residual Effects

No new impacts are anticipated during the operational phase of the Project on the geological, geomorphological and geotechnical environment therefore no additional mitigation measures are required.

Maintenance and monitoring during the operational phase of the Project pose similar hazards and risks associated with the construction phase but to a far lesser extent, for example, the potential for fuel spills from vehicles, etc. The mitigation measures described in this EIAR chapter will be adopted and implemented. All wastes from the control building and ancillary facilities will be removed by the appropriate contractor. The operational team will carry out maintenance works (to Site Access Tracks, Onsite Substation and turbines) and will put in place control measures to mitigate the risk of hydrocarbon or oil spills during the operational phase of the windfarm. Any vehicles utilised during the operational phase will be maintained on a weekly basis and checked daily to ensure any damage or leakages are corrected.

Regular monitoring, similar to the construction phase but on a less frequent basis will be required i.e. monthly. The Project will be inspected on a routine quarterly basis and following storm events. Any potential issues arising will be noted and remedial action taken in line with construction phase mitigation.

8.5.2.12 Operational Phase Residual Effects

The potential effects on the soil and geological environment during the operational phase of the work will be mitigated through good Site practice; vehicular movements, hydrocarbon controls, sustainable use of natural resources, human health etc. as discussed previously. Overall, the residual effects from these aspects will have a **slight to moderate, permanent, adverse** effect on the Site. The residual effect of land take for the operational windfarm has a **slight to moderate, long-term to permanent** but **reversible** after decommissioning and restoration effect of the Development.

8.5.3 Development Decommissioning and Restoration Phases

8.5.3.1 Decommissioning of Infrastructure

Following the permitted lifespan of the wind farm, decommissioning of the infrastructure will occur. Decommissioning of the proposed windfarm will include:

- Removal of five wind turbines and concrete plinths.
- Removal of permanent meteorological mast.
- Removal of all associated underground electrical and communications cabling connecting the wind turbines to the wind farm substation. Ducting is to remain in-situ.

Cranes of similar size to those used for construction will disassemble each turbine using the same crane hardstands. Turbines will be cut on Site so as to fit on articulated trucks, therefore allowing the use of the civil construction delivery route for removal. All physical infrastructure; towers, blades and all above ground components will be removed from Site and reused, recycled, or disposed of in a suitably licenced facility as appropriate.

Residual impacts after the decommissioning phase are complete include all impacts classified as being long-term to permanent effects of the Project, that is, there will remain a change in ground conditions at the Site with the replacement of natural materials such as peat, subsoil and bedrock by concrete, subgrade and surfacing materials. This is a **localised, adverse, moderate significance, direct permanent** change to the materials composition at the Site.

No new impacts are anticipated during the decommissioning phase of the Project (removal of turbines and similar infrastructure on the geological, geomorphological and geotechnical environment) therefore no new mitigation measures are required, however the decommissioning of major infrastructure including proposed turbines poses similar hazards and risks to the environment compared to that of the construction phase.

Restoration of the Site following decommissioning of the proposed infrastructure is in its own right a phase of the Development. Restoration activities have the potential to be disruptive and hazardous to the environment, to the point that a 'benefit analysis' will be required to evaluate any such activity before it is permitted. Ultimately, any such restoration activities will need to be assessed under the scope of multiple environmental disciplines, similar to this EIAR, and the potential synergistic effects. Given that the condition of the environment will likely change over the course of the operational phase of the Development, particularly in terms of the condition and degree of establishment of blanket bog and associated ecology, and ornithology, it is recommended that the potential for restoration following the decommissioning phase of the Development is evaluated closer to the time (c. 25-30 years). It is noted that restoration activities do not currently conform to baseline conditions.

Extensive vehicular movement on peat is not anticipated to any significant extent considering adequate Turbine Hardstand will have been established, however the risk of fuel or other contaminant spillages, or management of waste are valid hazards during the decommissioning phase. The mitigation measures described in this EIAR chapter will be adopted and implemented by means of a Decommissioning Plan.

On the basis that a Decommissioning Plan has been established, **Management Plan 6** of the CEMP **(Appendix 2.1)** and will be implemented during the decommissioning works associated with the Project, potential issues arising giving cause to residual effects are likely to be **infrequent, imperceptible to slight, localised and reversible**.

Residual impacts after the decommissioning phase are complete include all impacts classified as being long-term to permanent effects of the Project, that is, there will remain a change in ground conditions at the Site with the replacement of natural materials such as peat, subsoil and bedrock by concrete, subgrade and surfacing materials. This is a localised, negative, moderate significance, Significant / Moderate weighted significance, direct permanent change to the materials composition at the Site. However, the carefully managed reintroduction and/or reuse of soils and peat at the Site in place of Turbine Hardstand areas, and successful habitat management, revegetating and rewilding of those areas will have beneficial impacts, or revert to baseline conditions preconstruction phase.

8.5.4 Cumulative Effects

Considering the discipline under investigation, soils and geology, and the fact that potential effects of the Project on same are generally localised, the cumulative effects of the Project are not considered to vary dramatically or behave synergistically when considering the Site as a unit, or indeed when considering in conjunction with other developments, outlined in **Appendix 2.5**, in the vicinity or downgradient of the Site. However, on a national scale the importance of soils and peatlands in particular in terms of ecological value and carbon value must be considered. The cumulative effects on land use are likely to be imperceptible to slight. The cumulative impacts associated with hydrological and hydrogeological characteristics of the Site are also identified in **Chapter 9: Hydrology and Hydrogeology**.

8.6 SUMMARY OF SIGNIFICANT EFFECTS

This chapter assesses all elements of the Project in terms of Land, Soils, and Geology. The potential impacts that could arise from the Project during the construction, operational and decommissioning phases relate to the potential for increased stability issues and the erosion of soils and entrainment of solids in runoff associated with Site preparation activities and excavations for the infrastructure elements including the turbine foundations and cable trenches.

The unavoidable residual impacts on the soils and geology environment as a function of the Project is that there will be a change in ground conditions at the Site with natural materials such as peat, subsoil and bedrock being replaced by concrete, subgrade and surfacing materials.

Other potential impacts are considered to range in significance from Slight to Moderate, **Table 8.11**, while others range from Significant to Profound (e.g., Landslide **–** *worst case*). Providing the prescribed mitigation measures outlined in this report are fully implemented and best practice is followed on Site, the risk of such potential impacts can be significantly reduced or in some cases are considered avoidable resulting in neutral impacts. Furthermore, some impacts have some benefit to the receiving environment, including the incremental clear fell of forestry.

No new impacts are anticipated during the operational phase of the Project. Similar impacts are identified when comparing the construction and operational phases of the Project (i.e., hydrocarbon spill, excavations, etc.), however considering that works will be far less intensive during the operational phase the likelihood of impacts is low, thus the risk is low.

No new adverse impacts are anticipated during the decommissioning phase of the Project however the phase will be considered similar in nature to the construction phase in terms of impacts and application of mitigation measures.

A summary of Potential Effects on the receiving environment from the Project is presented in the following table. The table presents both un-mitigated or pre-mitigation effects, and anticipated effects with the adequate application of the prescribed mitigation measures.

Table 8.11: Summary of Potential Effects on receiving environment from the Project in the absence of and with mitigation measures.

		Qualifying Criteria Pre-Mitigation									Qualifying Criteria with Mitigation	
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Land Take Grid Connection Route	Construction	Direct *	Adverse	Small	Slight	Localised	Conforms to Baseline e.g., public roads.	Unavoidable	Permanent but Reversible	Yes	Adverse	Slight
Land Take Turbine Delivery Route	Construction	Direct *	Adverse	Small	Slight	Localised	Conforms to Baseline e.g., public roads.	Unavoidable	Permanent but Reversible	Yes	Adverse	Slight
Clear Felling of Afforested Areas	Construction	Direct *	Adverse	Small to Moderate	Moderate	Development Footprint and turbine buffer felling zones.	Conforms to baseline e.g., forestry tracks or operations)	Unavoidable	Permanent but Reversible	Yes	Adverse to Beneficia l	Slight Adverse to Small Beneficial

		Qualifying Criteria Pre-Mitigation										Qualifying Criteria with Mitigation
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Subsoil and Bedrock Removal – General Excavations	Construction	Direct *	Adverse	Large	Slight to Moderate	Development Footprint	Conforms to baseline e.g., Agri/forestry tracks or operations)	Unavoidable	Permanent but Reversible	Yes	Adverse	Slight to Moderate
Subsoil and Bedrock Removal – Site Access Tracks	Construction	Direct *	Adverse	Moderate to Large	Slight to Moderate	Development Footprint	Conforms to baseline e.g., Agri/forestry tracks or operations)	Unavoidable	Permanent but Reversible	Yes	Adverse	Slight to Moderate
Subsoil and Bedrock Removal – Hardstand and Foundation Areas	Construction	Direct *	Adverse	Moderate to Large	Slight to Moderate	Development Footprint	Conforms to baseline e.g., Agri/forestry tracks or operations)	Unavoidable	Permanent but Reversible	Yes	Adverse	Slight to Moderate

		Qualifying Criteria Pre-Mitigation										Qualifying Criteria with Mitigation
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Subsoil and Bedrock Removal – Borrow Pit	Construction	Direct *	Adverse	Moderate to Large	Slight to Moderate	Development Footprint	Conforms to baseline e.g., Agri/forestry tracks or operations)	Unavoidable	Permanent but Reversible **	Yes	Adverse	Slight to Moderate
Subsoil and Bedrock Removal – Site Cable Trenches	Construction	Direct *	Adverse	Small to Moderate	Slight	Development Footprint	Conforms to Baseline e.g., public roads and services.	Unavoidable	Permanent / Reversible	Yes	Adverse	Neutral
Subsoil and Bedrock Removal – Turbine Delivery Route	Construction	Direct *	Adverse	Small	Slight	Localised	Conforms to Baseline e.g., public roads and services.	Unavoidable	Permanent / Reversible	Yes	Adverse	Neutral

		Qualifying Criteria Pre-Mitigation									Qualifying Criteria with Mitigation	
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Subsoil and Bedrock Removal – Grid Connection Route	Construction	Direct *	Adverse	Moderate	Slight	Localised	Conforms to Baseline e.g., public roads and services.	Unavoidable	Permanent / Reversible	Yes	Adverse	Neutral
Spoil Management	Construction	Direct *	Adverse	Moderate to Large	Slight to Moderate	Development Footprint; Localised	Conforms to Baseline e.g., public roads and services.	Likely	Permanent / Reversible	Yes	Adverse	Neutral / Beneficial
Geological Stability	Construction	Direct *	Adverse	Small to Large	Slight	Localised	Contrast to Baseline	Unlikely	Permanent	Yes	Adverse	Neutral

		Qualifying Criteria Pre-Mitigation										Qualifying Criteria with Mitigation
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Vehicular Movements - Compaction, Erosion and Degradation	Construction	Direct *	Adverse	Moderate to Large	Slight to Moderate	Development Footprint	Conforms to Baseline (forestry)	Likely	Permanent	Yes	Adverse	Neutral
Localised Stability Issue (Peat/soil stability issues arising from e.g., vehicular movement or excavations)	Construction	Direct *	Adverse	Small to Moderate	Slight (to Profound)	Localised (Potentially Regional)	Contrast to Baseline	Likely	Temporary / Reversible	Yes	Adverse	Slight
Landslide – worst case (Stability issues and slope failure arising from e.g., vehicular movement and excavations).	Construction	Direct *	Adverse	Small to Moderate	Significant (to Profound)	Localised (Potentially Regional)	Contrast to Baseline	Unlikely	Permanent	Yes	Adverse	Neutral

		Qualifying Criteria Pre-Mitigation									Qualifying Criteria with Mitigation	
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Soil Contamination - Hydrocarbon	Construction	Direct *	Adverse	Small	Significant	Localised*	Contrast to Baseline	Likely	Long term / Permanent	Yes	Adverse	Neutral
Soil Contamination - Horizontal Direction Drilling Material	Construction	Direct *	Adverse	Small	Slight to Moderate	Localised*	Contrast to Baseline	Likely	Short term / Reversible	Yes	Adverse	Slight
Soil Contamination - Wastewater Sanitation – Waste	Construction	Direct *	Adverse	Small	Moderate to Significant	Localised*	Contrast to Baseline	Likely	Long term / Permanent	Yes	Adverse	Neutral

		Qualifying Criteria Pre-Mitigation									Qualifying Criteria with Mitigation	
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Soil Contamination - Wastewater Sanitation – Chemicals	Construction	Direct *	Adverse	Small	Moderate to Significant	Localised*	Contrast to Baseline	Likely	Long term / Permanent	Yes	Adverse	Neutral
Soil Contamination - Construction of Cementitious Material	Construction	Direct *	Adverse	Small	Slight to Significant	Localised*	Contrast to Baseline	Likely	Long term / Permanent	Yes	Adverse	Slight
Soil Contamination - General Waste	Construction	Direct *	Adverse	Small	Slight	Localised*	Contrast to Baseline	Likely	Long term / Permanent	Yes	Adverse	Neutral

		Qualifying Criteria Pre-Mitigation										Qualifying Criteria with Mitigation
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Land Take Wind Farm	Operational	Direct *	Adverse	Small to Moderate	Slight to Moderate	Development Footprint	Conforms to baseline e.g., Agri/forestry tracks or operations)	Unavoidable	Long term/ Permanent / Reversible after Decommissioning / Restoration	Yes	Adverse	Slight to Moderate

Note:
* Includes Indirect / Secondary impacts to receptors i.e., Hydrology/Hydrogeology. For example: Contamination of soils / peat by hydrocarbons is considered a localised impact, however if hydrocarbon contamination is intercepted by surface water features or groundwater bodies the impact is potentially regional depending in the environmental circumstances (**Chapter 9: Hydrology and Hydrogeology**)
** Not reversible in terms of geology e.g., replacing competent bedrock, but impacts to ground levels will be reversible through reinstatement with fill.

8.7 REFERENCES

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9 HYDROLOGY & HYDROGEOLOGY

9.1 INTRODUCTION

This chapter assesses the impacts of the Project (**Chapter 1: Introduction**) on the Hydrology and Hydrogeology environment associated with the Site. The Project refers to all elements of the application for the construction of Inchamore Wind Farm (**Chapter 2: Project Description**). Where negative effects are predicted, the chapter identifies appropriate mitigation strategies therein. The assessment considers the potential effects during the following phases of the Project:

- Construction of the Project;
- Operation of the Project, and
- Decommissioning of the Project.

Common acronyms used throughout this EIAR can be found in **Appendix 1.2.** This chapter of the EIAR is supported by the following Figures provided in **Volume III** and by the appended documents provided in **Volume IV** of this EIAR.

- **Figure 9.1(a) –** Site Location & Layout Wind Farm
- **Figure 9.1(b) –** Site Location & Layout Grid Connection Route
- **Figure 9.2(a) -** Surface Water Network Wind Farm
- **Figure 9.2(b) -** Surface Water Network Grid Connection Route
- **Figure 9.3(a) -** WFD Status Wind Farm
- **Figure 9.3(b) -** WFD Status Grid Connection Route
- **Figure 9.4(a) -** WFD Risk Wind Farm
- **Figure 9.4(b) -** WFD Risk Grid Connection Route
- **Figure 9.5 -** Rainfall Trends at Site
- **Figure 9.6 -** Surface Water & Designated Area Flow Chart
- **Figure 9.7 (a) -** Surface Water Mapping and Survey Wind Farm
- **Figure 9.7 (b) -** Surface Water Mapping and Survey Grid Connection Route
- **Figure 9.8(a) -** Bedrock Aquifer Wind Farm
- **Figure 9.8(b) -** Bedrock Aquifer Grid Connection Route
- **Figure 9.9 (a) -** Groundwater Vulnerability Wind Farm
- **Figure 9.9 (b) -** Groundwater Vulnerability Grid Connection Route
- **Figure 9.10 (a)** - Groundwater Recharge Wind Farm
- **Figure 9.10 (b) -** Groundwater Recharge Grid Connection Route
- **Figure 9.11(a) -** Designated & Protected Areas Wind Farm
- **Figure 9.11(b) -** Designated & Protected Areas Grid Connection Route

- **Figure 9.12(a) -** Surface Water Network and Water Resources Wind Farm
- **Figure 9.12 (b) –** Surface Water Network and Water Resources Grid Connection Route
- **Figure 9.13 (a) -** Constraints Map Wind Farm
- **Figure 9.13 (b) -** Constraints Map Grid Connection Route

- **Appendix 9.1 –** Inchamore Wind Farm Site Specific Flood Risk Assessment
- **Appendix 9.2 –** Inchamore Wind Farm Site Photographs
- **Appendix 9.3 –** Hydrochemistry Database
- **Appendix 9.4 –** SW Laboratory Certs
- **Appendix 9.5 –** Safety Material Datasheet-Clearbore
- **Appendix 9.6 –** Conceptual and Info Graphics

A Construction and Environmental Management Plan (CEMP) is appended to the EIAR in **Appendix 2.1**. This document will be a key construction contract document, which will ensure that all mitigation measures, which are considered necessary to protect the environment during the construction phase are implemented. It will include and apply all of the construction phase mitigation described within the EIAR where relevant, and by relevant competent engineers at the detailed construction design phase of the Project. For the purpose of this application, a summary of the mitigation measures is included in **Appendix 17.1**.

9.2 PROJECT DESCRIPTION

The Project (**Figure 8.1a-b**) is described in **Chapter 2: Project Description**.

9.2.1 Statement of Authority

Minerex Environmental Ltd. (MEL), an RSK group company was commissioned to carry out this Environmental Impact Assessment Report. RSK Group, is a consultancy providing environmental services in the hydrological, hydrogeological and other environmental disciplines. The company and group provide consultancy to clients in both the public & private sectors. More information can be found at www.rskgroup.com. The members of the RSK EIA team involved in this assessment include the following persons:

- Sven Klinkenbergh – Project Manager and Lead Author – B.Sc. (Environmental Science), P.G.Dip. (Environmental Protection) – Associate, Project Manager and EIA Lead Author with c. 10 years industry experience in the preparation of environmental, geological, hydrological and hydrogeological reports. Sven's involvement in this EIAR has been conducting field surveys and a technical reviewer of both Chapter 8 and Chapter 9
- Project Scientist: Jayne Stephens - B.Sc. (Environmental Science), PhD (Environmental and Infection Microbiology). Jayne is an Environmental consultant with

c. 5 years' experience working in microbiology, water, and environmental disciplines. She graduated with a BSc in Environmental Science from National University of Ireland Galway in 2014, majoring in mammal ecology. Following this, Jayne was the successful Irish applicant to the Tropical Biological Association in Cambridge to complete a field course in tropical biodiversity and conservation in Tanzania. She holds a PhD in environmental microbiology, graduating in 2023. Jayne has worked on a large number of bathing water and surface water monitoring investigations, on project Acclimatize, an EU funded project which aimed to bridge the knowledge gap in relation to at-risk urban and rural bathing waters in Ireland and Wales. During this project, Jayne was team lead for site investigations and has a number of years' experience on microbial contamination and public involvement projects for better water quality. Jayne's involvement in this EIAR has been data analysis and technical report writing.

- Lissa Colleen McClung - B.Sc. Environmental Studies (Hons.), M.Sc. Environmental Science Hons.). Current Role: Graduate Project Scientist. Colleen has recently joined RSK Ireland as a Graduate Project Scientist under the Hydrology & Hydrogeology and Land, Soils & Geology Team. After attaining an MSc in Environmental Science, with 1.1 First Class Honours, from Trinity College Dublin in 2021. Since coming on board, Colleen has worked on a variety of projects for urban residential development schemes and renewable energy. As a Project Scientist, Colleen has undertaken technical report writing in many forms, such as: Flood Risk Assessments (Stage 1 and Stage 2) (ROI), Drainage Assessments (NI), Water Framework Directive Assessments, Environmental Impact Assessment Reports (ROI) and Environmental Statements (NI). She has also carried out extensive field work around the country. Key capabilities include preparation of Environmental Impact Assessment Reports and running software such as QGIS, Python and Matlab coding languages. Colleen's involvement in this EIAR has been data analysis, technical report writing and producing technical appendices and figures.
- Mairéad Duffy- B.Sc. Environmental Management, M.Sc. Climate Change. Current Role: Graduate Project Scientist. Mairéad has experience in technical report writing and field work surveying of hydrological and geological elements of the environment with associated proposed green energy projects around the country. Mairead's involvement in this EIAR has been data analysis and technical report writing.

9.2.2 Assessment Structure

In line with the EIA Directive as amended and current EPA (2022) *Guidelines on the information to be contained in Environmental Impact Assessment Reports* the structure of this Hydrology and Hydrogeology chapter is as follows:

- Assessment Methodology and Significance Criteria.

- Description of baseline conditions at the Site.
- Identification and assessment of impacts to hydrology and hydrogeology associated with the Development, during the construction, operational and decommissioning phases of the Development.
- Mitigation measures to avoid or reduce the impacts identified.
- Identification and assessment of residual impacts of the Development considering mitigation measures.
- Identification and assessment of cumulative impacts if and where applicable.

9.3 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

The following sections are general to the EIAR process and where specific items are raised, they are assessed and discussed in detail in following sections of the report.

9.3.1 Assessment Methodology

The following calculations and assessments were undertaken in order to evaluate the potential impacts of the Project on the hydrology and hydrogeology aspects of the environment at the Inchamore Site:

- Characterise the topographical, hydrological and hydrogeological regime of the Site from the data acquired through desk study and onsite surveys.
- Water balance calculation.
- Flood risk evaluations.
- Consider hydrological or hydrogeological constraints together with Project design.
- Consider drainage issues, or issues with surface water runoff quality as a result of the Development, its design and methodology of construction.
- Assessment of the combined data acquired and evaluation of any likely impacts on the hydrology and hydrogeology aspects of the environment.
- Where impacts are identified, measures are described that will mitigate or reduce the identified impact.
- Findings are presented and reported in a clear and logical format that complies with EIAR reporting requirements.

Assessments of routes (Grid Connection Route and Turbine Delivery Route) are assessed in a similar manner but use mainly desktop assessment data to evaluate and qualify potential impact at locations associated with significant infrastructure (cable joint bays and watercourse crossings). These routes generally follow existing infrastructure, namely public roads.

9.3.1.1 General Approach

The Environmental Impact Assessment Report (EIAR) is a comprehensive document that assesses the potential impacts of a proposed development on the environment. It typically includes several fundamental components, including an assessment of baseline conditions, identification of site constraints, evaluation of the proposed development layout, identification of potential unmitigated impacts, and the identification and description of mitigation measures to minimize potential impacts to acceptable levels where possible, and to evaluate likely or expected residual impacts posed by the Project.

During the baseline assessment phase, the importance and sensitivity of environmental attributes are qualified relative to each chapter or discipline. This process involves considering available legal instruments, guidance, and relevant information or research to form the basis of qualifying environmental attributes or receptors. Site constraints are also identified during this phase, which are then used to inform the proposed development design.

The Project frozen layout is then evaluated in terms of its likely impact on the receiving environment. Potential unmitigated impacts are identified and qualified by considering the importance and sensitivity of the receiving environment, as well as the nature, scale, magnitude, and duration etc. of the proposed activity or impact arising from the development.

Once potential impacts have been identified, the EIAR then describes mitigation measures that will be applied to minimize impacts to acceptable levels where possible. These measures are objective-driven and are applied with a view to achieving the desired end result. Mitigation by design, such as avoiding constraints, can help minimize the most significant potential impacts, but residual risks will remain. Therefore, adequate application, design and execution of described mitigation measures, ongoing monitoring, management, and escalation of emergency response mitigation where relevant will be required, and the mitigation measures may need to be redesigned, repeated or re-applied until the objectives of mitigation are being achieved.

Once mitigation measures have been established, the likely residual impacts of the development are then reported. This report is typically presented in an objective, transparent, and comprehensive manner, which is essential to ensure that stakeholders have a clear understanding of the Project's potential impacts on the environment.

9.3.1.2 Objective Led Approach

In the previous section there are two items in particular which will be linked strongly by objectives. For instance; qualifying the importance and sensitivity of an environmental attribute or receptor will align with relevant legal instruments. For example; to qualify surface water features, the EIAR will align with the objectives of the Water Framework Directive (WFD) whereby the objective for surface waters is; *member states must achieve or maintain at least Good status in all water bodies*. This approach equates to qualifying all surface water features as very important and sensitive receptors and that any adverse impact will be viewed as potentially jeopardising the objectives of the WFD.

Similarly, when assessing the Site and prescribing conceptual mitigation measures, the EIAR will set out to achieve mitigation and residual impact in line with the same objectives. For example, mitigation will set out to minimise any potential for contaminants to reach sensitive receptors identified, will monitor the efficacy of mitigation measures applied, and where failing to achieve the objectives set, emergency response and mitigation measures are escalated until such time as the site stabilises and objectives of mitigation are being achieved once more.

9.3.1.3 Striving for Nature Based Solutions and Net Benefit Impacts

Similar to objectives for water quality discussed previously, the objectives of the WFD and other instruments also include for other environmental hazards, for example; flooding. For any new development, Flood Risk Assessment will involve two main components, flood risk on site, and the potential to enhance flood risk downstream. In keeping with the objective of WFD and FRA guidance and policy, a new development in a greenfield site will invariably impact adversely on the hydrological response to rainfall whereby, unmitigated there will be a net increase in runoff rates at the site following a storm event, in turn potentially exacerbating flooding in flood risk areas downstream of the site. Despite the fact that the likely net increase will be relatively tiny compared to the runoff and discharge rates at a catchment scale, the objective set by relevant instruments and guidance is that the cumulative nature of these impacts can have significant adverse impacts, and therefore, all developments will set out to not only neutralise any potential net adverse impact, but to strive to attain a net benefit impact where by the development will attenuate more than the net increase posed by the development.

The approach to achieving objectives and net beneficial impacts is mainly through the application of Nature Based Solutions. This can include improvements rooted in an ecological context, such as areas designated for ecological improvement, but a development can also be engineered to achieve Nature Based Solutions, for example; the introduction of new drainage networks in greenfield areas has the potential to significantly alter the hydrological regime at the site, but the same drainage network will be engineered to maintain or emulate the baseline hydrological regime in so far as possible. This can be achieved through application of Sustainable Drainage Systems but the design of such systems and drainage network must also be designed and specified in an objective led manner, while also considering constraints that might limit the application or positioning of such features.

9.3.2 Relevant Legislation and Guidance

This study complies with the EIA Directive as amended which requires Environmental Impact Assessment for certain types of development before development consent is granted.

In addition, the following environmental legislation relevant to hydrological and hydrogeological aspects of the environment were adhered to:

- Drinking Water Directives (98/83/EC) on the Quality of Water Intended for Human Consumption and resultant SI No. 122 of 2014 (Drinking Water) Regulations and SI No. 464 of 2017 (Amendment) Regulations.
- Quality Required of Surface Water Intended for Abstraction of Drinking Water (75/440/EEC) and European Communities Environmental Objectives (Surface Waters) Regulations 2009 SI No. 272 of 2009 as amended (S.I. No. 327 of 2012, S.I. No. 386 of 2015, S.I. No. 77 of 2019).
- Dangerous Substances Directive (76/464/EEC) and resultant SI No. 12 of 2001: Water Quality (Dangerous Substances) Regulations
- Quality of Fresh Waters Needing Protection or Improvement in order to Support Fish Life (78/659/EEC) and resultant SI No. 293 of 1988: Quality of Salmonid Waters Regulations
- SI No. 258 of 1998: Water Quality (Phosphorous Regulations)
- The Water Framework Directive (2000/60/EC) and resultant regulations:
- European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003) as amended
- European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (S.I. No. 272 of 2009) as amended
- European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010)

- European Communities (Technical Specifications for the Chemical Analysis and Monitoring of Water Status) Regulations, 2011 (S.I. No. 489 of 2011)
- European Union (Water Policy) Regulations 2014 (S.I. No. 350 of 2014)

The Water Framework Directive (WFD), which was passed by the European Union (EU) in 2000, requires all Member States to protect and improve water quality in all waters so that we achieve good ecological status by 2015, is a wide-reaching piece of legislation which replaces a number of the other water quality directives (for example, those on Water Abstraction). Implementation of others (for example, The Integrated Pollution Prevention and Control and Habitats Directives) will form part of the 'basic measures' for the Water Framework Directive. The fundamental objective of the Water Framework Directive aims at maintaining "high status" of waters where it exists, preventing any deterioration in the existing status of waters and achieving at least "good status" in relation to all waters by 2027* (WFD). (*Current RBMP cycle).

The Cork County Development Plan (2022-2028) and Kerry County Development Plan (2022-2028) were also consulted as part of the EIA process.

This study has been prepared using the following guidance documents, which take account the current legislation and policy:

- CIRIA (2006) Control of Water Pollution from Linear Construction Projects – Technical Guidance
- CIRIA (2015) Environmental Good Practice on Site (fourth edition) (C741)
- CIRIA (2015) The SuDS Manual (C753)
- Enterprise Ireland (n.d.) "Best Practice Guide (BPGCS005) Oil Storage Guidelines"
- Environmental Protection Agency (EPA) (2014) "Guidance on the Authorisation of Direct Discharges to Groundwater".
- EPA (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (supersedes 1997 and 2002 versions)
- Exploration & Mining Division, Minerals Ireland, Dept. of Communications, Climate Action & Environment (2019) "Exploration Drilling – Guidance on Discharge to Surface and Groundwater".
- Inland Fisheries Ireland (IFI) (2016) "Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters" *Inland Fisheries Ireland*
- Institute of Geologists of Ireland (IGI) (2002) Geology in Environmental Impact Statements – A guide

- IGI (2013) Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements
- Irish Wind Energy Association (IWEA) (2012) Best Practice Guidelines for the Irish Wind Energy Industry
- Law, C. and D'Aleo, S. (2016) Environmental Good Practice on Site Pocket Book. (C762) 4th edition. CIRIA
- Masters-Williams, H. et al. (2001) "Control of Water Pollution From Construction Sites. Guidance for Consultants and Contractors (C532)
- Murnane, E., A. Heap, A. and Swain, A. (2006) "Control of Water Pollution from Linear Construction Projects, Technical guidance (C648)" CIRIA
- Murnane, E., A. Heap, A. and Swain, A. (2006) "Control of Water Pollution from Linear Construction Projects, Site Guide (C649) CIRIA
- Murphy, D. (2004) "Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites" Eastern Regional Fisheries Board
- National Roads Authority (NRA) (2008) "Guidelines on Procedures for the Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes"
- NRA (2008) "Environmental Impact Assessment of National Road Schemes" – A Practical Guide – Rev 1
- NRA (2008) "Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes"
- Office of Public Works (2009) "The Planning System and Flood Risk Management, Guidelines for Planning Authorities"
- Office of Public Works (OPW) (2013) "Construction, Replacement or Alteration of Bridges and Culverts" Office of Public Works
- Scottish Environment Protection Agency (SEPA) (2010) "Engineering in the Water Environment: Good Practice Guide – River Crossings" *Scottish Environment Protection Agency*
- Scottish National Heritage (SNH) (2018) Environmental Impact Assessment Handbook – Version 5
- Scottish nature Heritage (2019) Good practice during wind farm construction 4th Edition)
- Transport Infrastructure Ireland (TII) (2014) "Drainage Design For National Road Schemes - Sustainable Drainage Options".

9.3.3 Desk Top Study

Desk top study assessments were undertaken of the hydrology and hydrogeology aspects of the Project before and after field investigations. This involved the following components:

- Obtain and compilation of all available and relevant mapped data of the Project provided by the client.
- Study and assessment of the proposed locations of turbines and access roads relative to available data on site topography and slope gradients. At minimum, open source (relatively low accuracy) data will be used where specific data is required, for example; opensource Global Digital Elevation Model (GDEM) data for topo and slope data in the absence of Lidar (relatively high accuracy) or similar.
- Study and assessment of the proposed locations of turbines, access roads and other associated infrastructure units relative to available data on hydrology and hydrogeology.
- Study of geospatial data obtained from various sources including; Environmental Protection Agency (EPA), Geological Survey Ireland (GSI), Teagasc, Ordinance Survey Ireland (OSi), National Parks and Wildlife (NPWS) overlain with the Development plan drawings using a Graphic Information System (GIS). Data was assessed at a regional, local and site-specific scale.
- Assessment of relevant additional data was obtained where relevant, for example, rain data obtained from Met Eireann, and river discharge rates and synoptic data sets obtained from the EPA.
- Assessment of site-specific aerial data (Blue Sky Lidar data (1 m)).

9.3.4 Field Work

Field inspections were carried out by Project Manager Sven Klinkenbergh, at the Site of the Project during c. January and February 2019 as well as September 2020 and November 2022.These works consisted of the following:

- Site walk over including recording and digital photography of significant features. Photographs obtained during Site Surveys are presented in **Appendix 9.2.**
- Drainage distribution and catchment mapping.
- Field hydrochemistry of the drainage network (electrical conductivity, pH and temperature).
- Recording of GPS co-ordinates for all investigation and monitoring points in the study.
- Baseline sampling of surface water for analytical laboratory testing. Four baseline sampling events were carried out i.e., targeting low and high flow conditions.
- Baseline sampling and estimating of surface water flow and discharge rates during baseline surface water sampling events.
- Limitations include some access limiting factors such as active commercial forestry and similar vegetation e.g. scrub.

9.3.5 Evaluation of Potential Effects

9.3.5.1 Sensitivity

Sensitivity is defined as the potential for a receptor to be significantly affected by a proposed development [1]. The EPA provides guidance on the assessment methodology, including defining general descriptive terms in relation to magnitude of impacts however, in terms of qualifying significance of the receiving environment the EPA guidance also states that:
"*As surface water and groundwater are part of a constantly moving hydrological cycle, any assessment of significance will require evaluation beyond the development site boundary.*"[2]

To facilitate the qualification of hydrological and hydrogeological attributes, guidance specific to hydrology and hydrogeology as set out by National Roads Authority (NRA) [3], and guidance specific to landscape as set out by Scottish National Heritage (SNH) [4], has been used in conjunction with EPA guidance.

The following table presents rated categories and criteria for rating site attributes:

Table 9.1: Criteria for Rating Site Attributes – Hydrology and Hydrogeology Specific

Importance	Criteria
Extremely High	Attribute has a high quality or value on an international scale.
Very High	Attribute has a high quality, significance or value on a regional or national scale.
High	Attribute has a high quality, significance or value on a local scale.
Medium	Attribute has a medium quality, significance or value on a local scale.
Low	Attribute has a low quality, significance or value on a local scale.

Considering the above categories of rating importance and associated criteria, the following table presents rated sensitivity categories (SNH, 2013):

Table 9.2: Criteria for Rating Site Sensitivity - Landscape Character Specific

Importance	Criteria
High Sensitivity	Key characteristics and features which contribute significantly to the distinctiveness and character of the landscape character type. Designated landscapes e.g. National Parks, Natural Heritage Areas (NHAs) and Special Areas of Conservation (SACs) and landscapes identified as having low capacity to accommodate proposed form of change, that is; sites with attributes of **Very High Importance**.
Medium Sensitivity	Other characteristics or features of the landscape that contribute to the character of the landscape locally. Locally valued landscapes which are not designated. Landscapes identified as having some tolerance of the proposed change subject to design and mitigation, that is, sites with attributes of **Medium to High Importance**.

[1] Environmental Protection Agency (EPA) (2017) Guidelines on the information to be contained in Environmental Impact Assessment Reports
[2] Environmental Protection Agency (EPA) (2022) Advice Notes for Preparing Environmental Impact Statements Environmental Protection Agency, Ireland
[3] National Roads Authority (NRA) (2008) Guidelines on the information to be contained in Environmental Impact Assessment Reports
[4] Scottish National Heritage (SNH) (2018) Environmental Impact Assessment Handbook V5

Importance	Criteria
Low Sensitivity	Landscape characteristics and features that do not make a significant contribution to landscape character or distinctiveness locally, or which are untypical or uncharacteristic of the landscape type. Landscapes identified as being generally tolerant of the proposed change subject to design and mitigation, that is, sites with attributes of **Low Importance**.

9.3.5.2 Magnitude

The magnitude of potential impacts arising as a product of the Project are defined in accordance with the criteria provided by the EPA, as presented in the **Table 9.3**[5]. These descriptive phrases are considered general terms for describing potential effects of the Development, and provide for considering baseline tends, for example a *Moderate* impact is one which *is consistent with the existing or emerging trends*.

Table 9.3: Describing the Magnitude of Impacts

Magnitude of Impact	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 Effects	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate Effects	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
Significant Effects	An effect which, by its character, magnitude, duration or intensity, alters a sensitive aspect of the environment.
Very Significant Effects	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.

In terms of hydrology and hydrogeology, magnitude is qualified in line with relevant guidance, as presented in **Table 9.4** and **Table 9.5**[6]. These descriptive phrases are considered development specific terms for describing potential effects of the Project, and do not provide for considering baseline tends and therefore are utilised to qualify impacts in terms of weighting impacts relative to site attribute importance, and scale where applicable.

Table 9.4: Qualifying the Magnitude of Impact on Hydrological Attributes

Magnitude of Impact	Description	Example/s
Large Adverse	Results in loss of attribute and/or quality and integrity of attribute	Loss or extensive change to a waterbody or water dependent habitat, or

[5] Environmental Protection Agency (EPA) (2022) Guidelines on the information to be contained in Environmental Impact Assessment Reports
[6] National Roads Authority (NRA) (2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes

Magnitude of Impact	Description	Example/s
		Calculated risk of serious pollution incident >2% annually, or Extensive loss of fishery
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute.	Partial reduction in amenity value, or Calculated risk of serious pollution incident >1% annually, or Partial loss of fishery
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute.	Slight reduction in amenity value, or Calculated risk of serious pollution incident >0.5% annually, or Minor loss of fishery
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity.	Calculated risk of serious pollution incident <0.5% annually
Minor Beneficial	Results in minor improvement of attribute quality.	Calculated reduction in pollution risk of 50% or more where existing risk is <1% annually
Moderate Beneficial	Results in moderate improvement of attribute quality.	Calculated reduction in pollution risk of 50% or more where existing risk is >1% annually
Major Beneficial	Results in major improvement of attribute quality.	Reduction in predicted peak flood level >100 mm

Table 9.5: Qualifying the Magnitude of Impact on Hydrogeological Attributes

Magnitude of Impact	Description	Example
Large Adverse	Results in a loss of attribute.	Removal of large proportion of aquifer, or Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or Ecosystems, or Potential high risk of pollution to groundwater from routine run-off
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute.	Removal of moderate proportion of aquifer, or Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or Ecosystems, or Potential medium risk of pollution to groundwater from routine run-off.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute.	Removal of small proportion of aquifer, or Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems, or Potential low risk of pollution to groundwater from routine run-off.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity.	Calculated risk of serious pollution incident <0.5% annually

9.3.5.3 Significance Criteria

Considering the above definitions and rating structures associated with sensitivity, attribute importance, and magnitude of potential impacts, rating of significant environmental impacts is done in accordance with relevant guidance as presented in **Table 9.6**. This matrix qualifies the magnitude of potential effects based on weighting same depending on the importance and/or sensitivity of the receiving environment. In terms of Hydrology and Hydrogeology, the general terms for describing potential effects (**Table 9.3: Describing the Magnitude of Impacts**) are linked directly with the Project specific terms for qualifying potential impacts (**Table 9.4: Qualifying the Magnitude of Impact on Hydrological Attributes** and **Table 9.5: Qualifying the Magnitude of Impact on Hydrogeological Attributes**). Therefore, qualifying terms (**Table 9.6**) are used in describing potential impacts of the Project. This is largely driven by the potential for effects to extend down gradient, beyond the Redline Boundary in terms of Hydrology and Hydrogeology.

Table 9.6: Weighted Rating of Significant Environmental Impacts

Sensitivity (Importance of Attribute)	Magnitude of Impact			
	Negligible (Imperceptible)	**Small Adverse (Slight)**	**Moderate Adverse (Moderate)**	**Large Adverse (Significant to Profound)**
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant / Moderate	Profound / Significant	Profound
High	Imperceptible	Moderate / Slight	Significant / Moderate	Profound / Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

9.3.5.4 Consultations

A Scoping Response was received for the proposed Project from the Development Applications Unit which yielded the following pertaining to a population of freshwater pearl mussel:

> *The combination of clean water diversion, lined multicelled stone-constructed sediment ponds which can be cleaned by suction rather than excavated out, an environmental management plan, alarmed autosamplers, and previous best-practice upland construction experience indicates that a sediment control system could control sediment release such that it will not have an adverse effect on freshwater life downstream.*

Responses to this Scoping Response can be found in **Section 9.6.1.2, Section 9.6.1.2.5,** and **Appendix 9.6 Tile 13.** Further information on sensitive ecological populations is detailed in **Chapter 6 Aquatic Ecology.**

9.4 BASELINE DESCRIPTION

9.4.1 Introduction

An investigation of the existing hydrologic and hydrogeologic characteristics of the study area was conducted by undertaking a desk study, consultation with relevant authorities and site-based fieldwork surveys. All data collected has been interpreted to establish the baseline conditions within the Study Area and the significance of potential adverse effects have been assessed. These elements are discussed in detail in the following sections.

9.4.2 Site Description

The Site is located 5.9 km west of Ballyvourney, Co. Cork and shares the county boundary between Cork and Kerry. It is 54 km west of Cork City, and 23 km north-east of Kenmare, Co. Kerry. The Project is located within the townlands of Inchamore, Mileeny Derryreag and Derreenaling. The Site is characterised by relatively complex (hilly) topography with associated elevations ranging between 460 metres Above Ordnance Datum (m AOD) in the north-western side of the Site to 350 m AOD towards the eastern side of the Site. The Project is 'novel' relative to the Site which is characterised as being rural agricultural land generally, however there are a number of established wind farms in the region including Coomagearlahy Wind Farm, Coolknoohil Kilgarvan Wind Farm, Glanlee Wind Farm and Grousemount Wind Farm c. 2.7 km, 4.4 km 4.9 km, and 7.5 km southwest of the Site, respectively **(Appendix 2.3: Wind Farms within 20 km of Proposed Turbines).**

The Site extends to approximately 170 ha of which 145.4 ha consists of low yielding, commercial forestry. owned by Coillte. Coillte own 76.0 ha of the forestry (53% of forestry on site) while 69.4 ha (47%) of the forestry is owned privately. Other principal land use in the area consists of a mix of agricultural sheep and cattle grazing, farmland, residential properties, agricultural structures and open mountain heath. Topography across the site varies ranging from mostly gently to occasional steep inclinations. Rocky outcrops with steep, shear faces are occasionally distributed across several of the slope faces. Topography is discussed in greater detail in relation to stability and constraints in **Chapter 8: Soils and Geology.**

9.4.3 Rainfall and Evapotranspiration

Rainfall data for the region associated with the Project has been assessed in terms of the following parameters:

- Historical average and max monthly rainfall and effective rainfall. Effective rainfall is calculated as being rainfall minus evapotranspiration equals effective rainfall, or the amount of rainfall which will contribute to surface water runoff discharge volumes and/or groundwater recharge.
- Potential significant storm events including events with a 1 in 100 year return period over 1 hour duration, 25 day duration and 30 day or month duration (inferred using available data).
- Daily 2020 rain (specifically in relation to meteorological conditions at the time of Site Surveys).

Data from the meteorological stations listed in

Table 9.7: Meteorological Stations are used in this assessment[7]. Using data presented in **Table 9.9: Met Éireann Return Period Rainfall Depths (Irish Grid; 113392, 78786)**, storm event of 30 days duration with a 1 in 100 year return period is inferred to be 498.3 mm. For the purpose of this environmental impact assessment, predicted extreme or worst-case values are used, as presented in **Table 9.9: EIA Specific Assessment Data**. Rain fall amounts in the three days preceding baseline sampling events are presented in **Table 9.11: Rainfall Prior to Baseline Sampling Events.**

Table 9.7: Meteorological Stations [8]

Category	Meteorological Station/s & Data Set	Approx. Distance from the Site (km)
Rainfall (Historical Monthly)	M.BALLINGEARY 1948-2020	4
Rainfall (2020/21 Monthly/Daily)	M.BALLINGEARY 1948-2020	4
Evapotranspiration	Cork Airport – 2016-2019 Minimum	50

[7] Met Éireann, Historical Data, Available at; www.met.ie, Accessed; 03rd March 2021
[8] Met Éireann

Table 9.8: Met Éireann Return Period Rainfall Depths (Irish Grid; 113392, 78786)[9]

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 113392, Northing: 78786,

	Interval		Years													
DURATION	6months	1year	2	3	4	5	10	20	30	50	75	100	150	200	250	500
5 mins	3.1	4.0	4.5	5.1	5.6	5.9	6.9	8.0	8.7	9.6	10.4	11.0	11.9	12.6	13.2	N/A
10 mins	4.4	5.6	6.3	7.2	7.7	8.2	9.6	11.1	12.1	13.4	14.5	15.4	16.6	17.6	18.4	N/A
15 mins	5.1	6.6	7.4	8.4	9.1	9.6	11.3	13.1	14.2	15.7	17.1	18.1	19.6	20.7	21.6	N/A
30 mins	7.2	9.2	10.2	11.6	12.5	13.2	15.4	17.8	19.2	21.2	22.9	24.2	26.2	27.6	28.8	N/A
1 hours	10.2	12.8	14.2	16.1	17.3	18.2	21.1	24.1	26.0	28.6	30.8	32.5	35.0	36.9	38.4	N/A
2 hours	14.3	17.9	19.7	22.2	23.8	25.0	28.8	32.8	35.3	38.6	41.5	43.6	46.8	49.2	51.2	N/A
3 hours	17.5	21.7	23.8	26.8	28.7	30.1	34.5	39.2	42.1	46.0	49.3	51.8	55.5	58.3	60.6	N/A
4 hours	20.1	24.9	27.3	30.6	32.8	34.4	39.3	44.5	47.7	52.1	55.8	58.5	62.7	65.7	68.2	N/A
6 hours	24.6	30.3	33.1	37.0	39.5	41.4	47.2	53.2	57.0	62.1	66.3	69.5	74.3	77.9	80.7	N/A
9 hours	30.0	36.8	40.1	44.7	47.6	49.8	56.6	63.7	68.1	74.0	78.9	82.6	88.1	92.2	95.5	N/A
12 hours	34.6	42.2	45.9	51.1	54.4	56.9	64.5	72.4	77.2	83.7	89.2	93.4	99.4	104.0	107.6	N/A
18 hours	42.3	51.3	55.6	61.7	65.6	68.5	77.4	86.6	92.2	99.8	106.2	110.9	117.9	123.2	127.4	N/A
24 hours	48.7	58.9	63.8	70.6	75.0	78.2	88.1	98.3	104.6	113.0	120.1	125.3	133.1	138.9	143.5	159.0
2 days	64.3	76.4	82.2	90.2	95.2	99.0	110.4	122.0	129.1	138.5	146.4	152.2	160.8	167.1	172.2	189.0
3 days	77.6	91.4	97.9	106.9	112.5	116.7	129.3	142.1	149.9	160.1	168.7	175.0	184.3	191.2	196.7	214.8
4 days	89.8	105.0	112.1	121.9	128.1	132.6	146.3	160.1	168.6	179.6	188.8	195.6	205.5	212.8	218.7	237.9
6 days	112.1	129.7	138.0	149.3	156.3	161.5	177.1	192.8	202.2	214.7	224.9	232.5	243.5	251.7	258.2	279.3
8 days	132.7	152.5	161.8	174.4	182.2	188.0	205.2	222.5	232.9	246.5	257.7	265.9	278.0	286.8	293.8	316.8
10 days	152.3	174.1	184.3	198.1	206.6	212.9	231.6	250.3	261.5	276.2	288.3	297.1	310.0	319.5	327.0	351.5
12 days	171.2	194.9	205.8	220.7	229.9	236.6	256.7	276.8	288.8	304.4	317.3	326.7	340.5	350.5	358.5	384.5
16 days	207.5	234.6	247.1	263.9	274.3	281.9	304.5	327.0	340.4	357.8	372.2	382.6	397.8	408.9	417.7	446.3
20 days	242.6	272.7	286.6	305.2	316.7	325.1	350.0	374.6	389.3	408.4	424.0	435.4	451.9	463.9	473.5	504.4
25 days	285.2	318.9	334.3	355.1	367.8	377.1	404.6	431.7	447.9	468.8	485.8	498.3	516.3	529.4	539.8	573.4

NOTES:
N/A Data not available
These values are derived from a Depth Duration Frequency (DDF) Model
For details refer to:
'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

[9] Met Eireann, Rainfall Return Periods, Available at; https://www.met.ie/climate/services/rainfall-return-periods , Accessed; October 2022

Table 9.9: EIA Specific Assessment Data [10]

Category	Value
Max monthly effective rainfall (mm/month)	680.2
1 in 100 Year Rainfall Event (30 day duration) (mm/month)	498.3
1 in 100 Year Rainfall Event (1 hour duration) (mm/hour)	32.5
Minimum monthly evapotranspiration (mm/month)	9.7

Table 9.10: Rainfall Prior to Baseline Sampling Events [11]

Event No.	Date	Rainfall on days leading up to sampling event (Day 0)				Total Rain in 3 no. days prior to sampling. (Days 1-3)	Event Category	Weather Station
No.	Sampling Date (Day 0)	Day 3 mm/day	Day 2 mm/day	Day 1 mm/day	Day 0 mm/day	mm / 3 days		
1	12/08/2020	0.0	0.0	0.0	14.6*	0.0	Dry	Ballingeary
2	26/08/2020	2.3	53.4	4.0	4.0	59.7	Wet	Ballingeary
3	24/02/2021	0.5	14.1	33.2	4.8	47.8	Wet	Cork Airport
4	16/03/2021	8.1	0.0	0.0	0.0	8.1	Dry	Cork Airport
* Sampling occurred ahead of recorded rainfall for the day. Lead up to sampling event was dry.								

9.4.4 Regional and Local Hydrology

The surface water network draining the Site is mapped and presented in **Figure 9.2a.**

The Project is situated within the Lee, Cork Harbour and Youghal Bay catchment (ID: 19, Area: 2,182 km^2). Surface water runoff associated with the Site drains into the Sullane sub catchment and/or Sullane_010 river sub basins.

All surface waters drainage from the Site eventually combine in Carrigdrohid Reservoir, from which waters eventually flow to Cork Harbour and into the Celtic Sea.

9.4.5 Site Drainage

The Site is characterised by a relatively extensive network of non-mapped natural and artificial drainage channels. Drainage channels identified during desk study assessment

[10] Met Eireann
[11] Met Eireann

and during Site Surveys are presented in **Figure 9.7a and Figure 9.7b**. Photographs of some significant features are presented in **Appendix 9.2**.

Note: Mapping of minor natural or artificial drainage channels has been completed is limited in places due to some site access constraints (afforested areas). Considering the nature of the areas in question, afforested areas, it is presumed that these areas possess extensive forestry drainage channels. Similarly, there are likely to be additional culverts associated with afforested areas or with minor existing access trails and minor drainage channels. Aerial lidar survey data (topographical elevation data, accuracy 1 m) and recent aerial photography was interrogated and some additional drains were identified, however none were material to the impact assessment for the development. It is likely any residual undetected drainage features are minor in scale.

9.4.6 Water Framework Directive (WFD) Water Body Status, Risk & Objectives

Details in relation to the Water Framework Directive (WFD) 2016-2021 status assigned to surface waterbodies associated with the Site are presented in **Figure 9.3a** and **Figure 9.6.**

The WFD status (2016-2021) for the mapped surface water body / river (Sullane_010), directly draining the Site is classified as 'Good'.

Further downstream, the WFD status for rivers fluctuates between 'High' and 'Good' status. However, the status then deteriorates to 'Moderate' in places due to significant pressures in hydro-morphology from channelisation and hard infrastructure such as reservoirs, weirs, embankments and culverts.[12]

Lake water bodies associated with the surface water network possess WFD 2016-2021 status ranging from 'Moderate (e.g., Carrigdrohid Reservoir) to 'Good (e.g., Inniscarra). According to the EPA (2021), based on the 1st and 2nd RBMPs, the WFD statuses associated with the lake water bodies are due to the following actions:

The Carrigdrohid is designated as a heavily modified water bodies (HMWB) in the catchment due to power generation, in addition to 'significant unknown anthropogenic pressures' impacting Carrigdrohid. Pressures upon the Inniscarra are due to power generation and abstraction for drinking water. Both lake waterbodies (Carrigdrohid & Inniscarra) are At Risk of not achieving "Good' status.

[12] Environmental Protection Agency (2021) "3rd Cycle Draft Lee, Cork Harbour and Youghal Bay Catchment Report (HA 19)" Catchment Science & Management Unit. Version no.(1).

The headwaters of the Sullane_010, directly draining the Site, and where proposed locations of WC1, WC2 and WC3 will cross is 'At risk' of deteriorating (WFD), (**Figure 9.4a, Figure 9.6**) from significant pressures in hydro-morphology.

9.4.7 Surface Water Hydrochemistry

Baseline surface water sampling was carried out at four locations that can be seen in **Figure 9.7b** which are representative of drainage and surface water network channels associated with the Site (**Figure 9.2a).** Data on surface water flow at representative baseline sampling locations at the time of sampling is presented in **Appendix 9.5,** and laboratory certificates are presented in **Appendix 9.4**.

Surface water quality observed at all four monitoring locations is of similar standard and is generally of good quality when screened against relevant reference concentrations, however the following is noted:

- Ammoniacal Nitrogen as N was elevated above the relevant reference concentration (0.02 mg/L Ammoniacal Nitrogen as N) at all monitoring locations at given sampling dates (Min Max Range; 0.024 – 0.042 mg/L Ammoniacal Nitrogen as N). Elevations occurred during at least two out of four monitoring events for all monitoring, ranging up to four of four monitoring events at a number of locations.
- Nitrite as NO_2 was elevated above relevant reference concentration (0.05 mg/L Nitrite as NO_2) at SW1 (0.273 mg/L Nitrate as NO_3) during the 24/02/2021 sampling event.
- pH was more acidic than the relevant reference range (pH 6 – 9) at SW1 (pH 5.73) during the 26/08/2020 sampling event.

Elevated concentrations of Nitrogen compounds (Ammoniacal Nitrogen, and Nitrate) as observed at all monitoring locations is indicative of current land practices at the Site, agriculture and forestry (see Photographs **in Appendix 9.2)**.

Low pH in surface water, (see **Appendix 9.3 – Surface Water Hydrochemistry Database),** can be attributed to a range of environmental characteristics and pressures, including the presence of humic and fulvic acids associated with peat (**Chapter 8: Soils and Geology**).

9.4.8 Hydrogeology – Bedrock Aquifer

Consultation with GSI Groundwater maps (2022) indicates that the entire Project is underlain by a Locally Important Aquifer (LI), that is; bedrock which is moderately productive only in local zones (**Figure 9.8a - Bedrock Aquifer)**.

There are no mapped karst features within 10 km of the Wind Farm Site.

9.4.9 Groundwater Vulnerability & Recharge

Vulnerability depends on the quantity of contaminants that can reach the groundwater, the time taken by water to infiltrate to the water table and the attenuating capacity of the geological deposits through which the water travels. These factors are controlled by the types of subsoil that overlie the groundwater, the way in which the contaminants recharge the geological deposits (point or diffuse source) and the unsaturated thickness of geological deposits from the point of contaminant discharge.

Where low permeability subsoil overlies the bedrock, it is the thickness of subsoil between the release point of contaminants and bedrock that is considered when assessing vulnerability of bedrock aquifers, regardless of whether the low permeability materials are saturated or not. The GSI vulnerability mapping guidelines allow for the assignment of vulnerability ratings from "extreme" to "low", depending upon the subsoil type and thickness. Regarding sites where low permeability subsoil is present, the following thicknesses of unsaturated zone are specified.[13]

Table 9.11: Groundwater Vulnerability Ratings

Vulnerability Rating	Thickness of unsaturated zone (m)
Rock at or Near Surface (X)	0
Extreme (E)	0 to 3
High (H)	3 to 5
Moderate (M)	5 to 10
Low (L)	>10

Consultation with the GSI Groundwater Map Viewer (2022) indicates that the Wind Farm Site is underlain by areas classified predominantly mapped as 'Extreme (E)' vulnerability rating which tend to be at lower elevations, with some areas mapped as 'Rock at or Near Surface (X)' vulnerability rating particularly at higher elevations. Both the Turbine Delivery Route and Grid Connection Route traverse land with groundwater vulnerability ratings ranging from 'Moderately Vulnerable' to 'Extreme Vulnerability' (**Figure 9.9a – Groundwater Vulnerability**).

The potential groundwater recharge rate (recharge coefficient) for the local area, as mapped by GSI (2022), ranges significantly depending on the underlying soil / subsoil type and

[13] Geological Survey Ireland (2022) Story Map Series. Available at: <https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228>

varies significantly relative to the thickness of overburden or aquifer vulnerability, and corresponds to the recharge capacity of the underlying bedrock aquifer. The underlying bedrock aquifer is classified as Locally Important and will therefore have an inferred maximum recharge capacity per annum assigned, that is; effective rainfall available for recharge but in excess of maximum recharge capacity will form rejected recharge once conditions become saturated. Peat has very low permeability, however peat stores large amounts of water, that is; bog water levels in intact peatland areas are generally near the surface[14]. Combining these factors results in the Site being characterised by low recharge rates and high surface water runoff rates.

In peat areas associated with the Site the mapped groundwater recharge coefficient is as low as 20% of effective rainfall. This recharge coefficient is considered very low [15]. Whereas areas where bedrock is at or near the surface the mapped groundwater recharge coefficient is 85% of effective rainfall. This recharge coefficient is considered very high. However, the maximum recharge capacity of the aquifer will limit recharge to groundwaters.

Areas of the Site underlain by Locally Important Aquifer (LI) possess a maximum annual recharge capacity of 200 mm effective rain fall. (**Figure 9.10a)**. For additional context, the maximum recharge capacity of 200 mm per annum equates to a recharge coefficient of approximately 15% of effective rainfall respectively, in line with peat which is considered highly impermeable with a recharge coefficient <20%.

Considering all of the above, the Site is characterised by low to very low recharge rates in overburden (soils/subsoils) and very low recharge capacity in the underlying bedrock aquifer. This implies that, particularly during seasonally wet or extreme meteorological conditions, the majority of water (rain) introduced to the Site will drain off the Site as surface water runoff, and the rejected recharge water volumes will likely discharge to surface waters relatively rapidly and locally. As such, the surface water network associated with the Site is characterised as having a rapid hydrological response to rainfall (i.e., a flashy regime). This is indicative of lands comprising of blanket peat or catchments with elevated peat cover [16] [17].

[14] Labadz J, et al (2010) Peatland Hydrology. Draft Scientific Review, IUCN UK Peatland Programme's Commission of Inquiry on Peatlands. UK.
[15] Williams N. H., et al. (2011) A NATIONAL GROUNDWATER RECHARGE MAP FOR IRELAND. National Hydrology Conference 2011, Ireland.
[16] Misstear B., Brown L. (2008) Water Framework Directive – Recharge and Groundwater Vulnerability. EPA STRIVE Report, EPA, Ireland.
[17] Jennings S. (2008) Further Characterisation Study: An Integrated Approach to Quantifying Groundwater and Surface Water Contributions of Stream Flow, RPS, Ireland

9.4.10 Flood Risk Identification

A Site Flood Risk Assessment (SFRA) Stages 1 & 2 for the Wind Farm Site is presented in **Appendix 9.1 – Inchamore Wind Farm Site Specific Flood Risk Assessment**. Conclusions are summarised as follows:

- The Site is not within a probable flood zone, nor has it experienced any historical flooding.
- With reference to **Table 4.4 of Appendix 9.1**, the Project will lead to a net increase in runoff equating to 0.253 m^3/s or 2.06% relative to the Site area. This is considered an imperceptible impact of the Project.
- The associated drainage will be attenuated for greenfield run-off and the Project will not increase the risk of flooding elsewhere in the catchment.

Consultation with OPW Flood Maps (Accessed; October 2022) indicates that:

- No Arterial Drainage Schemes (ADS) have been implemented.
- The Catchment Flood Risk Management Plan (CFRAM) programme did not indicate any flood extents within the proposed Site boundaries, nor its immediate surrounding vicinity.
- There has been only one recorded localised flood event between the Site and the CFRAM mapped probable flood areas. This event 'Flooding at Coolea, Milleeny and Derreenaling' took place on 11/09/2015, however no further information about the event was available.

The closest mapped probable flood areas are associated with:

- The Sullane (030) river approximately four kilometres to the north-east of the Site near Ballymakeery town.

Flood Relief Schemes for Ballymakeery town (flood area identified above) include Measures Applicable in All Areas, which includes:

- Sustainable Drainage Systems (SuDS). Objective: Planning authorities will seek to reduce the extent of hard surfacing and paving and require the use of sustainable drainage techniques to reduce the potential impact of development on flood risk downstream.
- Land Use Management and Natural Flood Risk Management Objective: during the project-level assessments of physical works and more broadly at a catchment-level to identify any measures, such as natural water retention measures (such as restoration of wetlands and woodlands), that can have benefits for Water Framework Directive, flood risk management and biodiversity objectives.

Broad stroke objectives such as the above in addition to those outlined in **Section 9.6.1.2** are relevant to the Project whereby any development within the catchment of a Flood Relief Scheme should aim for a minimal or neutral impact in terms of net change in surface water runoff and in turn impacts downstream. Furthermore, any mitigation which promotes beneficial impacts, i.e., net-decrease in runoff or delaying the hydrological response to rainfall, contributes to the objectives of the Flood Relief Schemes and ultimately the WFD.

In regard to the Grid Connection Route, there are no recorded historic flood events along the proposed Grid Connection Route. However, there is a portion of the route near the proposed HDD crossing of Stream 3 (ITM: 517767, 583303), that crosses both a National Indicative Fluvial Mapping (NIFM) Medium (1% AEP) and Low (0.1% AEP) probability scenario. Both these risks are mapped for the current and future scenarios.

In regard to the Turbine Delivery Route, there have been several 'Single' and 'Reoccurring' Flood Events along the Sullane, in particular near the townlands of Baile Bhuirne, Macroom and closer to Cork Harbour along the River Lee. It is proposed that the TDR will utilise the Macroom to Ballyvourney Dual Carriageway. Along this route, NIFM flood risks have been identified at the following crossing locations:

- ITM: 519851, 578443
- ITM: 527446, 573948
- ITM: 535259 ,572778

Furthermore, where the Sullane meets the River Lee, south of Macroom CFRAM River Flood Extents have been mapped for the surrounding areas of 0.1%, 1% and 10% AEP, where the Turbine Delivery Route follows the N22.

9.4.11 Wells

Consultation with GSI (2022) well database indicates there are no mapped wells within the Redline Boundary. Governing industry guidelines stipulate a buffer zone of 250 m is required of from boreholes used for drinking water abstraction when assessing excavations for Turbine Foundations. The closest mapped wells are more than 1 km from the Redline Boundary (southeast of proposed T5 works), **Figure 9.12a**, suggesting that any potential impact from the Project is low risk for wells in the immediate vicinity.

With reference to **Section 9.4.9**, the groundwater aquifer underlying the Inchamore Wind Farm Site is classified as a Locally Important Aquifer (LI) **–** Bedrock which is Moderately Productive only in Local Zones.

The Grid Connection Route traverses land underlain by a LI aquifer. Similarly, a small portion of the Turbine Delivery Route, c. 5 km, is underlain by a Poor Aquifer – 'Bedrock which is generally Unproductive except for Local Zones' (PI), the remaining track has been routed over a LI aquifer. While no wells were identified along the Grid Connection Route during the desk top assessment, **Figure 9.12b**, Any identified boreholes along these route during the detailed design stage will highlight the significant potential for the Project to impact groundwater supplies in local zones.

9.4.12 Groundwater Levels, Flow Direction & Groundwater Hydrochemistry

With reference to **Appendix 8.1** and **Appendix F,** groundwater observations during SI rotary core drilling to bedrock depths indicate that the underlying siltstone bedrock is weathered to a minor degree only, with minor volumes of groundwater perched on top of bedrock in the subsoil underlying the Site. This is of importance for a groundwater dependent ecosystem such as the superficial peat observed on Site, that grows in the saturated zone. No significant water strikes were encountered, as would generally be the case in the absence of folding and faults, (maximum drill depth was approximately 10.5 m).

Groundwater flow patterns, or the water table of an entire aquifer, can often mimic surface water flow patterns. Overall, groundwater will follow the regional topographical gradient of a given area, moving along flow paths from areas of recharge to areas of discharge, i.e., surface waterbodies. Therefore, groundwater flow directions at the Site are presumed to follow the topography of the area, and flow paths are considered to be short due to the moderately productive underlying bedrock aquifer. Groundwater flow likely circulates in the upper overburden saturated zone, recharging and discharging in local zones with a high flowrate; thus, the groundwater is considered to be young. The implications for 'young' groundwater is that it will be more vulnerable in terms of water quality from a pollution incident.

Due to the absence of any recorded groundwater quality data within or proximal to the Study Area, no published data on groundwater quality for the Site is available. However, the 2016-2021 WFD Groundwater status for groundwater underlaying the Site is 'Good' (Groundwater unit: Ballinhassig West) and is considered not at risk.

Peat at the Site is generally shallow but with areas or pockets of deeper peat (**EIAR Chapter 8: Soils & Geology, Appendix 8.1 – App A**). Furthermore, extensive drainage and general topography conditions indicate that bog water levels will be variable and are likely impacted to a minor extent by existing drains etc., with the exception of isolated pockets of moderately deeper intact peat areas where bog water levels are likely in line with Active Blanket Bog i.e. near or at the surface.

9.4.13 Designated & Protected Areas

Special Areas of Conservation (SACs) and Special Protection Areas (SPAs), often referred to as "European Sites" or "Natura 2000 Sites", are the means by which European legislation protects threatened or rare habitats and species. Candidate sites (i.e. cSAC or cSPA) have the same level of protection as fully designated sites under Irish Law. Candidate sites are those that are currently under consideration by the Commission of the European Union for SAC or SPA status in accordance with the Habitats Directive. Natural heritage areas (NHAs) are designated areas that are protected under the Wildlife Act 2000 for areas considered important for the habitats present or which hold species of plants and animals whose habitat needs protection. Proposed natural heritage areas (pNHAs) are sites not yet offered the same statutory protection as NHAs but which may become NHAs in due course and are sites of significance for wildlife and habitats.

Designated and Protected Areas, as outlined above, associated with the Project are detailed in **Figure 9.6** and presented in **Figure 9.11a** and **9.11b**.

The Site and Turbine Delivery Route are not positioned within or directly adjacent to or immediately upstream of any designated or protected area (Special Protection Area (SPA), Special Area of Conservation (SAC), Natural Heritage Area (NHA)). The nearest downstream designated areas include the following as outlined in **Figure 9.6** and **Figure 9.11b.**

- St. Gobnet's Wood SAC and proposed Natural Heritage Area (pNHA) (EPA Site Code: 000106) which boarders the Sullane_010 approximately 5 km southeast of the Site.
- Prohus Wood Proposed NHA (Site Code: 001248), approximately 18 km downstream of the Site
- Lee Valley Proposed NHA (Site Code: 000094), located approximately 54 km downstream of the Site
- Cork Harbour SPA (EPA Site Code: IE0004030); Douglas River Estuary Proposed NHA (Site Code: 001046); Rockfarm Quarry, Little Island Proposed NHA (Site Code: 001074); Great Island Channel SAC (SiteCode: 001058), approximately 60 km downstream of the Site.

Sections of the Grid Connection Route cross certain watercourses that flow into designated Natural Heritage Areas (NHA) and Special Area of Conservation (SAC) of Killarney National Park, approximately 40 m from proposed works in some areas, **Figure 9.11b**. Particular attention to stockpiling of material will be paid along the proposed Grid Connection Route that runs parallel to the designated area. Horizontal Directional Drilling (HDD) will be utilised, where standard trenching methodologies cannot be applied, to facilitate underground cabling to mitigate the impact to the surrounding ecology through minimising vegetation cutting near the designated areas.

9.4.14 Water Resources

Drinking water rivers designated in accordance with European Communities (Drinking Water) (No. 2) Regulations 2007 (SI no. 278/2007) which are protected for the purposes of drinking water abstraction are presented in **Figure 9.12a** and **Figure 9.12b,** however none are located within the River Subbasin or Sub Catchment associated with the Site.

Surface water bodies designated for drinking water downstream of the Site include:

- Sullane_060. The Sullane_010 flows into the Sullane_020, _030, _040 and _050 until reaching the Sullane_060 approximately 23.5 km southeast of the Site. From here waters flow into the Lee (Cork)_060 which continues east and flows into Carrigdrohid Reservoir and Inniscarra Reservoir which are not designated, however the reservoir discharges to the downstream section of the Lee (Cork) river (090) which is designated for drinking water.

Groundwater encompassing all elements of the Project is (nationally) protected under the European Communities (Drinking Water) (No. 2) Regulations 2007 (S.I. no. 278/2007). Therefore, although the groundwater aquifer at the site is classed Locally Important, and relatively low on the scale in terms of importance or sensitivity compared to, for example; Regional Important Kart Aquifer, all groundwater is considered an important and sensitive receptor, groundwater is considered a very important and sensitive attribute and receptor.

9.4.15 Receptor Sensitivity

All receptors associated with the Project i.e., groundwater, streams and rivers, are considered highly sensitive receptors when considering:

- Water Framework Directive (WFD) status (2016-2021) "Good". The principal objective of the WFD is to achieve good status or higher in all waters and to ensure that status does not deteriorate in any waters.
- The down-stream designations (sensitive protected areas e.g., SAC, SPA) associated with the catchment and the sensitive habitats and species associated with same (i.e., Freshwater Pearl Mussel (FWPM)).
- The designation of all waterbodies within the boundary of the Site and downstream surface water bodies and all groundwater bodies as sources of drinking water.

Ultimately, all surface waters and groundwaters associated with the Site are considered sensitive and important attributes in their own right and must be protected in accordance with the WFD to achieve and maintain at least 'Good' status. However, waterbodies associated with additional receptor sensitivities such as designated and protected areas (e.g., FWPM, SAC, SPA), should be considered at the highest level on the sensitivity scale, due to the increased risk associated with specific additional ecological attributes they possess.

Risk to receptors must consider both the hazard, and likelihood of adversely impacting on any given sensitive receptor, and therefore parameters such as, distance from potential source of hazard to receptor, pathway directness and/or connectivity, and assimilative capacity of the receiving water body will also be considered.

In terms of groundwater sensitivity and susceptibility, as discussed in previous sections, all groundwater associated with the Site is protected as a source of drinking water, under the European Communities (Drinking Water) (No. 2) Regulations 2007 (S.I. no. 278/2007). However, the bedrock aquifer underlying the Project is Locally Important (LI), which can be expressed as an aquifer with relatively low to moderate production and connectivity, and therefore the risk of potential adverse impacts on groundwater will be limited to localised zones within the Site. It is noted, with reference to **Section 9.3.14,** no wells have been identified within the 250 m buffer zone of shallow excavations for any element of the Project.

In terms of surface water sensitivity, as stated above, the vast majority of potential contaminants or unmitigated adverse impacts will infiltrate to surface water bodies, however sensitive receptors are of variable distance from the Project and the pathways are of variable condition for each proposed turbine location and for any part of the Development.

9.5 ASSESSMENT OF POTENTIAL EFFECTS

In relation to the assessment of effects the following sub-sections consider the potential worst case or unmitigated scenarios which are likely to occur as part of the proposed development, or similar developments in the context of the observed baseline conditions, e.g. effects of construction on peatlands or the receiving surface water network. The potential effects identified will be mitigated to minimise impacts, and reduce the potential adverse unmitigated impacts in line with achievable mitigation objectives.

9.5.1 Significance Rating

The receiving environment associated with the Project is considered as ranging from Low to Very High Sensitivity. With reference to **Section 9.3.5**, receptor sensitivity is qualified as follows:

- Surface Water; Very High
- Groundwater; Bedrock Aquifer; Low
- Bog Water - In areas of cut over peat, forestry or where existing drainage networks exist; Medium
- Bog Water - In areas of intact habitat and/or designated areas e.g., blanket bog / SAC; Very High

These items are discussed further in the following sections.

To account for this, the potential impacts associated with the Project will be limited to Magnitudes associated with respective environmental characteristics, as presented in the **Table 9.14.**

Table 9.12: Magnitude of potential impacts relative to receptor sensitivity

Sensitivity (Importance of Attribute)	Magnitude of Impact			
	Very Small (Imperceptible)	Small Adverse (Slight)	Moderate Adverse (Moderate)	Large Adverse (Significant to Profound)
Very High (Surface Water, Groundwater Regionally Important Aquifers, Bog water in intact or designated peat)	Imperceptible	Significant / Moderate	Profound / Significant	Profound
High (Groundwater but with limited abstraction potential / recorded abstraction points)	Imperceptible	Moderate / Slight	Significant / Moderate	Profound / Significant
Medium (Groundwater but with limited abstraction potential / recorded abstraction points) (Bog water in existing impacted areas)	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

In terms of determining and assessing the magnitude of impacts on surface water features, or groundwater features, categories of magnitude relate to the potential effect on the status of the attribute, that is; the attribute driving the classification of sensitivity is the current WFD status (if applicable) and baseline condition of the surface water feature/s, the risk of not reaching WFD objectives (if applicable) and the potential for the surface water system to support, or function as part of designated and protected areas (SAC, drinking water, etc.) downstream of the Site.

9.5.2 Do Nothing Impact

The "Do Nothing Impact" is the effect on the Site should the Project not be constructed. Site investigations and assessment of the baseline hydrological and hydrogeological conditions at the Site indicate that parts of the Site have already experienced impacts to baseline conditions through the planting and the installation of drainage networks associated with commercial forestry (**Appendix 9.2 – Plate 5 and Plate 9**), and peat harvesting across portions of the Site (**Appendix 9.2 – Plate 5**),

Planting of commercial forestry and agriculture / land reclamation activities (reconstitution of soils and drainage) have had a significant impact to the Site relative to absolute baseline or (hypothetically) perfect natural conditions with regard to the hydrology or hydrogeology of the Site in terms of drainage infrastructure in particular. Those activities are likely to apply pressure to the receiving surface water network and potentially regularly contribute nutrients and/or suspended solids to the receiving surface water systems. Release of contaminants will likely peak on occasion particularly during intrusive activities such as felling or after heavy rainfall events.

Should the Project not proceed, the existing land-use practice of commercial afforestation, will continue with associated gradual alteration of the existing environment and associated pressures on surface water and groundwater quality.

9.5.3 Construction Phase Potential Effects

9.5.3.1 Earthworks

The construction phase of the Project will involve the following primary excavations activities which may have the potential to adversely impact on surface water and groundwater:

- Construction of Site Access Roads
- Temporary Construction Compound
- Turbine Foundations and Turbine Hardstands
- Foundations for the Onsite Substation and Control Building
- On-Site Borrow Pit
- Foundations for the proposed Met Mast
- Trenching for underground electrical cabling, including along the Grid Connection Route.
- Temporary and permanent stockpiling of peat, subsoils and bedrock.

All of the above-mentioned excavations which will be required will necessitate the removal of vegetation, the excavation of peat and mineral subsoils. Such excavations and associated ground disturbance may increase the risk of either point source or diffuse sediment laden run-off to sensitive receptors via drainage channels and discharge routes. The proposed earthworks therefore have the potential to result in the release of elevated suspended solids to surface waters, particularly during prolonged heavy rainfall events. The release of elevated suspended solids to watercourses would adversely affect water quality and potentially negatively affect aquatic habitats downstream of the discharge source point if not mitigated against. The most vulnerable areas to surface water quality deterioration through the release of elevated suspended solids are considered to be:

- Proposed access track crossing the Sullane_010 River at (Watercourse = WC) WC1, WC2 and WC3 locations.
- Verge widening and strengthening along the Turbine Delivery Route Turning point over Flesk (Kerry)_030 headwaters.
- Proposed Grid Connection Routes Horizontal Directional Drilling crossing points of Streams 1, 2 and 3 as well as crossing of existing culverts.
- Turbine Hardstand and infrastructure development, particularly in close proximity to existing drainage with direct connection to surface waterbodies (T2, T3, T4, T5).

The **potential** unmitigated release of elevated suspended solids to surface waters is considered to be a **direct, adverse, large** in scale**, moderate to profound**, **temporary** effect of the Project. This potential impact arising from earthworks is considered **unavoidable** and **conforms to Baseline** (e.g., forestry tracks or operations), and is limited to the footprint of the Project (limits of vehicular movements, discussed later in report). Considering the mobility characteristics of surface waters to downstream receptors, it is not considered reversible and has the potential for indirect impacts to receptors downstream. However, with appropriate mitigation measures in place and via the implementation of environmental engineering controls, this impact will be reduced to within water quality regulatory limits. Potential effects impacting on water quality are discussed in greater detail in the following sections of this chapter.

9.5.3.2 Clear Fell of Afforested Area

Felling of forestry at the Site will be necessary for areas of the Project in afforested sections within the Redline Boundary. This is an **unavoidable** consequence of the Project. The Site contains 145.4 ha of commercial forestry. Turbines T2, T3, T4 and T5 are within afforested areas. Subsequently, tree felling will be required as part of the Project. To facilitate the construction of access roads, civil works, site compounds, borrow pits and Turbine Hardstands, 25.68 ha coniferous forestry will need to be clear-felled. The likely felled area of approximately 25.68 ha will represent approximately 15.11% of the proposed Site area (170 ha). In a spatial or land use context this is considered a **slight** to **moderate** impact.

The clear fell of afforested areas is in line with baseline conditions and future activities as part of Do Nothing impact. Therefore, in the context of the Project, the clear fell of forestry overall is considered **neutral**, however there is a range of potential **adverse** impacts associated with the activity which will require management and mitigation. Potential effects include:

1. Soil erosion, compaction and degradation: The removal of trees and underbrush during clear-felling can expose soils to wind and water erosion, leading to soil loss, compaction and degradation. This is mainly caused by vehicular movements (**Section 9.5.3.4 Figure 9.1a**).
2. Geology: Clear-felling can cause changes in the geology of an area, leading to soil instability, landslides, and other geological hazards (**Chapter 8 Section 8.4.3.3, Figure 8.7)**
3. Hydrology & Hydrogeology: The removal of trees and vegetation can lead to changes in hydrological processes, causing changes in water flow rates and patterns, such as the lowering of water tables.
4. Water quality: Clear-felling can cause increased sediment runoff and nutrient pollution in waterways, which can impact water quality, negatively affecting aquatic ecosystems and downstream water users.
5. Soil nutrient loss and nutrient loading of receiving waters: Clear-felling removes vegetation and leaves soil bare, exposing it to weathering, which can cause the entrainment of solids and/or the loss of soil nutrients, essential for plant growth. This in turn will lead to an increase in nutrients i.e. Nitrogen and Phosphorous compounds, dissolved organic carbon, potassium etc. in receiving waters flowing from the Site, which is considered a negative impact of the Project.

The overall potential effects here are considered to be of **moderate** significance**, permanent but reversible**, and **adverse**, though this is of a minor scale in comparison to the normal forestry activities taking place at the Site (i.e., small-scale felling proposed). If the Project does not take place, it is likely that the forestry at the Site will eventually either be clear felled or felled in larger volumes than the amount proposed as a function of this Project. Therefore, the resulting incremental felling of the afforested area will benefit the receiving environment, namely the receiving surface water network by means of reducing the potential magnitude of impacts, namely erosion, solids entrainment, and shock nutrient and sediment loading. With appropriate mitigation measures, planning and management this impact can be reversed, and disturbance minimised.

9.5.3.3 Release of Suspended Solids

Excavation and construction activities, associated with the Project, such as stockpiling material and vehicular movements of plant machinery introduce the **potential** risk of solids being entrained in runoff. Runoff contaminated with suspended solids will add turbidity to the receiving surface water body, can block fish gills and smother spawning grounds, reduce light penetration for flora growth, and promote bacteria and algae production. Nutrients that are associated with the solids (inorganic nutrients such as phosphorus and organic such as hydrocarbons, and sewage if present) can lead to eutrophication of the water environment and eventually to fish-kills due to lowering of oxygen supply.

The degree to which inorganic solids are entrained in runoff is related to the particle sizing of the soil components. Smaller inorganic particles (e.g. clay) will be easily entrained and will remain in suspension for a longer period than larger particles (silt / sand), and will require lower flow rates and longer retention rates to settle out of the water column when given the opportunity. Peat, comprising mostly of organic matter, will behave in a similar manner to a fine grained soil whereby much of the material will remain in suspension for a relatively long period of time, but will also dissolve and degrade within the water body, dramatically impacting on water quality.

- Forestry operations will continue at the Site. With reference to **Chapter 8: Soil and Geology**, forestry operations, harvesting and planting, will likely lead to a release of solids and nutrients entrained in surface water runoff.
- Release of suspended solids can be attributed to enhanced nutrient enrichment. This is highly dependent on the type of soil, for example peat released in water will disintegrate and most of the constituents of the peat material (carbon) will eventually dissolve into the water column and / or be consumed by micro-organisms. However, peat and other soils / subsoils will contribute varying degrees of loading of various compounds and nutrients, including Nitrogen (N) and Phosphorous (P) compounds, which are attributed to Nutrient Enrichment, or excessive loading of N and P in waters leading to eutrophication and potentially profound adverse impacts on ecological attributes downstream of the Site.
    - Given the historical land use of the Site, i.e., agricultural forestry, there is likely to be trace amounts of fertiliser in the vicinity of the afforested Site. Teagasc (2017) has stated routine fertiliser application is undertaken following chemical analysis of foliar (tree leaf) samples. If thresholds are not met, fertiliser is applied manually between the months of April and August, avoiding drains and a 20 m buffer zones to waterlogged and aquatic areas. Ground Rock Phosphate (GRP) is used in two forms: Granulated Rock Phosphate (c. 11% P) and Ungranulated Rock

Phosphate (c. 14% P), in application process, given there are no adverse environmental impacts, e.g. deterioration in water quality status.

- Peat soils behave differently to mineral soils, when it comes to some nutrients such as phosphorous. High organic matter soils (OM > 20%, i.e. peat) do not adsorb P in the same way that mineral soils do. Therefore, P does not bind to peat soil particles, however mineral soils associated with forestry do have the capacity to build up or increase the store of phosphorous they hold.

During excavation, storage and reuse of materials, it is likely that a high volume of suspended solids will be entrained by surface water runoff and intercepted by surface water networks associated with the Project, particularly during sustained rainfall events and when in close proximity to receptors.

The aspects of the Project most likely to impact surface water quality and result in deterioration are:

- Exposed soils / peat generally, including new drainage channels, temporary stockpiles.
- Construction of infrastructure within surface water buffer zones (i.e., site access tracks asses tracks to proposed location of T2 and on-site Sub station, WC1, WC2, WC3), and/or relatively close proximity to surface water receptors, or areas characterised by extensive existing drainage networks which present a direct connection to mapped surface water features, will cross buffers in a perpendicular direction i.e., to minimise any potential effects), and/or instream works associated with proposed watercourse crossing locations.

In addition to potentially direct adverse impacts on ecological sensitivities down-gradient of the Site, runoff of suspended solids will potentially impact on the WFD status and objectives associated with the surface water networks both within and downstream of the Project. Considering the 'Good quality of the baseline surface waters draining from the Site, in addition to the sensitivity and 'Very High' importance of the associated surface water networks, any introduction of contaminants is considered an adverse impact of high significance.

Mechanism/s:	• Construction activities; Excavation, handling/transport, temporary storage of soils / subsoils / bedrock, vehicle tracking. • Erosion in areas impacted by construction activities. • Erosion in areas with newly formed preferential pathways for water runoff.

- Peat / slope stability, significant or localised.
- Reinstatement activities; similar to construction.

Impact
- Release of suspended solids and nutrients entrained in runoff, intercepted by surface water network.

Receptor/s:
- Surface Water. Surface water quality, ecological sensitivities and WFD status.

The **potential** release of elevated suspended solids to surface waters is considered to be an **unavoidable**, **direct, adverse, moderate to profound significance**, **small to moderate** in scale impact of the Project. This potential impact is considered to contrast to baseline conditions when considering the intensive nature of the construction phase, however forest felling activities occur on site and therefore occasional **temporary** release. Considering the long ranging mobility of surface waters, this potential impact is not considered reversible and can have indirect impacts upon receptors downstream (i.e., potential regionally). However, with the implementation of mitigation measures and appropriate environmental engineering controls, this impact can be reduced to within water quality regulatory limits.

It is considered that the release of suspended soils does not have significant potential to adversely impact on groundwater due to the natural process of filtration associated with percolation of water through soils. This principle is particularly pertinent at a Site of this nature where a combination of low permeability subsoils beneath the peat and low recharge rates at the Site are anticipated.

Chapter 8: Soils and Geology indicates that peat depths are generally low and the risk of significant stability issues leading to mass movement or landslides is low, however there is elevated risk of localised stability issues, particularly in areas in close proximity to sensitive receptors i.e., rivers.

The Project will invariably alter drainage at the Site which if unmanaged has the potential to create new preferential pathways for runoff potentially leading to erosion of soils / construction materials and entrainment of solids in runoff in the process.

9.5.3.4 Vehicular Movements

During the construction phase of the Project, vehicles will cross over or excavate into areas in order to construct the proposed access tracks, hardstands, and gain access to the Project areas. There is the potential for soil compaction, erosion and degradation during such vehicular movements. Localised stability issues, and erosion or degradation of soil by e.g., vehicular movements, have the potential to increase the potential for entrainment of suspended solids in surface water runoff, impact or obstruct established drainage networks, and increase the amount of excavation works required generally which in turn increases the potential for standard effects associated with earthworks. Earthworks in relation to reinstatement must also be considered.

Potential localised peat stability issues, and erosion or degradation of peat such as by vehicular movements have the potential to increase the potential for entrainment of suspended solids in surface water runoff, impact or obstruct established drainage networks, and increase the amount of excavation works required generally which in turn increases the potential for standard effects associated with earthworks. This is considered an **unavoidable, direct and indirect, adverse, moderate to significant**, localised and potentially regional impact on receiving surface waters. However, with the implementation of mitigation measures and appropriate environmental engineering controls, this impact can be reduced. While small to moderate in scale this effect is considered to conform to Baseline (e.g. forestry operations).

[1] Assuming mitigation measures described in **Chapter 8 – Soils and Geology** and in this chapter will be implemented and adhered to, localised stability issues are unlikely to give rise to impacts on surface water networks associated with the Project.
[2] With reference to **Appendix 8.1 Peat Stability Risk Assessment and Chapter 8 – Soils and Geology,** the risk of mass movement of peat is considered to be low.

9.5.3.5 Release of Hydrocarbons

Hydrocarbons are a pollutant risk due to their inherent toxicity to all flora and fauna organisms. Hydrocarbons chemically repel water and do not readily dissolve in polar solvents such as water. Most hydrocarbons are light non-aqueous phase liquids (L-NAPL's) that they are less dense than water. If hydrocarbons are accidentally released to water, they will therefore float on the water's surface. Hydrocarbons adsorb onto the majority of natural solid objects they come in contact with, such as peat, soil, vegetation and animals. Hydrocarbons will burn most living organic tissue they come in contact with due to their volatile chemistry. Hydrocarbons also represent a nutrient supply for adapted micro-organisms, this process in turn can rapidly deplete dissolved oxygen and thus result in fish kills or mortality of water based vertebrate and invertebrate life.

During the construction phase, vehicles and plant associated with excavation, material transport, and construction activities introduce the risk of hydrocarbon spillages and leaks from fuels and oils. The risk is increased when regular refuelling is required which in turn implies the requirement of a designated refuelling area which will likely require fuel storage on Site. Alternatively, the fuel could be supplied by fuel tanker scheduled to refuel the plant and equipment directly.

Hydrocarbons or any other forms of toxic chemicals such as paints or adhesives etc. accidentally released to the environment will likely be intercepted by drainage and surface water networks at the Site. The low permeability subsoils beneath the peat and low recharge rates at the Site will inhibit the spatial distribution and temporal variation of hydrocarbon mass and concentration should an accidental spill occur. This results in limited potential for contaminant movement through peatland. Therefore, the risk to subsoils / peat is limited, and in turn the risk to groundwater at a significant scale is also limited.

Mechanism/s:

- Lubricants and other construction consumables **–** minor in scale.
- Fuel leak from personnel vehicle **–** minor in scale.
- Fuel leak from plant machinery **–** minor in scale.
- Fuel spill during refuelling **–** significant in scale.
- Fuel leak from storage - significant in scale.

Impact

- Release of hydrocarbons in runoff, intercepted by surface water network.
- Release of hydrocarbons to ground, intercepted by groundwater.

Receptor/s:

- Surface Water. Surface water quality, ecological sensitivities and WFD status.
- Groundwater. Groundwater quality for the purposes of extraction.

With regards to surface waters at the Site, an accidental hydrocarbon spillage is considered a **likely, adverse, direct and indirect, small** in scale**, moderate to profound significance, localised (potentially regional), permanent but reversible** effect which is in contrast to baseline conditions. However, with implementing mitigation and best practice the risk of an accidental spill can be greatly reduced.

In terms of groundwater associated with the Site an accidental hydrocarbon spillage is considered to be a **likely, indirect, adverse, small** in scale**, moderate to profound significance, localised (potentially regional), permanent but reversible** effect of the Project, which is in contrast to baseline conditions. With the implementation of appropriate mitigation measures and environmental engineering, these potential risks will be significantly reduced.

9.5.3.6 Release of Horizontal Directional Drilling Materials

With reference to **Section 9.2.1.1**, there are 4 No. locations along the Grid Connection Route which will require HDD. Depending on the drill material in question, etc. the introduction of such materials can lead to a local change in hydrochemistry and impact on sensitive attributes e.g., ecology. For example, the introduction of bentonite-based clay material can lead to changes in water quality as opposed to a non-toxic single component polymer-based product.

In terms of the HDD process, drilling will involve plant machinery which will be powered by hydrocarbons, therefore risk during the refuelling process as stated previously remains the same. The risk of hydrocarbon spills stems primarily from broken hydraulic hoses used during the drilling/boring process. Small-scale quantities of greases known as 'drilling fluids' are also commonly used during the drilling process to keep components of the drill rig cool and lubricated. These drilling fluids are commonly composed of a mixture of bentonite clay, which can be harmful to the environment[18]. Therefore, there is a risk of a potential oil leak from horizontal directional drilling (HDD) along the grid connection route. It is unspecified at this time which drilling lubricant will be used during UGC route works. From experience in the industry the use of Clearbore is recommended, and this or a similar product will be used when working beneath watercourses. Clearbore is a single component polymer-based product that is designed to instantly break down and become chemically destroyed in the presence of small quantities of calcium hypochlorite. The product is not toxic to aquatic organisms and is biodegradable.

An accidental contaminant spillage (also known as drill return or frack out), would have a **likely, adverse, direct, small** in scale**, slight, localised (potentially regional), long term to permanent** effect which is in contrast to baseline conditions. However, with implementing mitigation and best practice the risk of an accidental spill can be greatly reduced.

[18] Moore Group (2016) "Appropriate Assessment of Cork Lower Harbour Main Drainage Project Estuary Crossing by Horizontal Directional Drilling", Moore Group Environmental Services on behalf of Irish Water, Ref No. 15184.

In terms of groundwater associated with the Site an accidental drilling fluid breakout is considered to be a **likely, direct and indirect, adverse, small** in scale**, moderate to significant, localised (potentially regional), temporary to long term but reversible** effect of the Project, which is in contrast to baseline conditions. With the implementation of appropriate mitigation measures and environmental engineering, these potential risks can be significantly reduced.

Spoil arising from drilling activities will require temporary stockpiling and has the potential to be entrained by surface water runoff (suspended solids). Spoil arising from drilling activities could be mobilised by large volumes of water which would rapidly traverse overland if not managed appropriately and has the potential to mobilise additional solids via eroding soils, or other contaminants, and infiltrate the receiving surface water bodies, or groundwater bodies. Similar to the release of suspended solids, **Section 9.5.3.3,** the introduction of drill arisings to the receiving surface water receptor is considered a **direct, adverse,** potentially **moderate to profound significance** impact of the Development.

9.5.3.7 Release of Wastewater Sanitation Contaminants

The installation of permanent sanitation facilities at the Site will not be required for the operational phase of the Project, s however temporary sanitation facilities for site workers during the construction phase are proposed. Therefore the Project has the potential to result in the accidental leakage of wastewater or chemicals associated with wastewater sanitation onto peat/soils and ultimately into surface waters during the construction phase of the project.

Accidental release of wastewater to surface waters would likely result in an increase in biochemical oxygen demand (BOD) which in turn would lower the dissolved oxygen concentration and adversely impact on aquatic life. Wastewater sanitation chemicals are also pollutant risks due to their inherent toxicity to aquatic flora and fauna and their potential to adversely impact on the productivity or status of surface water systems. The level of risk posed by such temporary facilities is dependent upon the following key factors:

- The location of the proposed temporary sanitation facilities relative to sensitive receptors
- The condition, emptying schedule and maintenance of the facilities
- The level of toxicity of the chemical agents used to aquatic flora and fauna.

In addition to direct adverse impacts on ecological sensitivities downgradient of the site, runoff of suspended solids and/or other contaminants will potentially impact on the WFD status and objectives associated with the receiving surface water networks associated with the Project. Considering the quality of the surface water draining from the site (baseline), and the 'Very High' sensitivity and importance of the associated surface water networks downstream, any introduction of contaminants is considered a potentially profound adverse impact of the Project.

Potential incidents of release contaminants at the Site will likely be short lived or temporary, however the potential impacts to downstream receptors can be long lasting, or permanent. With appropriate environmental engineering controls and mitigation measures these potential impacts can be significantly reduced.

Mechanism/s:
- Waste water leak **–** minor in scale.
- Chemical leak **–** minor in scale

Impact
- Release of waste water / chemicals in runoff, intercepted by surface water network.

Receptor/s:
- Surface Water. Surface water quality, ecological sensitivities and WFD status.
- Groundwater. Groundwater quality for the purposes of extraction.

A potential worst case scenario(s) associated with wastewater sanitation is the potential for wastewater or sanitation chemicals to accidentally spill or leaking and to be intercepted by surface water drainage features, ultimately discharging to surface waters. This is considered to be a **likely, adverse, direct and indirect,** and therefore **localised and potentially regional** effect. While **small** in scale**,** it is considered to be **moderate to significant**, **temporary to long term but reversible** impact of the Project, which is in contrast to baseline. With the implementation of appropriate mitigation measures and environmental engineering, these potential risks can be significantly reduced.

9.5.3.8 Release of Construction or Cementitious Materials

The construction phase of the Project has the potential to result in the accidental spillage or deposition of construction waste into peatland or soils. This in turn has the potential for waste materials to leach out toward preferential drainage flow paths that may ultimately be connected to the surrounding surface water network.

The accidental leaching of cementitious wastes such as concrete, lean mix or cement used in turbine foundations, can result in an adverse change to hydrochemistry which can adversely impact on sensitive aquatic flora fauna. Cementitious materials are highly alkaline and if accidentally released to surface waters can significantly elevate the pH concentration above the tolerance range of fish such as cyprinid and salmonid species. Freshly poured or wet concrete has greater potential to leach out towards preferential flow paths when compared to set concrete which is considered inert in comparison, the risk from wet concrete is further increased during periods of heavy rainfall. Surface water runoff that comes into contact with concrete will be impacted to a lesser extent than water percolating through lean mix concrete which will be impacted significantly. Regardless of the nature of the construction waste in question, the deposition of any construction materials or waste deposited at the Site that does not form part of the constructed development, even if inert, is considered contamination.

Mechanism/s:

- Accidental spillage or unmanaged deposition of construction materials such as wet concrete which is intercepted by drainage or surface water networks associated with the Development.
- Dust generation in relation to the production of concrete and management of raw materials.
- Transport of material on Site and washout of plant machinery.
- Pouring, forming, deposition of concrete during construction.
- Generation of waste.

Impact

- Release of cementitious material in runoff, intercepted by surface water network.

Receptor/s:

- Surface Water. Surface water quality, ecological sensitivities and WFD status.
- Groundwater. Groundwater quality for the purposes of extraction.

This process also gives rise to result in the accidental spillage or deposition of construction waste into soils and in turn impact on surface water runoff, or accidental spillages directly intercepted by drainage or surface water networks associated with the Project. The accidental spillage or deposition of construction materials such as wet or lean mix concrete which is intercepted by drainage or surface water networks is considered a **likely, adverse, direct and indirect,** and therefore **localised and potentially regional** effect. While **small to moderate** in scale**,** it is considered to be **a moderate to significant**, **temporary to**

medium term effect of the Project, which is in contrast to baseline. With the implementation of appropriate mitigation measures and environmental engineering, these potential risks can be significantly reduced.

Local Groundwater Supplies (Wells)

The Project has the potential to impact on ground water levels proximal to excavation and dewatering activities. Dewatering of excavations in particular can create a relatively significant cone of depression or lowering of the water table in the surrounding area. The degree to which the water table is lowered is dependent on the baseline static water level, is proportional to the depth of the particular excavations and/or depth at which the pump is placed, and the hydrogeological characteristics of the surrounding geology / aquifer.

The potential productivity and connectivity of groundwater in the underlying bedrock aquifer/s is considered low (Baseline, **Section 9.4**) however the availability of groundwater in a social or agricultural sense is considered important, therefore the importance of groundwater quantities underlying the Site is considered 'Medium to High' sensitivity and importance. Any impact to the availability of groundwater for use (lowering of water level in wells) is considered a **potentially significant adverse** impact of the Project.

Contaminants released due to an environmental incident have the potential to infiltrate soils/subsoils potentially reaching the water table and in turn adversely impacting on groundwater quality. However, it is noted that the Proposed Wind Farm, Grid Connection Route and Turbine Delivery Route do not interfere with any Public Source Protection Areas as mapped by GSI (2022) or Zones of Contribution under the National Federation of Group Water Schemes as outlined and mapped by the EPA and GSI (2022).

Considering the quality of the groundwater underlying the Site (Baseline, **Section 9.4**), and the 'Medium to High' sensitivity and importance associated with groundwaters nationally, any introduction of contaminants is considered an **unlikely, direct and indirect, adverse, slight**, **temporary** effect of the Project which conforms to Baseline (e.g., other shallow excavations). With the implementation of appropriate mitigation measures and environmental engineering controls, these potential risks can be significantly reduced.

The release of suspended soils does not have significant potential to adversely impact on groundwater due to the natural process of filtration associated with percolation of water through soils and bedrock (Potential exception: Karst geology. There is no indication of karst geology underlying the Site (Baseline, **Section 9.4**). Hydrocarbons (e.g., diesel) pose the most significant risk to groundwater quality and can persist for many years.

It is noted:

- Excavations will be of c. 2.8 m to 3.2 m depth for Turbine Foundations (**Chapter 2: Project Description)**. Some deeper excavations will occur, for example, the proposed borrow pit. (See Drawing No. **6226-PL-804**).
- The recommended buffer distance determined by relevant Industry Guidance (**Section 9.3.2)**, for existing wells in relation to Turbine Foundations is 250 m. There are no mapped wells within the Site, or with 1 km of the Development.
- Governing Industry Guidelines (**Section 9.3.2)** stipulate a groundwater buffer zone of 100 m is required of from wells used for drinking water abstraction in relation to the proposed Site Access Roads and cable trenches i.e., shallow excavations.

Given the incomplete nature of the GSI well database and the rural location, it has been assumed for the purpose of conservatism that all dwellings in the vicinity of the Site are utilising a private groundwater well and that groundwater flow direction in the underlying aquifer mimics the local topography. In other words, the groundwater flow paths are expected to be from topographic high points to lower elevated discharge points at streams, drains and rivers. Utilising this conceptual model of groundwater flow, dwellings that are located down gradient of the Site can be identified as potential receptors. The groundwater flow direction in the area of the Site is expected to be predominantly in a north to south direction. There are no dwellings located withing the redline Site boundary, however numerous dwellings are located within 2 km of the Site, **Figure 9.12b**. It is anticipated that any potential groundwater impacts will have attenuated across these distances in the underlying aquifer.

Considering the baseline data and Project characteristics, the risk of lowering groundwater levels to a significant extent is not considered likely. Furthermore, there are no mapped wells (**Figure 9.12a**) within the Redline Boundary, and no mapped wells were identified within a 100 m buffer along the proposed Grid Connection Route or Turbine Delivery Routes.

A combination of low permeability soils (. i.e. peat), the temporary nature of the construction works, and low recharge rates at the Site is expected to result in a likely, **neutral to negative, slight to moderate significance, localised** impact of the Project which is in contrast to the baseline. With appropriate mitigation measures in place, the potential impacts on groundwater wells can be managed and reduced to **Imperceptible to Slight**.

9.5.3.9 Groundwater or Bog Water Associated with Wind Farm

The Project has the potential to impact on bog water levels proximal to excavations and/or drainage channels. Existing drainage at the Site, particularly in forestry and agricultural areas, are intended to drain the respective area, however existing tracks and adjacent drains can also impact on bog water levels. Lowering of the water table in peat lowers the potential for peat growth i.e., sub-optimal conditions. This will lead to the gradual decline in productivity in the acrotelm (living layer of peat), and in time the degradation of the drained peat area, potentially leading to erosion.

The scale of the impact is dependent on the depth of the excavation in question and subsequent lowering of the water table at the location. This can vary depending on the underlying characteristics of the Project. In peat the impact can be minimal in scale initially but over time and as the acrotelm layer degrades and recedes the impact can continue to progress slowly/chronically, potentially leading to profound impacts in worst case scenarios. However, it is noted that the Site is characterised by shallow peat or peaty soil generally with isolated areas of moderately deep saturated peat (**Chapter 8: Soils and Geology**). Therefore, the scale of such impact is likely limited to the extent of those isolated pockets, near the proposed location of T1, if impacted. Furthermore, the Site is generally characterised as having extensive existing drainage features, and therefore impacts arising from drainage can be in line with baseline conditions.

With regards to bog water levels at the Site, drainage is considered a **likely, adverse, direct and indirect, small to moderate** scale**, moderate to significant, localised, permanent but reversible** effect which conforms to baseline conditions (forestry drains).

With appropriate environmental engineering controls and measures (i.e. Mitigation measures), these potential risks can be significantly reduced. Additionally, in areas impacted by draining activities, if considered adequately, mitigation measures have the potential to have a **positive beneficial** impact on bog water levels, particularly in places already impacted by drainage.

Furthermore, groundwater levels are unlikely to be impacted to a significant extent due to:

- Baseline conditions (**Section 9.4**) i.e., upland area, locally important aquifer with low productivity and low groundwater recharge (indicative of low groundwater levels). Site investigation data indicates (**Appendix 8.1 and Appendix D**), that in most instances trial pits (in line with construction depths) were dry. Shallow groundwater encountered (**Appendix F**) is associated with areas of deeper peat (bog water) and perched groundwater (perched on bedrock or bedrock troughs).

- Characteristics of the Project i.e., excavations will generally be shallow and any potential dewatering will likely be for short duration. Deeper excavations will potentially encounter groundwater. However due to the Baseline character, volumes will likely be low and dewatering of such locations will not impact groundwater levels to a significant extent.

9.5.3.10 Groundwater and Surface Water Associated with Grid Connection Cable Works

The GSI well database has not indicated any wells mapped along or within the vicinity of the proposed Grid Connection route. Given the incomplete nature of the GSI well database and the rural location, there is a potential for more private wells in use along the proposed Grid Connection route, however it is noted the route traverses mainly forestry lands in the absence of any identified dwellings. Shallow trenching (c.1,220 mm deep) which will be backfilled is expected to be required for the proposed Grid Connection, with a depth of c. 1,500 mm at Horizontal Drilling locations.

Due to the vast majority of the gird connection requiring shallow trenching and the temporary nature of the construction works, it is expected to result in a **likely, direct and indirect, adverse, small** in scale, **slight and temporary** effect which conforms to Baseline (e.g. public roads and services). With appropriate environmental engineering controls and measures (i.e. Mitigation measures), these potential risks can be significantly reduced.

9.5.3.11 Excavation Dewatering & Construction Water

Construction waters arising from open excavations, or construction waters intercepted from construction areas are likely to be heavily laden with suspended solids. The dewatering of excavations during construction phase of the Project is likely to have significant adverse effects on surface water runoff quality in the absence of mitigation measures. Should dewatering of open excavations, Turbine Foundations etc. be required, the receiving engineered drainage and attenuation features will likely receive water discharges elevated in suspended solids.

This impact is considered to be in contrast to baseline conditions although it is also temporary. Although temporary, considering the mobility characteristics associated with flowing surface waters, it is not considered reversible. However, with the implementation of appropriate mitigation measures and environmental engineering controls, this potential impact can be reduced to within water quality regulatory limits. Potential effects impacting on water quality are discussed in greater detail in the following sections of this report.

Potential dewatering through drainage in advance of excavation activities, or dewatering via pumping during excavation activities, will likely impact on groundwater and hydrogeological flow regimes at a localised scale but not at a regional scale. This is considered to be a **likely, adverse, direct and indirect, localised (potentially regional), temporary to permanent** effect of the Project which is in contrast to the baseline conditions. While **small to moderate** in scale it is considered to be **moderate to profound in significance**. With appropriate environmental engineering controls and measures (i.e. Mitigation measures), these potential risks can be significantly reduced.

The potential effects on groundwater during the proposed operational phase of the Project is considered to be **not significant.**

Considering the nature of the site, it is assumed that there is no significant source of ground contamination at the Site and therefore the potential to draw in contaminants during dewatering activities is **not significant.**

9.5.3.12 Constructed Drainage, Diversion or Enhancement of Drainage

Drainage features constructed at a Site have the potential to significantly adversely impact on the baseline hydrological regime, particularly in areas of intact peatland habitat, but equally in peatland areas impacted by artificial drainage and forestry operations, there is the potential for the Project to have a beneficial impact to the hydrological regime and to peatland regeneration. Peatland groundwater levels are generally dependent on rainfall. Rainfall infiltrates and percolates into peat/soil (recharge), initially through vegetated / root conduits in the acrotelm peat (living vegetated layer) or upper soil horizons, however percolation and/or permeability rates in peat, particularly the catotelm (decomposing lower layer) are poor and therefore peatland areas are characterised by rapid hydrological responses to rain fall i.e., rapid surface water runoff intercepted by the receiving drainage and surface water network. Due to this characteristic, peatlands require consistent rainfall to ensure adequate wetting of water dependant blanket peat habitats.

Poor drainage design has the potential to drain excess surface water runoff and draw water away from areas of peatland, thus reducing the potential of recharge to ground in those areas and creating an even greater hydrological response to rain fall in the receiving surface water network via more direct connections to the surface water network i.e., bypassing the peatland. Furthermore, uncontrolled surface water runoff interacting with the Project footprint has the potential to lead to adverse impacts including the development of new preferential pathways, erosion and peat degradation – particularly during and immediately after construction phase whereby unvegetated soils are exposed and wetting and/or drying of peat areas potentially occurs.

The Project will likely result in diversion, alteration and/or enhancement of the existing drainage networks at the Site during the construction phase relative to baseline conditions. The existing drainage network at the Site is mapped and presented in **Figure 9.7a.** Diversion of artificial drainage channels will be required at locations where the Project layout intercepts existing artificial drainage networks. This includes minor modifications where existing drainage will be aligned with proposed culverts etc. and/or where proposed drainage interacts or connects with existing drainage networks. Drainage modification / diversions is required at, but not limited to;

- Access track between T2 and T3 where cut and fill extents overlaps an existing drainage feature.
- Substation, where the footprint of the hardstand is over an existing drainage feature.
- Other non-mapped drainage within forestry areas i.e. commercial forestry locations will inherently possess extensive drainage channels.

Considering that pre-existing natural and artificially established drainage networks are present at the Site, the diversion, enhancement or introduction of additional drainage features is considered an **unavoidable, direct and indirect, adverse, localised (potentially regional**) and **permanent** effect of the Project which conforms to baseline conditions. While small in scale the effect is considered to be of **moderate to profound significance.** There are potential risks associated with the earthworks required to carry out such drainage works, and it is very important to recognise the drainage and surface water network are connected, that is in terms of assessing source pathway receptor, the construction or diversion of drainage is connecting source, pathway, and receptor. With appropriate environmental engineering controls and measures (i.e. Mitigation measures), these potential risks can be significantly reduced.

The potential impacts of excavations are addressed in **Section 9.5.3.1** and in **Chapter 8: Soils and Geology, Section 8.4.3.3.1**. Management of storm and construction water runoff to prevent loading of the receiving network with contaminants in detailed in the later sections, that is; these potential impacts can be mitigated.

9.5.3.13 Watercourse Crossings

9.5.3.13.1 Surface Water Crossings - Bridges & Culverts over Mapped Rivers and Non-Mapped Drains

In terms of mapped streams and rivers there are a number of existing bridges at the site are associated with the development footprint (e.g. along Turbine Delivery Routes). The development will also require a number of new bridges, including on the Wind Farm Site.

In terms of non-mapped surface water features and drains there are a number of existing culverts at the site are associated with the Project footprint. The Project will also require a number of new drainage culverts under the proposed access track, particularly in areas of extensive existing drainage (Figure 9.5a). Although more minor in scale, and less significant in terms of ecological importance and sensitivity, such culverts must be considered similarly to watercourse crossings in terms of potential impacts associated with poor design and construction. Note; existing culverts presented in Figure 9.5a were observed during site surveys and/or from desk top assessment of aerial imagery and site drainage mapping, including recent Lidar and Aerial Survey data (BlueSky) available for the site. There is potential for buried stone culverts/ land drains to be present on Site which are not mapped here and which could be discovered during excavations.

Through the design and construction and operation of watercourse crossings, examples of associated activities or impact mechanisms include:

- Significant changes to the hydrological regime at the Site.
- Construction activities (Earthworks, addressed under Release of Suspended Solids)
- Construction activities (Earthworks) within existing drainage channels and/or streams and rivers.
- Connecting new and existing drainage channels.
- Poor design and/or installation of watercourse crossings.
- Poor design and/or installation of culverts.
- Upgrading of existing bridges where necessary.
- Upgrading of existing culverts where necessary.
- Poor design and/or installation of drainage infrastructure including culverts attenuation features.

Potential impacts arising from such activities include:

- Release of suspended solids or other contaminants, intercepted by surface water network.
- Significant surge release of suspended solids, intercepted by surface water network.
- Altering hydrological regime at a particular location. Potentially leading to erosion / deposition not in line with baseline conditions.
- Restricting water flow.

Receptors include; Surface Water, and in terms of; Surface water quantity and flood risk, Surface water quality, ecological sensitivities and WFD status.

Mechanism/s:	• Significant changes to the hydrological regime at the Site. • Construction activities (Earthworks, addressed under Release of Suspended Solids) • Construction activities (Earthworks) within existing drainage channels. • Connecting new and existing drainage channels. • Poor design and/or installation of drainage network • Poor design and/or installation of drainage infrastructure including culverts. • Upgrading of existing culverts where necessary. • Poor design and/or installation of drainage infrastructure including culverts attenuation features.
Impact	• Drying - Lowering of bog / groundwater table proximal to respective drainage features. • Wetting **–** Excess discharge in a particular area (local flooding) • Increasing hydrological response to rainfall. • Release of suspended solids, intercepted by surface water network. • Significant surge release of suspended solids, intercepted by surface water network.
Receptor/s:	• Surface Water. Surface water quantity and flood risk. Surface water quality, ecological sensitivities and WFD status. • Groundwater. Groundwater / bog water quantity for water dependent terrestrial habitats.

Watercourse crossings and associated portions of access track are naturally in very close proximity to or directly within sensitive receptor buffer zones i.e. surface waters or drainage features discharging to surface water features. As sited in **Chapter 8 Land, Soils and Geology** it is very important to consider the potential for ground stability issues arising. Due to the close proximity to the receptor, minor, or localised stability issues arising can potentially have profound impacts on surface water features.

Potential effects with regards to upgrading and installing watercourse crossings at the Site are considered to be **unavoidable, adverse, direct and indirect, small to moderate** in scale**, moderate to profound significance, localised (potentially regional** when considering the extensive downstream surface water network), and **permanent** which conforms to baseline conditions (e.g. existing bridges and roads in the area. However, with implementing mitigation and best practice the risk of an accidental spill can be greatly reduced.

9.5.3.13.2 Wind Farm

The potential impacts that could arise from the Project during the construction, operational and decommissioning phases relate to the potential for increased suspended sediment concentrations associated with site preparation activities and excavations for the infrastructure elements including the turbine foundations, cable trenches and watercourse crossings (77,262 m^3). There will be no change to the potential impacts or predicted effects irrespective of which turbine is selected within the Turbine Range because of the design phase mitigation measures which will be implemented prior to construction. All works will be outside of the 65 m buffer from watercourses and 20 m buffer from drains, where possible. Where this is not possible, additional mitigation measures such as increased use of Sustainable Drainage Systems (SuDS), will be implemented. Additionally, all temporary stockpiles will be at no less than 25 m from watercourses. This will be implemented regardless of the volume of excavated materials created as a result of the Turbine Range.

The Development has been assessed at EIA stage in terms of the intersection of the Development footprint and existing surface water and drainage features at the Site. With particular reference to tributary locations identified **(Figure 9.7a)**, these locations relate to where the Development footprint intersects with EPA mapped rivers, and it must be noted that the actual drainage design will include some degree of drainage diversion and relocation and / or removal of some the listed *culvert* locations, however all will be considered in terms of maintaining the hydrological regime at the Site.

Regarding WFD or EPA mapped rivers, watercourse crossing locations identified are listed here:

There are three new watercourse crossings over mapped rivers included as part of the proposed Development (**Figure 9.7a**).

- WC1 and WC2 are located in close proximity to each other on two headwater tributaries of the Sullane_010 on the approach to proposed location of T2 hardstand area. Both the river sections at these locations span approximately 1.0 m in width and are observed to discharge water throughout the year, potentially with the exception of prolonged dry periods during summer months where there is the potential for the river to be at very low levels or dry. The banks of the rivers are low and the adjacent lands are characterised as agricultural (pasture) / mountain heath / blanket bog. Site photos of monitoring locations SW1 presented in **Appendix 9.2,** which is a short distance downstream from the WC1 and WC2 gives context to the significance of the feature**.** It is noted that the surface water features in this particular area of the site have likely been impacted and altered by historic agricultural activities at the site. A Clear Span Bridge is proposed at this location with the following indicative dimensions: 10 m width, 3.5 m water depth (flood level), 0.3 m freeboard, and standard length, that is; in line with width of Site Access Road.

- WC3 is located on the headwaters of the Sullane_010 and along the proposed Site Access Tracks between the proposed location of the On-Site Substation (west) and proposed locations of T4 and T5 (east). The river section at this location spans approximately 1.0 to 2.0 m in width and is observed to discharge water throughout the year, potentially with the exception of prolonged dry periods during summer months where there is the potential for the river to be at very low levels or dry. The banks of the rivers are variable with some overhanging peat or boulders etc. and the adjacent lands are characterised as agricultural (pasture) / mountain heath / blanket bog and forestry. Site photos of monitoring locations SW2 presented in **Appendix 9.2,** which is a short distance downstream from the WC3 gives context to the significance of the feature**.** It is noted that the surface water features including the riparian zone in this particular area of the site have likely been impacted and altered by historic agricultural and forestry activities at the site. A Clear Span Bridge is proposed at this location with the following indicative dimensions: 10 m width, 3.5 m water depth (flood level), 0.3 m freeboard, and standard length, that is; in line with width of Site Access Road.

Identified surface water crossings are listed in **Table 9.12.**

Table 9.12: Surface Water Crossings – Mapped Rivers (WFD / EPA)

Surface Water Crossings - Mapped Rivers (WFD/EPA)					
Category	**ID**	**Description**	**Easting ITM**	**Northing ITM**	**Comment**
River Crossing	WC1	New; Clear-Span Bridge	512924.6	578627.8	Watercourse Crossing under the proposed Site Access Tracks on approach to T2 **Clear Span Bridge**
River Crossing	WC2	New; Clear-Span Bridge	512943.8	578678.8	Watercourse Crossing under the proposed Site Access Tracks on approach to T2 **Clear Span Bridge**

Surface Water Crossings - Mapped Rivers (WFD/EPA)					
Category	**ID**	**Description**	**Easting ITM**	**Northing ITM**	**Comment**
River Crossing	WC3	New; Clear-Span Bridge	513495.5	578692.9	Watercourse Crossing under the proposed Site Access Tracks between the proposed location of the On-Site Substation (west) and proposed locations of T4 and T5 (east) **Clear Span Bridge**
Sub-Total	New	3			

A number of existing minor drains along the existing and proposed Site Access Road network within the Site (**Figure 9.7a**) will require upgrading to accommodate the increased width of the road. These minor surface drains can be dry and receive flows only following heavy rainfall events throughout the year, however, due to their connectivity to mapped surface water network within the catchment, appropriate measures outlined in the Mitigation Section, **Section 9.6**, of this report will be required during construction to avoid siltation or other pollutants entering the drainage network. **Table 9.13** lists culvert locations of crossings over non-mapped drains**.**

Table 9.13: Surface Water Crossings – Non-Mapped Drains

Surface Water Crossings - Drainage and/or Non-mapped Surface Water Features					
Category	**ID**	**Description**	**Easting ITM**	**Northing ITM**	**Comment**
Culvert	CULV-01	New	514047.1	578568.2	
Culvert	CULV-02	New	513347.1	578655.6	
Culvert	CULV-03	New	513300.4	578636.6	
Culvert	CULV-04	New	512732.5	578983.4	
Sub-Total	New	4			Number will potentially change pending detailed design.
Sub-Total	Existing				
Total	All				

9.5.3.13.3 Grid Connection Route

With reference to **Figure 9.2b** and **Section 9.5.3.3**, works along the Grid Connection Route related to culverts in the northeast portion of the route are hydrologically linked to the surface waterbody Garrane [Lee] (EPA Code: 19G03). Grid Connection Route works encompassing the HDD locations for Stream 1, Stream 2, Stream 3 and the N22 HDD are hydrologically linked to the Flesk [Kerry] River (EPA Code: 22F02). A worst-case scenario could possibly occur whereby the proposed works of HDD could result in a **direct, negative, potentially significan**t, impact of the Project. This impact could result from any number of indirect anthropogenic sources, most commonly would be from: inadvertent drill returns containing bentonite clay, as mentioned above or by spillages of oil, fuel, or drilling fluid disposal. Such spillages could potentially affect either surface water or groundwater depending on the nature of the contamination issue, and to varying degrees depending on the hydrological and hydrogeological characteristics of the Site area.

Potential incidents of release contaminants at the Site will likely be **short lived or temporary**, however the potential secondary impacts to downstream receptors, through leeching, can be **long lasting, or permanent**. With appropriate environmental engineering controls and mitigation measures these potential impacts can be significantly reduced.

9.5.3.13.4 Turbine Delivery Route

The Turbine Delivery Route will require road junction widening and one turning point off the N22 (**EIAR Chapter 2**). The estimated excavation amounts for the Turbine Delivery Route equates to approximately 1,870 m^2 (refer to **Table 2.1, Management Plan 4 Appendix 2.1** of the CEMP). Works relating to the Turbine Delivery Route will be hydrologically linked to the Sullane_010 River (EPA Code:19S02).

This portion of the Project and associated construction impacts are similar to those described for the construction of the wind farm infrastructure. Construction of any new watercourse crossing or modification of any existing watercourse crossing will have inherent risk given the level of disruption (e.g. excavations, heavy plant machinery) involved with construction activities, and the proximity to the primary sensitive receptor, that is; the watercourse itself.

Potential impacts on hydrology and water quality associated with the construction or upgrading of water course crossings include:

- Alteration of flow regime potentially leading to erosion and/or flooding.

- Potential loss of natural feature e.g., closed culverts implies the replacement of river/stream bed with the invert of the culvert structure, and the loss of riparian / vegetated banks.
- Potential loss of ecological function or service e.g., relatively long span structures have the potential to block light and lower soil moisture, in turn leading to loss in vegetation and bank stability through erosion.
- Harmful discharges during construction and operation, in particular the release of suspended solids.
- Other impacts associated with ecological sensitivities.

Unmitigated, the alteration of watercourse crossings poses a high level of risk and adverse but imperceptible to slight impact adverse, potentially permanent impacts on the quality and flow characteristics of the receiving surface water feature.

The main contributing factors for achieving worst-case scenario/s associated with installation of new watercourse crossings include:

- The potential for poor planning and construction methodology,
- Potential for poor design of new watercourse crossings,

Poor design and construction can potentially result in significant changes in flow, erosion and deposition patterns and rates associated with the surface water feature, which can potentially lead to flow being restricted leading to increased risk of flooding locally.

9.5.4 Operational Phase Potential Effects

The Operational Phase (OP) of the development will include maintenance and monitoring with a minor quantity of site presence in terms of personnel, welfare, and vehicles. In the context of operational staff / contractors during the OP, residual risk following the Construction Phase (CP) include the potential for; vehicular movements, accidental hydrocarbon or contaminant releases, wastes streams etc. The scale of potential impacts during the OP are small relative to the CP, however relevant mitigation measures outlined for the CP will be applied to maintenance and monitoring operations during the OP.

Other Operational Phase specific mitigation are described in the following sub-sections.

9.5.4.1 Increased Hydraulic Loading & Flood Risk

The Project has the potential to result in increased rates of runoff during the operational phase relative to baseline conditions. This is a function of the progressive excavation and removal of vegetation cover and replacement with hardstanding surfaces (effectively or assumed impermeable) and installation of constructed drainage along the Project footprint and thus removing the hydraulic absorption / buffer control from this part of the Site. Such an increase in surface water runoff, or an increased hydrological response to rainfall, has the potential to exacerbate flooding events and impact on hydro morphology of waterbodies downstream of the development, and/or to exacerbate flooding and erosion within the boundary of the Site.

Mechanism/s:

- Significant changes to the hydrological regime at the Site.
- Replacement of vegetated land with respective recharge capacity with impermeable (assumed) hardstand surfaces. Introduction of constructed drainage intercepting greenfield runoff. Construction activities (Earthworks) within existing drainage channels and/or streams and rivers.
- Connecting new and existing drainage channels.

Impact

- Increase in runoff at the Site.
- Increase in hydrological response to rainfall at the Site and in downstream surface water bodies.

Receptor/s:

- Surface Waters. Site hydrological response to rainfall and potential downstream flood risk areas.

Preliminary water balance calculations indicate that the Project will lead to a net increase of surface water runoff of approximately 0.253 m^3/sec (or 2.06 % relative to the area of the Site) during a 1 in 100 year storm. This calculation, as shown in **Table 4.4** of **Appendix 9.1,** assumes that all road and hardstand surfaces would be fully impermeable as a precautionary scenario which is unlikely to be considered as an option during the detailed design phase. This is considered to be an **unavoidable, direct and indirect adverse, slight, permanent** impact of the Project which conforms to Baseline (e.g., existing forestry tracks). The increase in hardstand area associated with the Project will likely impact on groundwater and hydrogeological flow regimes at a localised scale but not at a regional scale.

With appropriate environmental engineering controls and mitigation measures, i.e. attenuation features, these potential impacts can be significantly reduced. Furthermore, if considered adequately, mitigation measures have the potential to have a positive impact on the hydrological response to rainfall at the Site, whereby, if the Project can reduce discharge rates at the Site below estimated greenfield or baseline runoff rates, it will have a beneficial impact by reducing the Site hydrological response to rainfall and mitigate against potential flood events downstream.

Minimal land take is associated with the Grid Connection route, considering all proposed works will traverse already existing public roadways (i.e., Site access tracks to be constructed as part of the Project public and local road networks as well as privately owned forestry tracks.

Land take is required for the Turbine Delivery Route, off the N22 in the form of widening of existing portions of roads which typically involves digging out road verges to c. 0.4 m and replacing with compact stone for facilitate a turning point along the route for large plant machinery and vehicles. c. 1,870 m^2 of road is to be upgraded). Works involving existing portions of roads which traverse greenfield / green verge areas are considered to be small scale of disturbances (shallow excavation, superficial paving) the impact is considered **slight**. Similarly, there is unlikely to be an increase in the rate of runoff from the construction of both these routes due to utilization of pre-existing road infrastructure.

9.5.5 Decommissioning Phase

Decommissioning of the Project would result in the cessation of renewable energy generation at the end of the operational life of the wind farm with the removal of various infrastructural elements. The drainage network of the Site will be inspected by a SuDS hydrologist prior to any works commencing. The Decommissioning phase will involve the removal of the above ground elements of the wind farm which will require:

- Controlled dismantling of turbine components such as blades, blade hub & nose cone, tower, nacelle (generator and gearbox) and transformer
- Controlled removal of the Met Mast
- Removal of de-energised underground cables and electrical control systems from ground and disposed of to a licensed recycling facility.

It is anticipated that the following elements of the wind farm will be left in place after Decommissioning:

- The reinforced concrete Turbine Foundations
- The Crane Hardstand Areas adjacent to the turbines
- All Site Access Roads
- Substation
- Grid Connection

There will not be a requirement for additional drainage measures to be implemented during the Decommissioning phase of the Project. With the passage of time, the constructed drainage network will likely become full of deposited sediment and revegetation will naturally occur which will render the drainage system less effective over time. The Site will therefore revert over time to a more natural drainage regime. All anticipated impacts are similar in nature to those already highlighted during the construction phase of the Project, i.e., release of hydrocarbons, wase water / sanitation and suspended soils through the excavation of material in order to remove cabling from joint bay locations.

The works to be completed during the Decommissioning phase are expected to be an **imperceptible to slight, neutral, permanent impact** on the hydrological and hydrogeological setting surrounding the Site.

9.6 MITIGATION MEASURES AND RESIDUAL EFFECTS

The Project has associated potential impacts as described in the previous sections of this report. The following sections describe mitigation measures that will be implemented during the design, construction, operational and decommissioning phases of the Project. Potential residual effects after mitigation measures are implemented are also described in the following sections.

9.6.1 Design Phase

9.6.1.1 Mitigation by Avoidance

The fundamental mitigation measure implemented during each stage of the Project was the avoidance of sensitive hydrological or hydrogeological receptors wherever possible, this key principle is referred to as "mitigation by avoidance". This principle was adopted during the design of the turbine and associated infrastructure layout across multiple design iterations. Hydrological constraints maps have been developed which identified areas of the Site where surface water and drainage constraints resulted in areas of the Site being deemed less suitable for development. The constraints map is presented in **Figure 9.13a Figure 9.13b**.

The identified constraints have been extensively discussed in consultation between RSK Ireland Ltd. and the design team. The final Site layout plan has been identified as the optimal layout design available for protecting the existing hydrological regime of the Site, while at the same time incorporating and overlaying engineering and other environmental constraints as detailed in this EIAR.

9.6.1.2 Mitigation by Design

The descriptive mitigation measures outlined in this report will be applied to the development design and construction methodologies with a view to avoiding and/or minimising any potential adverse impacts to water quality in the receiving surface water network. Details on how such measures will be applied (objectives, design considerations, layout) are contained in a Surface Water Management Plan (SWMP) (see Management Plan 3 appended to the CEMP, EIAR **Appendix 2.1**). The aims and examples of important considerations in relation to mitigation measures described in the EIAR are further clarified here.

9.6.1.2.1 Nature Based Solutions

Nature Based Solutions (NBS) will be adopted at the Wind Farm site where possible. NBS include Sustainable Drainage Systems (SuDS), which will be employed to attenuate runoff and reduce the hydrological response to rainfall at the Site. Extending or maximising this approach sufficiently has the potential to attain net beneficial impacts i.e., a net reduction in runoff rates at the Site, beneficial impacts to water quality and reducing flood risk to downstream flood risk areas. Coupling SuDS with ecology and biodiversity mitigation can also provide opportunities to attain net biodiversity gain.

In peatland areas, one of the main objectives of Nature Based Solutions and SuDS is to create an array of runoff stilling areas / standing water and promote diffuse discharge and recharge of runoff on peatland. Generally, and as is the case on the subject site, peatlands have been subject to peat cutting and forestry operations which include extensive drainage networks and draining of peatland bogs. Lowering bog water levels leads to increases erosion, release of carbon to atmosphere and the receiving surface water network and reduces the productivity and general health of the bog, potentially leading to chronic degradation and decline. The objective of nature based solutions in peatlands will be to reverse this impact where there is the opportunity and where it is appropriate through surveying and risk assessment.

Runoff attenuation features or SuDS will be included as part of the Project as detailed in the following sections of this report. Best practice and relevant guidance in the design and construction of drainage features will be followed. This includes, but is not limited to;

- CIRIA (2015) The SuDS Manual (C753)
- Scottish Natural Heritage (2019) Good practice during wind farm construction 4th Edition)

The following sections outline design considerations for working towards effective nature based solutions and net beneficial impact, for example; maximising the distribution of check dams and stilling ponds and similar features where appropriate *, with the objective of attenuating as much water as possible safely, and to promote diffuse discharge to vegetated lands where valued *, and to promote and maintain high bog water levels and healthy peatland conditions.

* Relevant guidance on the Wise Use of Mires and Peatlands (Joosten H, Clarke D, 2022) outlines principals for decision making through considering the cultural, or other values held by stakeholders associated with the subject peatland. It is noted that active peat cutting, and commercial forestry operations require networks of drainage channels, with the objective of reducing and maintaining relatively low bog water levels. This is in contrast to promoting and maintaining higher bog water levels for healthy peatland function. Much of the mitigation outlined in the following sections is intended to attenuate water on site and promote the diffuse discharge and recharge of runoff on peatland at the site. Nature based solutions including SuDS will be designed in a manner that respects the ongoing land uses and stakeholder values, where valid and in line with local, national, and international, law, policy and guidance. That is, where stakeholders have a right, and value the peatland, and intend to maintain existing drainage arrangements, the Development drainage design will incorporate checks on suitability particular features at given locations, and to direct runoff on site to suitable locations for targeting rewetting, or the promotion and maintaining of high bog water levels.

9.6.1.2.2 Constructed Drainage

The drainage design for the Project (Surface Water Management Plan, **Appendix 2.1**), has been planned so that drains are positioned adjacent to the footprint of the Project, therefore the proposed drainage infrastructure can be considered part of the footprint. The scale of the impact a shallow drain poses on the surrounding peatland area is minor particularly in areas impacted as baseline. Therefore, the potential magnitude or scale of impact to waters posed by the introduction of the proposed drainage extends to a minor extent beyond the footprint of the Project. However, it is important to consider the gradual degradation over time.

The design principles of the proposed drainage network will facilitate:

- The collection of surface water runoff from the footprint of the Project i.e., the construction area (construction runoff interceptor drains) and management of potentially contaminated runoff in the constructed treatment train. Where possible the buffered outfalls from the treatment train / stilling ponds will be redistributed with a view to maintaining or improving the hydrological regime at the Site.

- Where extensive drainage networks exist, collected / diverted runoff will likely be diverted back into the existing network. In such instances it is important to include the existing drainage network in designing and specifying the treatment train and attenuation features, including improving, modifying, and constructing attenuation features in drainage channels. Similar to considerations for newly constructed drainage channels, the modification and/or improvements of existing drainage will be designed with a view to maintaining or improving the hydrological regime at the Site.

Maintaining or improving the hydrological regime at the Site involves achieving the objectives of the Surface Water Management Plan (SWMP) (**Appendix 2.1**) i.e., mitigating against potential adverse impacts to the hydrological response to rainfall at the Site, as well as monitoring water quality in the receiving surface water network during construction phase.

9.6.1.2.3 Attenuation Features

Mitigation measures to address surface water runoff and drainage will be implemented, including in line attenuation features such as check dams and stilling ponds and buffered outfalls. Both check dams and stilling ponds provide mitigation against potential impacts to water quality, erosion, and discharge velocity, however they also facilitate buffered and diffuse percolation of surface water runoff into the receiving environment along the permitter of the development footprint. Attenuation features have been designed to take into consideration for a 1 in 100-year rainfall event, including an additional 20% to account for climate change, **Appendix 9.1.**

9.6.1.2.4 Checked Dams

Check dams will be constructed along the length of constructed drainage at regular intervals in line with relevant guidance (**Section 9.3)** along with engineered calculations presented in **Table 5.1** of Management Plan 3, **Appendix 2.1**. Check dams (**Appendix 9.6– Tiles 3-6**), will be permanent (for the life of the project / drainage network), made of suitable locally sourced coarse aggregate (similar geology), and will attenuate (impede) surface water runoff in the drainage channel, therefore slowing the velocity of the runoff in turn reducing the potential for erosion in the channel and allowing suspended solids to settle out if present. At low velocity, the runoff has increased opportunity to percolate through the coarse aggregate and into the surrounding peat area, effectively contributing to bog water levels at that location.

Check Dams will be distributed widely, that is; exhausting all opportunities for placement of check dams in the drainage network across the development footprint. The distribution will be in line with relevant guidance (including CIRIA SuDS Manual), but aim to attenuate as much runoff in the drainage network itself as practically feasible. This is in line with Nature Based Solutions and striving for net beneficial impacts. Checks dams in the drainage network will attenuate runoff and reduce the hydrological response to rainfall at the site, mitigating against downstream flood risk, and will promote a more diffuse discharge of storm runoff into adjacent peatland by infiltration and recharge. The features once established could also provide some biodiversity gains.

9.6.1.2.5 Stilling Ponds

Stilling ponds with buffered outfalls will be constructed at drainage outfalls associated with the constructed drainage network. 28 No. buffered outfalls will be established at intervals along the clean runoff drainage network. Multiple outfalls (i.e., the proposed three consecutive cluster ponds shown on **Plate 5.4b** Management Plan 3 **Appendix 2.1**), along the drainage routes facilitates the strategic management of runoff with a view to maintaining the baseline hydrological regime in so far as possible.

Similar to check dams; stilling ponds will be permanent (for the life of the projects / drainage network), made of suitable coarse aggregate, and will attenuate surface water runoff in the drainage channel, slowing the velocity of the runoff before discharging to vegetated areas (buffered outfall). Slowing the water velocity allows suspended solids to settle out if present (to a degree of <25 mg/L), to not impact any sensitive receptors. At low velocity the runoff has increased opportunity to percolate through the coarse aggregate and into the surrounding peat area. Through both forms of discharge (buffered outfall and percolation through aggregate) the stilling ponds will contribute to bog water levels at their locations and are designed to provide attenuation to greenfield run-off rates. The 28 No. designed stilling ponds that will be constructed on site will have a combined area of 2,368 m^2. Please **see Management Plan 3: Surface Water Management Plan** of the CEMP (**Appendix 2.1**) for further details. Refer to detail drawings (**Drawing No. 6226-PL-303).**

9.6.1.2.6 Promotion of Peatland Habitats

Excavated peat will be deposited in order to restore infilled excavation areas associated with the Site e.g., adjacent to hardstand areas and borrow pits. The deposition of peat, particularly in cutover peat areas, once successfully restored / revegetated will promote the recovery and development of peatland habitats. This will also lead to improvements to the hydrological regime as a function of the Project through promoting the recovery and development of peat habitats, particularly in previously impacted areas due existing land use practices of constructed forestry drainage. For example; re-establishing degraded peatland, and promoting bog water levels and healthy ecosystems will improve environmental services provided by the site including improving isokinetic runoff storage (vegetation reducing runoff rates and promoting infiltration and recharge).

The Project layout and existing drainage network, and their interaction, are assessed in detail and a detailed constructed drainage and attenuation network layout has been provided which will be implemented in full and presents the requirement, locations and conceptual function and objective of the drainage network and treatment trains tailored to the Project footprint (**Section 5** of Management Plan, **Appendix 2.1**).

9.6.1.3 Constraints & Buffer Zones

The descriptive mitigation measures outlined in this report will be applied to the Project design and construction methodologies with a view to avoiding and/or minimising any potential adverse impacts to water quality in the receiving surface water network. Details and a description of how such measures will be applied (objectives, design considerations, layout, mitigation measures) are contained within this Chapter and in the Surface Water Management Plan (**Appendix 2.1**).

As part of mitigation by avoidance principles applied during the design phase of the Project, self-imposed groundwater, surface water, and drainage buffer zones were established where applicable. Buffer zones intended to inform the design process by minimising or avoiding the risk to surface water or other receptors and by restricting construction disturbance to outside these zones in so far as possible. Buffer zones will in turn provide enhanced potential for nature based mitigation including, for example; allowing filtering capacity of runoff within surface water riparian zone. However, it is important to note that buffer zones will not be relied upon to mitigate acute issues such as construction water laden with solids arising at the site.

The available guidance (**Section 9.3)** stipulates that surface water buffer zones should be prescribed to mapped surface waterbodies or aquatic zones i.e., defined as a permanent or seasonal river, stream or lake shown on an Ordnance Survey 6-inch map, however guidance also states any drainage features leading from the Site and flowing into the receiving surface water network which may short circuit buffer zones must also be considered. The prescription of surface water and groundwater buffer zones (sometimes referred to as setback distances), is in line with relevant guidance relating to forestry, agriculture, water resources, direct discharges and wind farm development guidance documents (**Section 9.3).**

The available guidance stipulates varying surface water buffer widths depending on type of activity, receptor type and sensitivity, and riparian zone characteristics including topography (steepness). Recommended surface water buffer widths range from 5 m to 50 m depending on site specific and activity specific characteristics. For the purposes of this assessment the following conservative approach has been applied:

- 50 m Surface Water Buffer Zone - Mapped surface water features i.e., mapped streams, rivers, lakes. Source for mapped surface water features; EPA.
- 15 m Drainage Buffer Zone - Non-mapped drainage features i.e., non-mapped streams, natural and artificial drainage features. Source for non-mapped surface water features desk study and aerial photography assessment, and field observations. Significant drainage features have been identified and mapped in so far as practical. Some drainage features will likely not be recorded due to issues relating to access and complexity e.g., within afforested areas. Such drainage features, while not mapped or prescribed buffer zones, will be treated with the same consideration as mapped drainage during the design and construction phase of the Project i.e., mitigating for the potential for drainage connection to receiving surface water network.

Wind Farm Surface Water Buffers are presented in **Figure 9.13a.** Grid Connection Route Surface Water Buffers are presented in **Figure 9.13b.**

Groundwater buffer zones are dependent on the characteristics of the receptor e.g., private well, or public supply source protection zone, and the characteristics of the underlying geology and associated aquifer e.g., poor unproductive aquifer, or regionally important karstified aquifer. Recommended groundwater buffer zones range from e.g., 15 m (exclusion zone karst swallow holes) to entire catchments (source protection in regionally important karstified aquifer) depending on site specific characteristics. For the purpose of this assessment the following conservative approach has been applied:

- 100 m Groundwater Buffer Zone – Groundwater abstraction points in relation to proposed access tracks and cable trenches i.e., shallow excavation. Source for mapped abstraction points: GSI. Not applicable, none within 100 m of the Site, Turbine Delivery Route or Grid Connection Route.
- 250 m Groundwater Buffer Zone – Groundwater abstraction points in relation to proposed borrow pits and foundations. Source for mapped abstraction points: GSI. Not applicable, none within 250 m of the Site.

Some portions of the Project infrastructure footprint falls within buffer zones due to the unique and limiting circumstances associated with the Site and the Project, such as constraints related to other environmental disciplines including; surface water receptors, ecology, ornithology, etc. restricted due to the proposed infrastructure itself whereby the proposed turbines require a minimum distance from each other to ensure the potential for wind turbulence impacting on downwind locations is minimised.

None of the proposed turbines or Turbine Hardstands fall within a buffer zone associated with a mapped stream / river. The proposed Site Access Roads and associated widening where required, watercourse crossings, etc. naturally fall within buffer zones associated with mapped streams / rivers. The proposed Site Access Roads and fill material intersect the Sullane_010 river surface waterbody and associated buffer zone at each water course crossing (WC1, WC2, WC3) which will result in implementation of clear span bridges during construction works.

Following Site Surveys significant natural and artificial drainage features observed which are relatively well connected to the mapped surface water network have been included in considering constraints. Some of the proposed Turbine Hardstands (T3, T4, T5), and Site Access Roads fall within the 15 m buffer zones associated with existing natural and constructed drainage features at numerous locations highlighted in pink in **Figure 9.13a**. These features pose an elevated risk in terms of connectivity to surface water receptors; streams and rivers.

No groundwater buffer zones are required for the Project, refer to the baseline section of this report. With reference to **Appendix 8.1 and Appendix H (a - c),** areas have been identified as Geo-Hazards and an effective drainage buffer zone will be applied whereby it is intended to divert runoff away from those areas. The areas in question are characterised as having steep incline, potential for deep till deposits and iron pan. These have elevated stability risk particularly in potential instances where hydrogeological conditions are adversely impacted, i.e., where the enhancement of recharge of groundwater and the perching of groundwater occurs in higher risk areas increasing pore water pressure against potentially parallel failure planes. Particular areas are discussed in **Chapter 8: Soils and Geology**, however in terms of drainage constraints, mapped High Landslide Susceptibility (GSI) (**EIAR Figure 8.6a**) is used to indicate constraints in relation to hydrogeology and stability (**Appendix 8.1 and supporting Appendices A-I**), which is overlaid with hydrological buffer zones as presented in **Figure 9.8 a-k**. Areas which are particularly sensitive include:

- The approach to proposed location to T2, in an area of moderately high landslide susceptibility (GSI) and will require the crossing of two WFD mapped river headwaters.

Furthermore, this area is surrounded by drainage channels with evidence of iron pan in the vicinity.

- The portion of the site south of T3 and proposed location of T5. These areas are characterised similar to the above scenario. Land surrounding T3 also contain areas of elevated localised stability risk due to steep localised inclines.

In the scenarios above, the Turbine Hardstands and associated drainage will divert runoff away from these higher risk areas and design the drainage network to place buffered outfalls in more favourable areas adjacent to the Project footprint, that is; avoiding steep inclines, areas of elevated stability risk, areas with degraded and exposed soils/peat etc, and targeting areas which will receive the runoff to vegetated, low risk areas where vegetation present will provide isokinetic storage, filtering and generally buffering runoff before being intercepted again by the side existing drainage and surface water network.

Some of the Project footprint will fall within buffer zones due to the unique and limiting circumstances associated with the Project, including; the proposed infrastructure itself whereby the Grid Connection Route traverses a relatively large distance and is limited to public and local road networks and privately owned forestry access tracks. Portions of the Grid Connection Route pass through numerous surface water buffers. Of note are the three watercourse crossings, which by their nature will be within surface water buffer zones. Given the extensive drainage network existing at the Site the construction activities associated with the Project will invariably be in close proximity to surface water / drainage features, including within the buffer zones.

Careful consideration and special attention to planning is required for the identified locations within the surface water buffer zones. The Surface Water Management Plan (**Appendix 2.1**) details multiple mitigation measures for works proposed within buffer zones. Method statements and the proposed design of the watercourse crossings (as detailed in **Appendix 2.1 Construction Environmental Management Plan**; **Management Plan 2 Water Quality Management Plan**) will require agreement from Inland Fisheries Ireland (IFI) in advance of construction which invariably must be constructed within the buffer zones. The mitigation measures described in the following sections will also be applied.

9.6.2 Construction Phase

9.6.2.1 Earthworks Proposed Mitigation Measures

9.6.2.1.1 General / Wind Farm

Management and mitigation for earth works is covered in further detail in **Chapter 8: Soils and Geology**. Mitigation measures to reduce the potential for adverse impacts arising from earth works and management of spoil include the following which will be implemented in full:

- Management of excavated material **–**with a view to establishing material balance (reuse of excavation arisings) during the proposed construction phase, thus minimising the potential for or the length of time excavated materials are exposed and vulnerable to entrainment by surface water runoff. A Peat and Spoil Management Plan has been prepared and forms **Management Plan 4** of the Construction & Environmental Management Plan (CEMP, **Appendix 2.1**), which adopts the mitigation measures outlined below.
- No permanent stockpile will remain on the site during the construction or operational phase of the Project Excavated materials will be stored temporarily adjacent to the excavation sites within the Project footprint while avoiding areas identified as Geo Hazards in **Chapter 8: Soils and Geology, Appendix H,** as well as prescribed surface water buffers (50 m for mapped river 15 m for drainage features, **Figure 9.13a**.
- Earthworks will be limited to seasonally dry periods and will not occur during sustained or intense rainfall events. Similar to measures outlined in relation to ground stability during excavation works (**Chapter 8: Soils and Geology**), an emergency response system has been developed for the construction phase of the project (see **Management Plan 1 – Environmental Response Plan** and **Section 5.10 of Management Plan 3, Appendix 2.1**), particularly during the early excavation phase. This involves 24-hour advance meteorological forecasting (downloadable from Met Éireann) linked to a trigger-response system. When a pre-determined rainfall trigger level is exceeded (e.g., sustained rainfall (any foreseen rainfall event longer than 4-hour duration) and/or any yellow or greater rainfall warning (>25 mm/hour) issued by Met Éireann), planned responses will be undertaken. These responses will include; cessation of construction until the storm event including storm runoff has passed over, assessment of construction areas and infrastructure by Ecological Clerk of Works, and confirmation no additional escalation of response is required. All construction works will cease during storm events such as yellow warning (Met Éireann) rainfall events. Following heavy rainfall events, and before construction works recommence, the Site will be inspected and corrective measures implemented to ensure safe working

conditions, for example, dewatering of standing water in open excavations, repair works to drainage features if necessary.

- Exposed soils/peat (exposed temporary stockpiles) will be covered with plastic sheeting during all heavy rainfall / storm events and during periods where works have temporarily ceased before completion at a particular area (e.g., weekends, overnight, etc), in a effort to minimise sediment laden runoff.
- All drainage infrastructure (as per drainage design, **Sections 4 and 5 of Management Plan 3, Appendix 2.1**) required for the management of surface water runoff or draining peat ahead of excavation works will be established before excavation works commence. Similarly, mitigation measures related to surface water quality and the release of suspended solids (**Section 9.6.2.8**) will be implemented before excavation works commence.

9.6.2.1.1 Grid Connection Route

The Grid Connection Route will require excavation of cable trenches in existing roadways as well as forestry tracks and private lands. With reference to general excavation practices discussed above, excavation of cable trenches in close proximity to (0 m at crossings) surface water features will require special consideration in terms of managing movements, spoil arising from excavations, and entrainment of solids and contaminants in surface water runoff.

Mitigation measures to reduce the potential for adverse impacts arising from earth works and management of spoil include the following:

- In sensitive areas, excavation of material will be conducted in a controlled manner whereby any temporary deposit of the material in buffer zones will be minimised. Vacuum excavation techniques or similar will be used for excavations within Surface Water Buffer zones and other sensitive areas (such as constraints, **Section 9.6.1.3**) (**Figure 9.13a)**. Excavated soil will be removed to temporary storage areas.
- Management of excavated material will adhere to the measures related to the management of temporary stockpiles outlined in **Chapter 8: Soils and Geology**, a Peat and Spoil Management Plan has been established and forms part of the Construction & Environmental Management Plan (CEMP, **Appendix 2.1, Management Plan 4**) with a view to establishing material balance during the proposed construction phase, thus minimising the potential for, or the length of time excavated materials are exposed and vulnerable to entrainment by surface water runoff. No permanent, or semi-permanent stockpile will remain on the site during the construction or operational phase of the Project.

- All spoil from trenches in public roadways will be removed from works areas as it is excavated and transported to a licenced facility this is due to the presence of bituminous material and potential hydrocarbon contaminants which will not have the opportunity to be entrained in runoff from stockpiling, but rather removed (i.e., mitigation by avoidance).
- Temporary stockpile locations will be situated outside of Surface Water Buffer Zones (as seen in **Figure 9.13a)**. Temporary Spoil stockpiles will have side slopes battered back to a safe angle of repose, e.g., 1:1. Silt fencing will be erected around the base of the temporary mound. Soil will be reinstated on completion of drilling and jointing operations. Temporary storage areas will require bunding and management of runoff likely contaminated with suspended solids (**Appendix 9.6 – Tile 7, 8, 9**). Management of construction waters is discussed in following sections.
- Earthworks will be limited to meteorologically dry periods and will not occur during sustained or intense rainfall events. Similar to measures outlined in relation ground stability during excavation works (**Chapter 8: Soils and Geology**), and as discussed in this chapter, an emergency response system has been developed for the construction phase of the project (see **Management Plan 1** appended to the CEMP, **Appendix 2.1**), particularly during the early excavation phase. This, at a minimum, will involve 24 hour advance meteorological forecasting (Met Éireann download) linked to a trigger-response system. When a pre-determined rainfall trigger level is exceeded (e.g., 1 in 100 year storm event or very heavy rainfall at >25 mm/hr), planned responses will be undertaken. These responses will include cessation of construction until the storm event including storm runoff surge has passed over. Following heavy rainfall events, and before construction works recommence, the site will be inspected and corrective measures implemented to ensure safe working conditions, for example dewatering of standing water in open excavations and transfer to treatment train.

9.6.2.2 *Excavation Dewatering Proposed Mitigation Measures*

Mitigation measures to reduce the potential for adverse impacts arising from earth works / management of spoil and associated entrainment of solids in runoff and construction water will include the following:

- **Appendix 9.6 – Tiles no. 7, 8 and 9** present layout and specification for Active Management treatment trains (containment, management and treatment of construction water) and emergency response and intervention (recycling or diversion of poor-quality runoff to the Active Management portion of the treatment train). Continuous real time monitoring is also detailed.

- Management of excavations, that is areas of soil / subsoils to be excavated will be drained ahead of excavation works by sumps, in a stepped / phased approach whenever necessary, with the aim of temporarily lowering groundwater levels to allow excavation to be carried out in dry and stable conditions. For example, saturated areas of peat will require dewatering prior to excavation, thus reducing the volumes of water encountered during excavation works.
- Engineered drainage and attenuation features (discussed in following sections) will be established concurrent with excavation works.
- Dewatering flow rate or pumping rate will be controlled by an inline gate valve or similar infrastructure (**Appendix 9.6- Tile 8, Tile 11**). This will facilitate reduction of loading on the receiving drainage and attenuation network, thus enhancing the attenuation and settlement of suspended solids. All pumped water will be discharged to constructed drainage and in line treatment train or to a vegetated surface through a silt bag (**Appendix 9.6 – Tile 12**) outside of surface water buffer zones **(Management Plan 3, Appendix 2.1** and **Appendix 9.6 – Tiles 7, 9 and 12).** Dewatering is a dynamic process and will require continuous monitoring and modification depending on conditions encountered (**Appendix 9.6 – Tile 8, refer to Section 9.5.5.5**).
- In some areas of the Project constraints related to incline and/or stability, or construction activities within the prescribed buffer zones, will likely limit the potential for installation of engineered attenuation features. In such instances water arising from dewatering activities will be directed or pumped to a settlement tank (**Appendix 9.6 – Tile 8**) before being discharged to the receiving drainage network, or pumped to an area of the site where the installation of attenuation features is suitable. Areas with such constraints are presented in **Figure 9.13a**.
- No extracted or pumped water will be discharged directly to the drainage or surface water network associated with the Site (This is in accordance with the Local Government (Water Pollution) Act, 1977 as amended).
- All pumps, tanks, settlement ponds, dewatering bags and check dams used in the dewatering process will be regularly inspected and maintained as necessary to ensure surface water run-off is appropriately treated.

9.6.2.3 Excavation Dewatering Proposed Mitigation Measures- Active Construction Water Management

In all instances where construction water, or runoff has the potential to entrain solids during excavation and other construction activities, runoff will be contained by means of temporary berms (lined geotextile of similar), bunds (lined) and sumps. This will be referred to as Dewatering. Construction water (contaminated) will be pumped to the Treatment Train (**Appendix 9.6 Tiles 7,8 and 9)**.

Contaminated water arising from construction works, namely; excavations, drilling and temporary stockpiling, will be contained and treated prior to release or discharge. The schematic presented here is a conceptual model of measures implemented to manage arisings and runoff (Letter headings align with **Appendix 9.6 – Tile 8)**:

A. Arisings. Arisings from the launch / reception pit, or any other significant excavation (e.g., cable joint bays), will be directed the treatment train.

B. Temporary Bund. Arising control area i.e., a temporary bund. Gross solids will be temporarily deposited here. Water arising with the material will be allowed to drain to sump.

C. Sump / Pump. Sump will discharge by gravity / pumped to stilling pond.

D. Temporary Stilling Pond. This can be constructed using soils for bunding in combination with an impermeable liner.

E. Outfall. The outfall from the stilling pond will be buffered (coarse aggregate) to dissipate energy and diffuse discharging water.

F. Silt Screen. A silt screen will be in place down gradient of the Stilling Pond outfall. This is a precautionary measure to mitigate peak loads or surcharges in the system.

G. Monitoring Location/s. Discharge quality will be monitored in real time using telemetry systems. Monitoring of discharge quality will be carried out at the outfall of the stilling pond i.e., before being actually discharged to surface vegetation or surface water (licenced).

H. Sump / Pump. Discharge By-Pass. If water discharging from the stilling pond exceeds quality reference limits water will be diverted (pumped) from the stilling pond to the settlement / treatment tank.

I. Stilling Pond By-Pass. Similar to Discharge By-Pass, if conditions dictate water can be diverted directly to Settlement / Treatment Tank.

J. Settlement / Treatment Tank. A settlement tank will be on standby and ready to use in line with the drainage network if required i.e., water quality at stilling pond outfall fails to meet quality reference limits. The tank will be equipped with treatment systems which will be activated as the need arises, for example, very fine particles which are very slow to settle can be treated with a flocculant agent to promote settlement of particles.

K. GAC Vessel/s. As a precautionary measure, GAC (Granulated Activated Carbon) vessel/s will be in line and ready to use if required. GAC vessels are used to filter out low concentrations of hydrocarbons. Significant hydrocarbon contamination is only envisaged under accidental circumstances. If a hydrocarbon spill does occur, normal operations will pause and the treatment train will be utilised to remediate captured contaminated runoff.

L. GAC Vessel By-Pass. If the quality of the water is acceptable in terms of hydrocarbon contamination.

M. Treated water will be discharge by gravity / pump to the stilling pond for additional clarification, monitoring and buffered discharge to vegetated area.

N. Silt Bag. A silt bag can be used as alternative to stilling ponds. However, silt bags must only be used as primary method in lower risk areas i.e., outside of buffer zones, etc. Stilling ponds will be the primary method (D, N) is circumstances where risk is elevated, however a gate vale and silt bag can be included in the treatment train and used as an emergency discharge route in the event that the stilling pond needs remediation or maintenance.

In all instances, stilling ponds (D), Silt Bags (N) and outfalls (E) will be situated outside of surface water buffer zones. At many locations, particularly at HDD locations works will be within buffer zones. In these instances, waters will be pumped to the treatment train which can be positioned upgradient along the road (Grid Connection Route) where discharge to vegetated areas / roadside drains can be managed.

Discharge of non-contaminated storm runoff to vegetated land within a site red line boundary is not a licenced activity however this methodology is possible only under relatively low flow conditions (e.g., <2 litres per second (L/s) typical of runoff over a relatively small site area. In the event that the expected incoming flow rate or dewatering rate is relatively high (>2 L/s) a discharge licence will be acquired, and trade effluent will be discharge directly to the surface water network. The latter will include all works associated with HDD.

The discharge points will be identified during the licence application process. As discussed previously, the main components of the treatment will be positioned outside of the prescribed surface water buffer zone where possible. The developer will identify suitable locations for the establishment of temporary infrastructure considering other variable such as traffic and access management. Similarly, the preferred location of discharge points will be outside of buffer zones and into minor or non-mapped surface water / drainage features where possible. The subject drain will be inspected to ensure connection to the mapped network (not blocked).

The quality of the water being discharged will be monitored. If discharge water quality is poor (e.g., >25 mg/L) additional measures will be implemented including Active Water Management to ensure the source of the spike in contaminants is identified, isolated and managed with a view to re-establishing favourable conditions in runoff and within receiving surface water bodies, for example; pausing works as required and treating construction water by dosing with coagulant to enhance the settlement of finer solids – this can be done in a controlled manner by means of a suitably equipped settlement tank. Collected and treated construction water will be discharged by gravity / pump to a vegetated area of ground within the Site. Silt fences will be established at the discharge area to ensure potential residual suspended solids are attenuated and the potential for erosion is reduced. The discharge area will be outside of designated surface water buffer areas (similar to dewatering of excavations. The quality of water discharged will be in line with licence discharge limits assigned by the Council and will be monitored in real time (telemetry with 15 minutes sampling rate), as well as laboratory samples taken, analysed and reported and the frequency indicated in the licence. Daily sampling is recommended given the short duration and temporary nature of the works.

Discharging of construction water (trade effluent) directly to surface waters or groundwater is a licenced activity. (This is in accordance with Local Government (Water Pollution) Act, 1977 as amended).

Active Construction Water Management will be utilised for all works within surface water buffer zones, and for all over pumping.

9.6.2.4 Excavation Dewatering Proposed Mitigation Measures- Passive Construction Water Management

Passive management systems (**Appendix 9.6 – Tile 7,** refer also to diagrams in **Management Plan 3, Appendix 2.1**) include some of the features described in Active Management treatment trains. The following measures will be implemented:

- Spoil bunds and/or temporary berms. Spoil bunds and/or berms will be constructed using either crushed rock or clean soils and overlain or lined with an impermeable layer e.g., geotextile or plastic membrane. These features are intended to control the movement of construction water / runoff with a view to:
    - Containing contaminated water (e.g., drilling / excavation spoil and runoff laden with solids). Temporary bunds will be used to manage spoil arising from drilling operations or saturated spoil arising from excavations in sensitive areas e.g., within SW buffer zones.

    - To divert runoff i.e., divert clean/storm runoff during construction works or contaminated construction water away from sensitive receptors such as drains/surface waters directly adjacent to construction areas.
- Silt screens. These will be utilised in a similar sense to berms whereby, silt screens will be installed between construction areas and sensitive receptors, including:
    - At the outfall of the treatment train where discharging to vegetated ground or within non-mapped drains (within redline boundary).
    - Along the perimeter of construction areas which are directly adjacent to watercourses or within surface water buffer zones. This includes all watercourse crossings and sections of Grid Connection Route alongside adjacent watercourses.

Passive systems are intended to function with minimal supervision, however in the management of construction water on this site or development, in many cases the diverted water will likely require active management to ensure sensitive receptors are protected. Diverted storm water, if clean will discharge to the receiving vegetated areas or existing drains, but any construction waters impacted by contaminants on the site will be managed, and potentially active management / treatment will be implemented.

9.6.2.5 Grid Connection Route – Excavation of Cable Trenches, Watercourse Crossings and Horizontal Directional Drilling

Excavation and installation of cable ducts within existing bridges (alteration) will require consent from the OPW and various mitigation measures. Mitigation measures outlined in this Report have been developed to minimise the environmental impacts of the grid connection route on the receptors of conservation importance that have been recorded in the area. Mitigation measures mentioned in this Report are included in the CEMP, **Management Plan 2- Water Quality Management Plan, Appendix 2.1**.

Detailed site risk assessments will be carried out with a view to identifying and qualifying risk associated with all watercourse crossings associated and in close proximity (within buffer zones) to the grid route connection corridor. In relation to directional drilling, and the general risk to groundwater during grid connection route construction, risk assessment and prescription of mitigation measures will be designed in accordance with relevant guidance and reference documents, **Section 9.3**.

Risk assessments involved identifying pathways and receptors for each potential source of contamination. This included each directional drilling location and is particularly important in relation to groundwater source protection zones and surface water bodies protected for the purposes of drinking water. Prescription mitigation measures are driven by the identification and qualified risk associated with each particular location and are as follow:

General Overview of Works Mitigation Measures

- The timing of grid connection cable laying will be carried out during metrologically dry seasons/periods.
- An Environmental Clerk of Works (EnvCoW) will be onsite in order to lessen environmental disruption and ensure site integrity is maintained. The Environmental Clerk of Works (EnvCoW) will also be responsible for routine environmental monitoring and report writing.
- Methodology Statements of works, prepared by the Contractor, will be submitted to the local and relevant authorities associated with the Development.
- Any temporary access structures, put in place to allow machinery access to the area will be arranged in discussion with the Environmental Clerk of Works (EnvCoW) and the site will be fully restored post grid route connection (GRC) works.
- All chemical fluids used in the boring process are to be inert to the environment (environmentally safe) and follow the relevant legislation. The Contractor will retain a chemical register and have Safety Data Sheet (SDS) documents available onsite during the operation. The Contractor will also be responsible for a Fluid Management procedure which will include:
  - Drilling Fluid program and Safety Data Sheets
  - Management of spoil including volume on site, specialised site storage
  - Management of drilling fluid displacement (expected volumes and proposed storage)
- Considering the high volumes, high flow rates and high contaminant content (drilling spoil) of water arising for drilling activities, water will be managed and treated by means of a settlement tank and/or associated infrastructure (**Appendix 9.6 – Tile 8**). If a separation (recycling) system is to be used it will be adequately sized and bunded to handle the through-put of the drilling fluid so continuous drilling and reaming operation can be maintained. A separation system will be complete with screens and hydro - cyclones to separate the solids from liquid. Drilling fluids and drill spoils will be disposed off-site at an approved licensed location or discharged to the local surround area with approved licencing permits.

Good Practice of Plant Machinery

- All equipment used during HDD will be in good working order, checked regularly and maintained when necessary. Fluid return lines used in HDD process will be tested for leaks prior to use to check their reliability. Plant machinery not in use will have drip trays below engines as well as at refuelling points, if necessary.
- All practices involving bentonite will be monitored closely, that is: pumping pressure, drilling mud formulation i.e., drilling fluid volume and the volume of mud returns.
- Fuels, lubricants and hydraulic fluids for equipment use on Site will be carefully handled to avoid spillage, properly secured and provided with spill containment kits in case of incident to ensure best practice.
- Spill kits, hydrocarbon mats, oil booms etc., will be maintained at areas of works for emergency use and replaced when necessary.

Contingency Plan

- In the event that a drilling fluid spill or 'breakout' occurs, the Contractor will cease drilling immediately, notify the Environmental Clerk of Works (EnvCoW) and Emergency Service Management Personnel.
- Emergency contact numbers for the Local Authority Environmental Section, Inland Fisheries Ireland, the Environmental Protection Agency and the National Parks and Wildlife Service will be displayed in a prominent position within the site compound. These agencies will be notified immediately in the event of a pollution incident.
- The Contractor will draft and apply a Contingency Plan highlighting with the principal HDD risks. At minimum, the Contractor will have equipment and materials on standby to mitigate against the following risks associated with HDD[19]:
  - Hydro-lock (loss of fluid flow)
  - A hydro-fracture incident (loss of fluid pressure)
  - Fluid spill over
  - Hydrocarbon/fuel spill
  - Drill pipe rupture
  - Borehole path failure
  - Major workplace safety events in remote areas

- The HDD operators will need to be equipped with straw bales, stakes to secure bails, oil booms, silt fences, sandbags, shovels, pumps, and any other materials or equipment necessary to contain and clean up and properly dispose of unintentional releases.

[19] MDM (2018) "Rockabill System Specifications for Cable Installation", McMahon Design & Management Ltd. Consulting Engineers and Project Managers, Job no. 1319

9.6.2.6 Groundwater Contamination Proposed Mitigation Measures

As identified and discussed, the risk posed to groundwater quality by the Project is low, however mitigation measures to further reduce the risk will be implemented.

The main threat to groundwater quality is the introduction of hydrocarbons. In order to mitigate groundwater contamination by hydrocarbons in particular, the following will be implemented:

- Minimum fuel storage will occur on site and re-fuelling of vehicles will occur off-site at a controlled fuelling station whenever possible.
- Where fuelling must occur on site due to logistical reasons, then a discrete "fuel station" will be used.
- For large machinery such as cranes, drip tray will be used and spill kits will be on hand.

The following mitigation measures will be implemented in relation to non-hydrocarbon potential contamination:

- Wastewater from the sanitation facility will be mitigated by use of temporary, self-contained compound. This facility will not interact with the existing hydrological environment in any way and wastewater will be removed off-site weekly, by a licensed wastewater disposal company and disposed at an appropriate licenced facility.
- Inorganic nutrients such as nitrogen and phosphorus compounds (if present in excavated sediment and as discussed in discussed in **Section 9.5.3.2** with commercial forestry) will be controlled by the attenuation of the suspended solids to which they adsorb to and by retention of discharge waters within stilling ponds to allow peak runoff to recede prior to discharge (refer to the next section, **9.6.2.12** for monitoring details). It is noted that the baseline surface water chemistry indicates elevated Ammoniacal Nitrogen and Phosphate.
- Bacteriological contamination arising from availability of nutrients (e.g., livestock etc.) will be mitigated by appropriate self-contained sanitation facilities (above) and livestock grazing control on the site overall, but particularly on areas zoned for excavation and development.
- There is low risk of mobilising trace metals that may naturally be present, refer to **EIAR Chapter 8: Soils and Geology, Appendix C** for recoded locations of iron pan. The potential impact may arise from introduced water percolation with excavated bedrock substrate[20]. Concentrations of trace metals are usually low in the natural environment; however, water quality will be checked for metals concentration before, during and after the construction phase as part of monitoring at river monitoring locations.

[20] Teagasc (n.d.) "Research Soils Special: Irish Soil Information System" *Agriculture and Food Development Authority*

9.7 RELEASE OF SUSPENDED SOLIDS PROPOSED MITIGATION MEASURES

Graphics associated with mitigating runoff quality are presented in **Appendix 9.6 – Tiles 7 - 9.**

To mitigate the impact posed by release of suspended solids to the surface water environment, the following mitigation measures will be implemented. The drainage, attenuation and other surface water runoff management systems will be installed concurrent with the main construction activities to control increased runoff and associated suspended solids loads in runoff during intensive construction activities e.g., excavation of turbine base. Vehicular movements will be restricted to the footprint of the Project and advancing ahead of any constructed hardstand will be minimised in so far as practical. For example, excavation ahead of established hardstands will be in line with expected phases of Turbine Hardstand and Site Access Road construction in terms of both delivery of and installation of material and site activity periods whereby excavations will not be opened ahead of site shut down periods. This will be done with a view to minimising soils / subsoils exposure to rain and runoff. Drainage infrastructure will be installed during meteorologically dry ground conditions **(Section 9.6.2.2**).

Diffuse surface water runoff will be managed as follows:

- With reference to **Management Plan 3, Appendix 2.1**, collector drains and/or soil berms will be established to direct/divert surface water runoff from development areas, including temporary stockpiles, and direct same into established treatment trains including stilling ponds, buffered discharge points or other surface water runoff control infrastructure as appropriate. This is particularly important for effective surface water management associated with proposed infrastructure within the varied surface water buffer zones. The drainage system will be permanent (see also **Appendix 9.6** for conceptual graphics).
- Silt fences will be established along the perimeter of source areas e.g., stockpiles, within the drainage network, and in existing natural drains and degraded peat areas which are likely to receive surface water runoff (**Appendix 9.6 – Tile 14).** Section 5.5 of the Surface Water Management Plan (**Management Plan 3, Appendix 2.1**) describes this in more detail. This will reduce the potential for surface water runoff loaded with suspended solids to rapidly infiltrate towards and be intercepted by drainage or significant surface water features. Where possible multiple silt fences will be installed at multiple locations in drains / treatment trains discharging to the surface water network. Double silt fences / screens will be deployed at outfalls within surface water buffer areas (**Appendix 9.6 – Tiles 7 – 9**). Silt fences will be temporary features

but will remain in place for a period following the completion of the Construction Phase (until such time that site conditions are stable.

Waters arising as a product of excavation activities will be managed as follows:

- Waters arising from dewatering practices during excavation works will be significantly loaded with suspended solids. As such, constructed stilling ponds followed by buffered outfalls may be insufficient in controlling the release of suspended solids to the surface water network. Routine monitoring will prevent the possibility of clogging from significant volumes of settled or attenuated solids. Therefore, any water pumped from excavations, or any waters clearly heavily laden with suspended solids will be contained and managed and pumped through the preestablished Active Management treatment train (**Appendix 9.6 – Tile no. 8, 9 and 11).** This will include continuous active monitoring of water quality by turbidity measurement on an hourly basis.

Waters (likely loaded with suspended solids) intercepted by the established drainage network will be managed as follows:

- In line Stilling Ponds will buffer the run-off discharging from the drainage system during construction, by retaining water, thus reducing the hydraulic loading to watercourses. Stilling ponds are designed to reduce flow velocity to 0.3 m/s at which velocity, silt particle settlement occurs. Stilling ponds will be permanent (life of development at minimum). The locations of stilling pond have been chosen as a part of the drainage design, refer to **Series 100 Site Layout Plans 6225-PL-100-108 planning drawings.** Flow control devices such as weirs and baffles will facilitate achieving better attenuation, particularly when considering fluctuating runoff rates (**Appendix 9.6 – Tile 11**).
- In line Check Dams will be constructed across drains (**Appendix 9.6 - Tiles 3 – 6, Section 5.6 of Management Plan 3, Appendix 2.1)**. Check dams will reduce the velocity of run-off in turn facilitating the settlement of solids upstream of the dam. Check dams will also reduce the potential for erosion of drains. Rock filter bunds may be used for check dams however, wood or straw/hay bales (**Appendix 9.6 – Tile 13**) can also be used if properly anchored, that is; supported with rock or fitted timber to reduce potential for material to be swept away by incoming water. Multiple check dams will be installed, particularly in areas immediately downgradient of construction areas. Check dams will only be constructed in drainage infrastructure and not in significant surface water features i.e., streams or rivers. Check dams (comprised of rock) established will be permanent. The following will be implemented in the design of check dams and their deployment (CIRA, 2004):

- Permanent rock filter bunds (coarse aggregate) will be used for check dams however, temporary wood or straw/hay bales can also be used if properly anchored and if the need arises. Permanent rock filter bunds are preferred and is therefore prescribed, as this will ensure that rapid surface water runoff is mitigated against for the life of the Development.
- Check dams will be installed at c. 20 m intervals within the length of drainage channels. This is dependent on the slope angle and height of check dams constructed, refer to **Appendix 9.6 – Tile no. 3**.
- Check dams will include a small orifice / pipe at the base to allow the flow of water during low flow conditions i.e., maintain hydrological regime during low flow conditions. Note: the use of coarse aggregate will facilitate some infiltration.
- Erosion protection will be established on the downstream side of the check dam i.e., cobbles or boulder (100-150 mm diameter) extending at least 1.2 m (**Appendix 9.6 – Tile no. 3 and 4).**
- Check dams will be constructed as part of the drain i.e., reduce the potential for bypassing between the drain wall and check dam.
- Further details and design considerations are presented in **Appendix 9.6 – Tile no. 3 to 6**, refer also to **Section 5 of Management Plan 3, Appendix 2.1**.

- Surface water runoff will be discharged to land via buffered drainage outfalls (refer to **Appendix 9.6 Tiles 7, 8 and 12**, see also **Figure 4.2** and **Drawing Nos. 6226-PL-301** and **6226-PL-100 to 108** in **Management Plan 3**, **Appendix 2.1**). Buffered drainage outfalls will contain hard core material of similar or identical geology to the bedrock at the site to entrap suspended sediment. In addition, these outfalls promote sediment percolation through vegetation in the buffer zone, removing sediment loading to acceptable levels any adjacent watercourses and avoiding direct discharge to the watercourse. A relatively high number of discharge points / buffered outfalls have been established as part of the design, thus decreasing the loading on any particular outfall. Discharging at regular intervals mimics the natural hydrology by encouraging percolation and by decreasing individual hydraulic loadings from discharge points.
- As per the drainage design (**Figure 2.6**), buffered drainage outfalls will be located outside of surface water buffer zones. Similarly, outfalls will not be positioned in areas with extensive existing erosion and exposed soils. Buffered outfalls will be fanned and be comprised of coarse aggregate (cobbles / boulders) (**Appendix 9.6 – Tiles 12 and 13**). These structures will be akin to rip raps (coastal erosion defences/ outfall erosion defences). Silt fences (**Figure 2.6** and **Sections 4 and 5 of Management Plan 3, Appendix 2.1**) will be established downstream of buffered outfalls with a view to

ensuring the effectiveness of the attenuation train, particularly during elevated flow events. Buffered outfalls established will be permanent.

- Very fine solids, or colloidal particles, are very slow to settle out of waters and the finest of particles require near still water and relatively long periods of time to settle, therefore, such particles are unlikely to settle despite the aforementioned measures. To address this, as required, flocculant will be used to promote the settlement of finer solids prior to redistributing to the treatment train and discharging to surface water networks. Flocculant 'gel blocks' are available and can be placed in drainage channels upstream of stilling ponds. Gel blocks are passive systems, self-dosing and self-limiting, however they still require management (by the Contractor's Environmental Manager and supervised by the Developer appointed Environmental Clerk of Works (EnvCoW)) as per the manufacturer's instructions. Flocculants are made from ionic polymers. Cationic polymers (positive charge) are effective flocculants; however, their positive charge make them toxic to aquatic organisms. Anionic polymers (negative charge) are also effective flocculants, and are not toxic i.e., environmentally friendly [21]. Therefore, when flocculants are required, the material used must be made from anionic polymer. Gel blocks will be a temporary measure during the construction phase.
- Straw bales (similar to stone check dams) (**Appendix 9.6 - Tile 13**), and silt fences (discussed under diffuse runoff) will also be used within drainage channels for the purposes of attenuating runoff and entrained suspended solids, however these measures should be considered temporary and will be used mainly in managing potential acute contamination incidents (e.g. additional features to control runoff during excavation works) or to facilitate temporary works (e.g. corrective actions, discussed in later sections). The installation of straw bales or silt fences will require checking on a daily basis by the Contractor's Environmental Manager and supervised by the Environmental Clerk of Works (EnvCoW) to ensure the bypassing does not occur. Coarse stone / boulders will be used in conjunction with these measures to address such issues.

The above measures, buffer zones, constructed drainage, check dams, two-stage stilling ponds design for attenuation, buffered outfalls are referred to as The Treatment Train, whereby the runoff will continuously be treated from source (construction area) to receptor (site exit, outfall of attenuation lagoon). Where necessary (>25 mg/L suspended solids) the treatment train will be augmented through the use of anionic polymer gel blocks. These measures reduce the suspended sediment and associated nutrient loading to surface water

[21] USEPA (2013) Stormwater Best Management Practice – Polymer Flocculation (Available at: http://www.siltstop.com/pictures/US_EPA_Polymer_Flocculant_Handout__3-14.pdf)

courses and mitigates potential impacts to water quality and on plant and animal ecologies downstream of the Site.

The precautionary and mitigation measures listed here will avoid, reduce or remedy all potential impacts on water quality and will ensure that the sensitive receptors in the catchment of the Project do not suffer any deterioration in water quality, either during construction, operation, or decommissioning. With reference to **EIAR Chapter 6: Aquatic Biology**, the populations of Freshwater Pearl Mussel in the lower catchments of the wind farm (Sullane) and along the grid connection route will not be negatively affected by the proposed development. Therefore, the risk to sensitive receptors is low.

Particularly sensitive areas are identified and presented in **Figure 9.13a** to inform the drainage design. Refer also to specific constraints relating to drainage, outfalls and stability in **EIAR Chapter 8 Land, Soils and Geology** and **Figure 8.7a**. Sensitive areas include identified site constraints / buffer zones, but also particular areas with elevated soil or slope stability risk results. Drainage design will not include outfalls discharging to those particular sensitive areas without proper consideration and tailored mitigation in buffer zones and will be avoided outright in areas of elevated risk.

The drainage design is presented on **JOD Drawings 6226-PL-100 to 6226-PL-108** and calculations are included in **Management Plan 3 – Surface Water Management Plan** appended to the CEMP, **Appendix 2.1**. The design indicates in detail the locations of treatment train features, and the specification required at each location.

9.8 RELEASE OF HYDROCARBONS PROPOSED MITIGATION MEASURES

The following mitigation measures to reduce potential impacts from the environmental release of hydrocarbons and other harmful chemicals to the surface waters will be implemented:

- Refuelling of vehicles will be carried out off Site to the greatest practical extent. This refuelling policy will mitigate the potential for impacts by avoidance. Due to the remote location nature of the Site, it is unlikely that implementation of this refuelling policy will be practical in all circumstances (e.g., bulldozers, cranes, etc.). In instances where refuelling of vehicles on Site is unavoidable, a designated and controlled refuelling area will be established at the Site (**Figure 2.16**). The designated refuelling area will enable low risk refuelling and storage practices to be carried out during the works. The designated refuelling area will contain the following attributes and mitigation measures as a minimum requirement:

- The designated refuelling area will be located a minimum distance of 50 m from any surface waters or Site drainage features
- The designated refuelling area will be bunded to 110% volume capacity of fuels stored at the Site
- The bunded area will be drained by an oil interceptor that will be controlled by a pent stock valve that will be opened to discharge storm water from the bund
- Management and maintenance of the oil interceptor and associated drainage will be carried out by a suitably licensed contractor on a regular basis, including Decommissioning following construction.
- Any oil contaminated water will be disposed of at an appropriate Licensed wate disposal site.
- Any minor spillage during this process will be cleaned up immediately
- Vehicles will not be left unattended whilst refuelling
- All machinery will be checked regularly for any leaks or signs of wear and tear
- Containers will be properly secured to prevent unauthorised access and misuse. An effective spillage procedure will be put in place with all staff properly briefed. Any waste will be collected, stored in appropriate containers and disposed of offsite in an appropriate manner.

Notwithstanding the management of refuelling and fuel storage at the designated refuelling area, the potential risk of hydrocarbon spills from plant and equipment or other general chemical spills at other areas of the Site remains. As a precautionary measure, to mitigate against potential spills at other areas of the Site, the following mitigation measures will be implemented:

- Oil absorbent booms and spill kits will be available adjacent to all surface water features associated with the Project. The controls will be positioned downstream of each construction area and at principal surface water drainage features. Oil booms deployed will have sufficient absorbency relative to the potential hazard
- Spill kits will also be available at construction areas such as at turbine erection locations, the Temporary Construction Compound, Onsite Substation, spoils storage areas and Met Mast location etc.
- Spill kits will contain a minimum of oil absorbent pads, oil absorbent booms, oil absorbent granules, and heavy-duty refuse bags for collection and appropriate disposal of contaminated matter
- Should an accidental spill occur during the construction or operational phase of the Project such incidents will be addressed immediately, this will include the cessation of works in the area of the spillage until the issue has been resolved.

- Spill kits will be kept in each vehicle at the Site and will be readily available to all operators
- No materials, contaminated or otherwise will be left on the Site
- Suitable receptacles for hydrocarbon contaminated materials will also be available at the Site
- A detailed spill response plan will be prepared as part of the Site specific CEMP.

Implementation of the above mitigation measures will significantly reduce the risk of hydrocarbon contamination being released to the surface water network. Nevertheless, the potential risk cannot be entirely eradicated. Therefore, precautionary measures and emergency response protocols have been established and specified in Management Plans 1 and 3 of the CEMP, **Appendix 2.1**.

9.8.1.1 Release of Horizontal Directional Drilling Material Proposed Mitigation Measures

In consultation with Drilling Supplies Europe[22], following the polymer break down, cuttings will settle out of the drill fluid which will form approximately 20% of the volume, the liquid phase will form about 80% of the volume. It is noted that settlement will be done overnight in a pit or holding tank, to leave a fluid phase of less than 400 ppm suspended solids.[21] As has been seen in the past, the remaining water phase will be decanted and disposed of to a wastewater treatment facility or in the sewerage infrastructure, with appropriate discharging licenses from relevant authorities; and the sludge/solids will be disposed of as semi-dry waste to landfill at a reduced cost.[21]

Quantities of drillings cuttings have not been specified to date; however, it is noted that in each entry and exit pit associated with HDD, a 1 m x 1 m x 2 m steel box will be installed to contain any drilling fluid returns from the borehole. The drilled cuttings will be flushed back by drilling fluid to the steel box in the entry pit. It has been determined that drilling rig and fluid handling units will be located on one side of each bridge and will be stored on double bunded 0.5 mm PVC bunds which will contain any fluid spills and storm water run-off. Upon completion of the HDD process, the steel boxes will be removed, with the drilling fluid disposed of to a licensed facility.

Drilling mud containing spoil recovered from the bored path can be retrieved at the launch and reception sites of the bore. This bentonite contaminated spoil will be treated in one of two ways. It can either be transferred off-site to an approved and authorized EPA license

[22] Drilling Supplies Europe (2022) "ClearBore" *Drilling Supplies Europe.* Available at: <https://www.drillingsupplieseurope.com/drilling-fluids/clearbore/>

facility (in accordance with the Waste Management Act 1996 as amended) to be properly disposed of; or the spoil can be pumped to a mechanical separation container (**Appendix 9.6 – Tile 14**). This involves drill mud being stored within a holding tank until separation of particulates can be achieve only then can the fluid be discharged to the surrounding area.

Very fine solids, or colloidal particles, are very slow to settle out of waters and the finest of particles require near still water and relatively long periods of time to settle, therefore, such particles are unlikely to settle despite at sufficient rates. To address this, flocculant will be used to promote the settlement of finer solids prior to discharging to surface water networks. Flocculant 'gel blocks' are passive systems, self-dosing and self-limiting, however they still require management as per the manufactures instructions. Flocculants are made from ionic polymers. Cation polymers (positive charge) are effective flocculants; however, their positive charge makes them toxic to aquatic organisms. Anionic polymers (negative charge) are also effective flocculants, and are not toxic i.e., environmentally friendly.[23] Therefore, if flocculants are deployed the material used must be made from anionic polymers.

9.8.1.2 Release Wastewater Sanitation Contaminants Proposed Mitigation Measures

A temporary compound area will be constructed on-site to contain temporary facilities for the construction phase including 'port-a-cabin' structures. The temporary compound will be constructed on a base of geo-textile matting laid at ground level. This will be stabilized with the laying of hardcore material on top. During the construction phase, foul effluent will be periodically removed for offsite disposal.

Wastewater/sewerage from the staff welfare facilities located in the Temporary Construction Compound will be collected and held in a sealed storage holding tank, fitted with a high-level alarm. The high-level alarm is a device installed in the storage tank that is capable of sounding an alarm during a filling operation when the liquid level nears the top of the tank. Chemicals are likely to be used to reduce odours.

All wastewater will be emptied periodically, tankered off-site by a licensed waste collector to the local wastewater sanitation plant for treatment. There will be no onsite treatment of wastewater. A wastewater or sewerage leakage is not anticipated in a properly managed Site.

[23] USEPA (2013) "Stormwater Best Management Practice: Polymer Flocculation" *United States Environmental Protection Agency: Office of Water*, 4203M.

9.8.1.3 Release of Construction and Cementitious Materials Proposed Mitigation Measures

In order to mitigate the potential impact posed by the use of concrete and the associated effects on surface water in the receiving environment, the following precautions and mitigation measures will be implemented:

- The acquisition, transport and use of any cement or concrete on site will be planned fully in advance of commencing works by the Contractor's Environmental Manager and supervised at all times by the Developer appointed Environmental Clerk of Works (EnvCoW). This entails minimising quantities on site, planning delivery routes and washout stations.
- Precast concrete will be used wherever possible i.e., formed offsite. Elements of the Project where precast concrete will be used have been identified and are indicated in the CEMP, **Appendix 2.1.** Elements of the Project where the use of precast concrete will be used include structural elements of watercourse crossings (single span / closed culverts) as well as Cable Joint Bays. Elements of the development where the use of precast concrete is not possible includes turbine foundations and joint bay pit excavations. Where the use of precast concrete is not possible the following mitigation measures will be implemented.
    - o Lean mix concrete, often used to provide protection to main foundations of infrastructure from soil biome, can alter the pH of water if introduced, which would then require the treatment of acid before being discharged to the surrounding environment. The use of lean mix concrete will be minimized, limited to the requirement of turbine foundations. The risk of runoff will be minimal, as concrete will be contained in an enclosed, excavated area.
    - o Vehicles transporting such material will be relatively clean upon arrival on site, that is; vehicles will be washed/rinsed removing cementitious material leaving the source location of the material. There will be no excess cementitious material on the vehicle which could be deposited on trackways or anywhere else on site. To this end, vehicles will undergo a visual inspection prior to being permitted to drive onto the proposed site or progress beyond the Contractor's yard. Vehicles will also be in good working order.
        - Drivers of such vehicles will be instructed to ensure that all vehicles are washed down in a controlled environment prior to the departure of the source site, such as at concrete batching plants. **(Appendix 9.6 – Tile 21)**
- Concrete will be poured during metrological dry periods/seasons in so far as practical and reasonably foreseeable. This will reduce the potential for surface water run off being significantly affected by freshly poured concrete. This will require limiting these works to dry meteorological conditions i.e., avoid foreseen sustained rainfall (any

foreseen rainfall event longer than 4-hour duration) and/or any foreseen intense rainfall event (>3 mm/hour, yellow on Met Éireann rain forecast maps), and do not proceed during any yellow (or worse) rainfall warning issued by Met Éireann. This also will avoid such conditions while concrete is curing, in so far as practical.

- Pouring of concrete into standing water within excavations will not be undertaken.
- Excavations will be prepared before pouring of concrete by pumping standing water out of excavations to the treatment train and buffered surface water discharge systems in place.
- Any required shuttering installed to contain the concrete during pouring will be installed to a high standard with minimal potential for leaks. Additional measures will be taken to ensure this, for example the use of plastic sheeting or other sealing products at joints.
- No surplus concrete will be stored or deposited anywhere on site. Such material will be returned to the source location or disposed of off-site appropriately at a suitable licensed facility. Concrete washing will be contained and managed similarly.
- Designated washout of concrete trucks shall be strictly confined to the batching facility and will not be located within the vicinity of watercourses or drainage channels. Only the chutes will be cleaned prior to departure from Site and this will take place at a designated area at the Temporary Construction Site Compound. The contents will be allowed to settle and the supernatant will be removed off site by licenced generator to a licenced waste water treatment plant.
- Temporary storage of cement bound sand (if required for construction of the substation building) will be on hardstand areas only where there is no direct drainage to surface waters and where the area has been bunded e.g., using sand-bags and geotextile sheeting or silt fencing to contain any solids in run-off.
- Ground crew will have a spill kit readily available, and any spillages or deposits will be cleaned/removed as soon as possible and disposed of appropriately.

9.9 CLEAR FELL OF FORESTRY

No new impacts or remediation measures are associated with forestry activities. However, good practices working in specific environments such as forested areas will be adhered to including working outside of surface water or other buffer zones, and risk assessing on a case by case basis in terms of drainage intercepting run off, ecological sensitivities, etc.

Further mitigation measures regarding the management of forestry operations which will be implemented include:

- Phased felling approach
- Minimising erosion by use existing tracks and use of brash for off track areas.

- Felling and extraction, if economical, of timber will, as far as possible, be undertaken at the same time as currently licensed extraction activities in order to minimise extra traffic and noise disturbance.
- Felling and extraction of timber will, as far as possible, be undertaken in dry weather conditions.
- All Forest Service guidelines will be adhered to during all harvesting activities.
- All relevant forestry guidance and policies as follows:
  - Forestry Service (2015) Forestry Standards and Procedures Manual
  - Forestry Service (2002) Forest Protection Guidelines
  - Forestry Service (2018) Forests & Water - Achieving Objectives under Ireland's River Basin Management Plan 2018-2021
  - Forestry Service (2000) Forests & Water Quality Guidelines
  - Forestry Service (2000) Forest Harvesting and Environmental Guidelines
  - Forestry Service (2018) Forestry and Freshwater Pearl Mussel Requirements - Site Assessment and Mitigation Measures DRAFT
  - Forestry Service (2000) Forest Biodiversity Guidelines
  - Forestry Service (2000) Forestry and The Landscape Guidelines
  - Forestry Service (2000) Forestry and Archaeology Guidelines
- It should be noted that the clear-felling of trees in the State requires a felling licence.
- All drains, either mound drains, culverts, water crossings crossed during extraction, if necessary, will be cleared of any debris to ensure no drainage issues will occur for the remining trees, which can be a major attributor to windblow.
- Felling and extraction of timber will be undertaken in dry weather conditions.
- Harvesting operations will be scheduled according to the nature of the soil seasonally, depending on ground conditions. Mechanised harvesting operations will be suspended during and immediately after periods of particularly heavy rainfall. Waterways are particularly vulnerable to the effects of harvesting as silt from the movement of machinery can enter streams and rivers causing blockage of gravels which affects insect and fish life. Also nutrients released from decaying branches, particularly from large clear felled sites, can cause enrichment of the waters which in turn causes pollution. To counteract these effects careful planning is required in carrying out harvesting operations. The following measures to avoid impacts will be implemented:
  - Limiting the size of the areas to be felled which reduces the amount of nutrients and silt released.
  - Minimising the crossing of drains and streams, but where necessary installing temporary structures (log bridges, pipes etc) to avoid machines entering the water;

- Establishing buffer zones around waterways from which machines are excluded and riparian zones maintained.

9.9.1.1 Watercourse Crossings Proposed Mitigation Measures

The Project includes the construction of three (3 No.) clear-span bridge watercourse crossings (**Figure 9.7**). The Grid Connection Route will encounter 113 No. Culvert crossings, 3 no. watercourse crossings and 6 no. service crossings (**Appendix 2.4**). These crossings require detailed planning and consideration to ensure potential impacts are assessed adequately and in turn mitigated against.

The proposed watercourse crossings are relatively near the head waters of the surface water network therefore, bridge or culvert specification and construction are envisaged to be of relatively low significance in terms of expected flow, etc. However, all watercourse crossings will be designed to facilitate peak, or storm discharge rates so as to avoid localised flooding and associated issues during storm events. Data presented in **Table 4.4** and **Table 4.5** of **Appendix 9.1 – IWF Flood Risk Assessment,** indicate potential surface water discharge rates during a 1-hour storm event and a 24 hour storm event with a 1 in 100 year return period. Upstream catchment areas are estimated and delineated by assessment of mapped catchment boundaries, topographical contours and existing infrastructure and associated drainage.

The above assessment is a conservative estimation which does not consider evapotranspiration or recharge to ground, or base flow and groundwater discharge to the respective surface water features.

In relation to the design and construction of watercourse crossings risk assessment and prescription of mitigation measures have been designed in accordance with relevant guidance and reference documents (**Section 9.3).**

Regulation 50 of the European Communities (Assessment and Management of Flood Risks) Regulations 2010 SI 122 of 2010 requires that: "No Person, including a body corporate, shall construct any new bridge or alter, Reconstruct, or restore any existing bridge over any watercourse without the Consent of the Commissioners or otherwise than in accordance with plans previously approved of by the Commissioners."

The word "watercourse" includes rivers, streams, and other natural watercourses, and also canals, drains, and other artificial watercourses.

The word "bridge" includes a culvert or other like structure.

The OPW is responsible for the implementation of the regulations and consent to construct any bridge will be sought from the OPW via their application process. Details on the application process and guidance / requirements of the bridge design and considerations in terms of flow can be found in the OPW guide Construction, Replacement, or Alteration of Bridges and Culverts (A Guide to Applying for Consent under Section 50 of the EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010 and Section 50 of The Arterial Drainage Act, 1945). The requirements of OPW have been incorporated into the design of the proposed watercourse crossings. Preliminary design details are included in **Drawings ref. 6226-PL-WC 1-3.**

All crossings will have clear span structures.

Single span structures are structures which span the width of the channel with no associated instream support and do not affect the bed of the river or water body. This ensures that the bank and instream habitats are maintained and the riverbed is not impacted.

The decision to use single span structures is in accordance with Engineering in the water environment: Good Practice Guide – River Crossings (SEPA, 2010) and Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes (NRA, 2008) for river waterbodies in upland or transitional river segments.

With reference to **EIAR Chapter 6 – Aquatic Ecology**, none of the proposed watercourse crossing locations are associated with areas, or immediately proximate to surface water features with significant ecological sensitivity or importance. The principal risk to ecological sensitivities associated with proposed watercourse crossing works is the potential for adverse impacts to water quality downstream of the Site, namely the potential for mobilisation of solids. It is also noted that watercourse crossing methodologies employed will ensure potentially long term / permanent impacts downstream (e.g. scouring etc) or upstream (e.g. passage of fish) will be avoided, in line with 'good practice' defined by SEPA.

Considering all of the above and considering baseline conditions – including ecological sensitivity and importance of surface water features associated with each of the watercourse crossings, all crossings will be Clear Span Bridges.

This is in line with good practice as defined by relevant guidance (SEPA, 2010) whereby; the course of action serves a demonstrated need, minimises the potential for ecological harm.

- Considering the width of all waterbodies associated with crossings discussed here (<2 m width) in stream supports will not be required for the construction of single span structures.
- The design facilitates adequate hydraulic capacity (**Management Plan 3 of Appendix 2.1**). This ensures that the design will maintain the existing channel and will facilitate peak discharge events (storm events) without flow being constrained and contributing to flooding or other issues. Values presented **Appendix 9.1 – SFRA** indicate the potential discharge rate associated with each watercourse crossing during a 1 in 100-year storm event. For existing crossings, the channel width will be maintained.
- In line with the above design consideration, allowance will be made for the transport of sediment through the crossing, not just hydraulic capacity.
- The design facilitates adequate freeboard to OPW requirements. The design facilitates passage of woody debris. Freeboard to facilitate navigation and recreation is not applicable in relation to the development and associated surface water features.
- For single span structures, abutments will be set back from the river channel (**Appendix 9.6 – Tile 15**) and banks to allow the continuation of the riparian corridor underneath the structure. This helps to minimise or prevent the need for bed and bank reinforcement, reduces the risk of creating a barrier to fish passage and allows mammal passage under the structure. The distance between the bridge abutments will be as wide as possible and will maintain the bank habitat, maximising the riparian corridor and allowing the river some space to move. Foundations (of abutments) will be deep enough to minimise or prevent the need for bed or bank reinforcement or bridge weirs or aprons. This will maintain the natural bed material and bed levels, protecting habitat and allowing fish passage. Foundations will be buried deep enough to allow for scour during high flows. Construction will be supervised by a suitably qualified engineer who will confirm that the depth is as per the design.
- The design minimises the potential for localised bank and bed erosion, refer to **Planning Drawing No. 6226-PL-WC-01, 6226-PL-WC-02, 6226-PL-WC-03**.

9.9.1.1.1 Culverts & Instream Works

Infrastructure such as culverts and non-mapped drainage features will require instream works. Where culverts are required and the subsequent in-stream works are necessary, the following will be implemented:

- Relevant guidance referenced is presented in **Section 9.3**. Method statements will be included in the CEMP, **Appendix 2.1.**
- The construction area will be isolated, this means; the water feature (streams / drains) will be temporarily dammed upstream of the watercourse crossing and flow will be diverted by means of a flume / pipe by gravity or pumped (this is referred to as over pumping, **Appendix 9.6 – Tile 1**) downstream of the watercourse crossing and construction area. Following the successful upstream damming, a downstream dam or barrier will also be established. The downstream barrier will ensure contaminated runoff in the isolated work area can be contained and managed and will block surface water back flow in lower lying or flatter areas. **Appendix 9.6 – Tile 1** presents a conceptual plan view of an isolated construction area within a surface water feature. Over pumping of a surface water feature is considered diversion of water runoff only and therefore considered similar to discharge of storm water runoff only to sewer (exempt from licensing), however it is imperative that controls are in place to ensure environmental impacts are minimised, particularly in relation to ecological sensitivities.
- In order to ensure isolation and over pumping is carried out effectively, the methodology will ensure that dams are secure / sufficiently supported, and that pumping of water can continue uninterrupted and that pumps are capable of keeping up with the discharge rate of the surface water feature. Pumping systems will require backup and fail-safe protocols e.g., backup pumps and generator. At significant surface water features e.g., non-mapped streams, isolation and diversion of drainage will be implemented.
- Provided the construction water within the isolation area is managed effectively, over pumping of the surface water feature does not pose a significant risk to surface water quality downstream of the watercourse crossing. With reference to **Section 6.4.2 of Chapter 6: Aquatic Biology**, clear span design of the bridges/crossings will not affect instream aquatic habitat or interfere with the passage of fish or aquatic fauna.
- Water ingress into the construction area will be managed and collected by established sumps immediately downstream of the works (upstream of the downstream barrier) (**Appendix 9.6 – Tile no. 1**). Runoff within the construction area will likely be heavily laden with suspended solids. Where required, dewatering (pumping out or extracting) of such waters will be discharged to an inline settlement tank, or preestablished stilling pond to remove suspended solids before being discharged (**Appendix 9.6 Tiles 8 and 9**). The quality of the water being discharged will be monitored. If discharge water quality is poor (e.g., >25 mg/L) additional measures will be implemented, for example treating construction water by dosing with coagulant to enhance the settlement of finer solids – this can be done in a controlled manner by means of a suitably equipped settlement tank. Collected and treated construction water will be discharged by gravity

/ pump to a vegetated area of ground within the Site (an example is provided in **Appendix 9.6 – Tile 12**). Silt fences (**Appendix 9.6 – Tile 14**), will be established at the discharge area to ensure potential residual suspended solids are attenuated and the potential for erosion is reduced. The discharge area will be outside of the surface water buffer areas (similar to dewatering of excavations). For further details refer to **Appendix 9.6 – Tiles 6 to 9**.

- Discharging of construction water (trade effluent) directly to surface waters is a licenced activity. No extracted or pumped or treated construction water from the isolated construction area will be discharged directly to the surface water network associated with the Site (This is in accordance with Local Government (Water Pollution) Act, 1977 as amended). It is noted that all runoff on the site will eventually discharge to the receiving surface water network, however with appropriate management the quality of runoff discharging to the surface water network will be acceptable e.g., <25 mg/L Suspended Solids.
- Operation of machinery in-stream will be kept to an absolute minimum and avoided where possible. Where in stream works are required, the area will be isolated by means of over pumping or drainage diversion (**Appendix 9.6 Tile 1**), discussed further below.
- Works in relation to watercourse crossings will be carried out during periods of sustained dry meteorological conditions and will not commence if sustained wet conditions or if wet conditions are forecast (**Section 9.6.2.1**).
- Works in relation to watercourse crossings will be planned and carried out as efficiently as possible. This means work plans are agreed fully and all equipment and materials are prepared fully before in stream works commence. Works will be completed as quickly as possible and will not pause for the duration of the in stream works e.g., Installation of culverts (24 hour as necessary), with the exception of circumstances related to meteorological and/or health and safety conditions.
- Only precast concrete will be used for in stream works.
- Precautions will be made to mitigate the potential risk of a hydrocarbon spill. Further to measures outlined in **Section 9.5.3.2**, settlement tanks (will be adequately equipped with hydrocarbon removal functionality on standby, for example hydrocarbon absorbent booms, oil skimmers, and GAC (granulated activated carbon) filters, should they become necessary (**Appendix 9.6 – Tile 8**).

9.9.1.1.2 Diversion of Drainage

Diversion of artificial drainage channels will be required at locations where the development layout intercepts existing artificial drainage networks (**Figure 9.7a**).

Diversion of drainage will be done under similar conditions to that described above for instream works. Many of the existing constructed drainage channels are observed to be dry during sustained dry meteorological conditions which implies that over pumping or diverting of water flow may not be necessary, nonetheless the methodology described for instream works will be implemented to mitigate the risk of any flow through the construction area or for unforeseen wet meteorological events.

Any newly installed drain will be fully formed prior to the diversion of existing drainage.

Erosion control will be incorporated into the design (**Appendix 9.6– Tile 2**), this requires minimising the area of exposed soil in existing and newly established channels. This will include a combination of the use of coarse aggregate / crushed rock (non-friable / non-weak), engineered solutions and/or revegetation.

A series of temporary silt fences (**Appendix 9.6– Tile 14)** will be installed to mitigate against the entrainment and mobilisation of solids during key events during the construction process, for example, the initial use of the new diverted channel, or the infilling of the original channel made redundant (**Management Plan 3, Appendix 2.1).** The use of silt screens as a form of mitigation during watercourse crossing works is considered a precautionary measure. Refer to **Appendix 9.6 – Tile 2** for further information on the recommended ordering of control measures.

9.9.1.2 Groundwater Contamination Proposed Mitigation Measures

A combination of the underlying bedrock geology, the associated aquifer potential, low permeability soils/peat and low recharge rates has resulted in the risk posed to groundwater quality by the Project being considered as low risk. Nevertheless, mitigation measures to reduce potential risks to groundwater will be implemented as a precautionary approach. A primary risk to the underlying groundwater quality would be through the accidental release of hydrocarbons from fuels or oils during the construction phase of the Project. In order to mitigate against potential groundwater contamination by hydrocarbons, the following measures will be implemented:

- In the first instance, no fuel storage will occur at the Site whenever feasible and refuelling of plant and equipment will occur off Site at a controlled fuelling station.
- In instances where on Site refuelling is unavoidable, then the bunded on Site designated refuelling area will be used. The designated refuelling area must be bunded to 110% volume capacity of fuels stored at the Site. **(Appendix 9.6 – Tile 19)**

- The bunded area will be drained by an oil interceptor that will be controlled by a pent stock valve that will be opened to discharge storm water from the bund.
- Management and maintenance of the oil interceptor and associated drainage will be carried out by a suitably licensed contractor on a regular basis.
- Any oil contaminated water will be disposed of at an appropriate oil recovery plant.
- Any minor spillage during this process will be cleaned up immediately.
- Vehicles will not be left unattended whilst refuelling.
- For large machinery such as cranes, a drip tray will be used and spill kits will be on hand.

The following mitigation measures will be implemented in relation to non-hydrocarbon potential contamination of groundwater:

- All other liquid-based chemicals such as paints, thinners, primers and cleaning products etc. will be stored in locked and labelled bunded chemical storage units.
- Sanitation facilities used during the construction phase will be self-contained and supplied with water by tank trucks. These facilities will not interact with the existing hydrological environment in any way and they will be maintained and serviced throughout the construction phase.
- The controlled attenuation of suspended solids in settlement ponds and check dams etc. will result in inorganic nutrients (if present in elevated concentrations) such as phosphorus and nitrogen being absorbed and retained by the solids in the water column. This will allow for a reduction of peak inorganic discharges in a controlled and stable run off rate. It is noted that the presence of elevated contaminants were detected during the four surface water quality monitoring rounds.
- It is considered that there is a low risk of mobilising trace metals that may naturally be present in low concentrations in the baseline environment. The potential for mobilising trace metals is most likely to result from enhanced water percolation associated with excavated bedrock substrate. To mitigate against this potential impact, water quality should be monitored for trace metal concentrations prior to, during and after the construction phase.
- The potential for livestock such as cattle and sheep which have been observed grazing in the vicinity of the Site to cause bacteriological contamination of groundwater will be controlled through the implementation of strict grazing control zones, Site perimeter fencing and exclusion zones around all open excavations.

9.9.1.3 Site and Water Quality Monitoring

9.9.1.3.1 Defining Monitoring Roles and Responsibilities

An Environmental Clerk of Works (EnvCoW) will be appointed during the construction and operational phases of the Project, to ensure sensitive areas outlined in this EIAR are prioritised and to ensure mitigation measures are followed to protect these sensitive areas. It is often compulsory as part of the planning conditions to have an EnvCoW present during works. Local Authorities will often define what role the EnvCoW has, for example; an advisory capacity, an audit capacity, for ecological work or an all-encompassing environmental role. For the Project, the EnvCoW will incorporate, where relevant, mitigation and monitoring responsibilities set out here width. The EnvCoW ensures compliance with the method statements and management plans, in turn in line with environmental and mitigation objectives outlined in this report, and will relay advice, information and instruction to the appointed contractors during the construction and operational phases of the Project.

9.9.1.3.2 Wind Farm Site

Monitoring of peat, subsoils, bedrock and material management during the construction phase of the Project will be fundamentally important in ensuring that potential suspended solid entrainment in surface waters is minimised. With comprehensive planning and preparation, and implementation of relevant mitigation measures contained in the CEMP, the potential for elevated suspended solids to be released to surface waters via runoff is likely to be minimal.

To ensure effective implementation of mitigation measures, environmental auditing, and monitoring of environmental obligations of the Developer, an Environmental Clerk of Works (EnvCoW) will be assigned by the Developer to carry out monitoring at the Site during the construction and operational phases of the Project. The role of the EnvCoW will be to actively and continuously monitor site conditions and advise on environmental issues and monitoring compliance. The EnvCoW will have the authority to temporarily stop works in a particular area of the Site to ensure corrective measures are implemented and adverse environmental impacts are minimised if not avoided. The following wind farm Site monitoring measures will be undertaken by the EnvCoW, to mitigate against potential impacts on the surface water and groundwater receiving environment:

- During the construction phase, daily inspection of silt traps, buffered outfalls and drainage channels, in conjunction with daily measurement of total suspended solids, electrical conductivity, and pH at selected water monitoring locations on the Site (locations close to active working zones). Monitoring of same features, parameters and locations during times when excavations are being dewatered (likely high in solids) will be done in real time. In this regard, physiochemical properties will be monitored in real time by means of alarmed telemetry e.g., telemetric monitoring at baseline sampling locations and alarm thresholds established in line with water quality reference concentrations/limits which will be set using relevant instruments for example, Surface Water Quality Regulations, <25 mg/l Total Suspended Solids (TSS). This threshold can be described as one of the environmental and mitigation objectives set for the Development.

- Continuous Monitoring will be carried out as part of Active Management of construction water management and treatment (**Appendix 9.6**). These monitoring systems will travel with remain with the Active Management infrastructure. The purpose of this is to recycle water if quality is unfavourable and adjust the dewatering and treatment train accordingly until discharge quality is observed to be acceptable. A small degree of tolerance above reference concentrations is acceptable at this location but only if the discharge from the Active Management train discharges to another Passive Management system or to a non-sensitive vegetated area. If discharging within sensitive areas or buffer zones, the quality of discharge from the Active Management train will be in line with prescribed reference limits (e.g., 25 mg/l TSS)
- Continuous Monitoring at designated downstream Baseline SW Locations (**Figure 9.7b**) will be carried out using telemetry during the construction phase. Exceedance of thresholds at these locations will trigger emergency response and escalation of measures including immediate full Site inspection to ascertain the potential unknown source (bearing in mind that the quality of managed runoff will be known by means of live telemetry and handheld meters). Monitoring at Baseline SW Locations will continue into the operational phase until such time that it is confirmed that the construction phase is complete, that there are no further construction activities required on site, and when stable conditions are observed i.e. stable conditions in line with baseline conditions observed for 2 months following the completion of the construction phase.
- Post construction: inspection of silt traps, buffered outfalls and drainage channels, measurement of total suspended solids, electrical conductivity, and pH at selected water monitoring locations at the Site will be carried out at a reasonable frequency (weekly initially gradually reduced based on observed stability of conditions) and will also be scheduled following extreme metrological events. During the operational phase of the project the stilling ponds and buffered outfalls will be periodically inspected e.g., weekly during maintenance visits to the Site initially and gradually reduced based on observed stability of conditions.
- During the construction phase of the Project, the areas or works will be monitored daily for evidence of groundwater seepage, water ponding and wetting of previously dry

spots, and visual monitoring of the effectiveness of the constructed drainage and attenuation systems so that it does not become blocked, eroded or damaged during the construction process. This monitoring will continue at a reasonable frequency (weekly initially, gradually reduced based on observed stability of conditions) during the operational phase of the Project, any potential issues in this regard will be identified and rectified during the construction phase.

- During both the construction and operational phases of the Project, watercourse crossings will be monitored frequently (daily during construction and intermittently during operational phase i.e., weekly / monthly inspections) and reduced gradually in line with observed stability and confidence in data obtained over time. Monitoring will include structural integrity and the impact on respective watercourses (i.e., erosion, siltation).
- A detailed inspection and continuous monitoring regime is specified in the CEMP, **Appendix 2.1**. This includes an environmental risk register e.g., constraints linked to the development construction schedule, routine reporting on the performance and effectiveness of drainage and attenuation infrastructure, and any actions taken to rectify or enhance the system. This also includes Site water runoff quality instructions at all designated downstream SW locations. Continuous Monitoring Locations or Telemetric Monitoring Stations (TMS) will use probes to monitor the following parameters:
  - Electrical Conductivity
  - Turbidity (Data obtained can be equated to estimated Total Suspended Solids (TSS) through calibration)
  - pH
  - Temperature
  - Capacity for additional probes.
  - TMSs will be self-powered and will be comprised of the following components at a minimum:
  - Remote Telemetry Unit (RTU) – Modem / data hub and transmission.
  - Solar panel
  - Sensor – pH
  - Sensor – Turbidity
  - Sensor – Electrical Conductivity
  - Sensor Cleaning Device (SCD)(Turbidity probe)
  - Power Management Unit (PMU)
  - Power Bank (PB)
  - Website – presenting data trends over time.
  - Metal stand / frame and protective fencing.

  - The TMS will have capacity for additional parameters.
- Telemetric continuous monitoring sampling frequency is generally set at one data point per 15 minutes, however considering the intensive nature of the proposed works, particularly drilling activities, if possible it is recommended that sampling frequency is set at 5 minutes or less with a view to escalating responses to potential discharge quality issues in good time. Data is transmitted to a project website which will display data trends over time. Access to the website can be gained and shared via a website link by the designated EnvCoW.
- Telemetric Monitoring Systems will be used a key part of Active Management of runoff and construction water at the Site, as presented in **Appendix 9.6 – Tiles no. 7 to 9.**
- A handheld turbidity meter will be available and used to accurately measure the quality of water discharging from the Site at any particular location. The meter will be maintained and calibrated frequently (per the particular unit's calibration requirements / user manual) and will also be used to check and calibrate remote sensors if they are employed. Quality thresholds have been established for the purposes of escalating water quality issues as they arise.
- Rainfall will be monitored (1 no. rainfall gauge required). This unit will be connected with and displayed with other site water quality telemetry data via the telemetry website.
- Surface water runoff control infrastructure will be checked and maintained on an ongoing basis, and stilling ponds and check dams will be maintained (de-sludge / settle solids removed by vacuum) on an ongoing basis, particularly during the construction phase of the Project. It is important to minimise the agitation of solids during these works, otherwise it will likely lead to an acute significant loading of suspended solids in the drainage network. This can be achieved by temporarily reducing or blocking incoming flow and vacuum extracting settled solids or sludge. Where the drainage feature poses relatively significant flow rates, isolating and over pumping is the best course of action. As part of the CEMP, **Appendix 2.1** regular checking and maintenance of pollution control measures are required (in line with frequencies outlined above), with an immediate plan for repair or backup if any breaches of design occur. In the event that established infrastructure and measures are failing to reduce suspended solids to an acceptable level, construction works will cease until remediation or upgrading works are completed.
- All details in relation to monitoring will be included in the Surface Water Management Plan (**Appendix 2.1**).

Monitoring the potential hydrological impact of the Project, particularly during the operational phase will be inherently linked to the ecological health of the blanket peat (as a functioning ecosystem) and therefore both hydrology and ecology will be considered, and monitored in tandem. For example, impacts to the hydrological regime at the Site can potentially impact on the ecological health or characterisation of the Site, and vice versa. Ecological indicators can potentially provide useful data in relation to the long-term impact of changes to the hydrological regime at the Site. However, as discussed in earlier sections of this report, changes to the management of runoff and in turn the hydrological regime at the Site will lead to a positive impact overall when compared to the baseline conditions associated with the Site e.g. introduction of intermittent buffered outfalls along the length of the drainage network is in contrast to baseline, this will promote a more even distribution runoff, attenuate runoff and reduce the hydrological response to rainfall, enhanced potential for recharge to ground, and in turn raising bog water levels resulting in wetting of peatlands at the Site.

9.9.1.3.3 Grid Connection Route and Turbine Delivery Route

Monitoring will be carried out at each significant construction location (HDD, any excavation >2.0 m) and at significant environmental receptors including the following Environmental Monitoring Locations:

- Upstream and downstream of surface water crossings on mapped rivers.
- Operational wells within groundwater buffer zones associated with significant construction locations (namely SW Crossings).
- Groundwater abstraction points within buffer zones (mapped wells, source protection areas, and/or associated Regionally Important Karst Aquifer).

Monitoring proposed will be specified relative to the particular activity and associated risk at respective locations.

9.9.1.3.4 Monitoring Under License

Where a discharge licence is required, the conditions of the licence will stipulate monitoring requirements in line with licence parameters with associated emission limit values. The frequency of sampling will likely be daily or weekly. Sampling will include obtaining physical samples at an agreed discharge sampling point and will be sent an accredited laboratory for analysis. Where discharge licence is required, monitoring in line with the licence will be done in addition to the other monitoring regimes undertaken as described in sections above. Monitoring under licence conditions will not negate the requirement for the other regimes described.

9.9.1.3.5 Tailoring Monitoring Requirements

The baseline monitoring undertaken at the Site as part of this study will be repeated periodically before, during and after the construction phase of the Project to monitor any deviations from baseline hydrochemistry that occur at the Site. This monitoring along with the detailed monitoring outlined below will help to ensure that the mitigation measures that are in place to protect water quality are working. Specifically, a construction period and post construction monitoring programme for the Development should include the following:

- During the construction phase, daily inspection of silt traps, buffered outfalls and drainage channels and daily measurement of total suspended solids, electrical conductivity, and pH at selected water monitoring locations on the site. Monitoring of same during times when excavations are being dewatered (likely high in solids) should be done in real time.
- Post construction: at a reasonable frequency inspection of silt traps, buffered outfalls and drainage channels, measurement of total suspended solids, electrical conductivity, and pH at selected water monitoring locations at the Site. During the operational phase of the project the stilling ponds and buffered outfalls will be periodically inspected during maintenance visits to the Site.
- During the construction phase of the project, development areas should be monitored daily for evidence of groundwater seepage, water ponding and wetting of previously dry spots, and visual monitoring of the effectiveness of the constructed drainage and attenuation system so that it does not become blocked, eroded or damaged during the construction process.
- During both the construction and operational phases of the project, watercourse crossings should be monitored frequently (daily during construction and intermittently during operational phase). The water course crossings should be monitored in terms of structural integrity and in terms of their impact on respective watercourses.
- A detailed inspection and monitoring regime, including frequency has been specified in the Construction and Environmental Management Plan (CEMP, **Appendix 2.1**).

9.9.1.4 Emergency Response

Monitoring of the development during the construction and operational phase will potentially indicate weaknesses of the drainage and attenuation design, and/or the potential for excessive loading at particular locations etc. In such instances corrective actions will be taken to mitigate against any potential adverse impacts. Depending on the severity of the issue there is the potential that immediate action will be required, for example the introduction of straw bales to reduce flow / enhance attenuation at a particular location, erect silt fences etc., however such measures will be temporary. Any issue observed will require assessment by a specialist consultant and alternative mitigation design (in line with measures described in this EIAR) will be implemented to ensure the efficacy of the system during both the construction and operational phases of the Development. Scenarios where corrective action will be required, and proposed corrective mitigation measures include:

- Potential issue; Elevated concentrations of suspended solids in runoff during excavation activities during an unforeseen or low probability storm event, for example a 1 in 100-year event. Proposed measure that will be implemented; Cover exposed stockpiles in plastic sheeting and placement of straw bales and silt fences in associated drainage channels.
- Potential issue; Failure or degradation of stone check dam during a storm event with associated elevated runoff volumes. Proposed measure that will be implemented; Introduction of straw bales and silt fences in order to regain attenuation capacity of the drainage channel until the maintenance can be completed.
- Potential issue; Localised peat stability issue leading to deposit of peat within an active drainage channel. Proposed measure that will be implemented; Introduction of straw bales and silt fences directly downstream, of the area in order to attenuate gross solids isolate the area and over pump until remedial works and maintenance can be completed, divert all runoff from the area to Active Management area of the treatment train (**Appendix 9.6 – Tile no. 7 to 9**).
- Potential issue; Management of unexpected runoff patterns leading to excessive drying or wetting in a particular area, potentially leading to enhanced erosion and / or adversely impacting on the ecological health of peat ecosystems. Proposed measure; This type of issue will require assessment on a case by case basis. Solutions might include; decommission, modification, introduction or relocation of buffered outfall, or diversion of runoff volumes to or away from the area. In regard to the potential for erosion and similar physical processes, any such issues will become apparent through monitoring relatively rapidly, whereas impacts to ecological sensitivities will become apparent relatively slowly in comparison. It is noted that much of the Site is impacted as part of baseline, (**Section 9.4.6**) in this regard e.g., extensive existing artificial drainage networks.

Prior to commencement of construction, the Environmental Clerk of Works will prepare a register of corrective action and emergency response sub-contractors that can be called upon in the event of an environmental incident, and/or to give training on escalating incident where useful, including e.g., specialist hydrocarbon spill response, specialist hydrological and/or water quality response.

Mitigations measures as outlined in the previous sections will reduce the potential for contamination of waters during the construction phase of The Development, however there remains the risk of accidental spillages and or leaks of contaminants, and excessive loading of surface water mitigation infrastructure.

Emergency responses to potential contamination incidents will be established and form part of the CEMP, **Appendix 2.1**, Management Plan 1. Potential emergencies and respective emergency responses include:

- Hydrocarbon spill or leak **–** Hydrocarbon contamination incidents will be dealt with immediately as they arise. Hydrocarbon spill kits will be prepared and kept in vehicles associated with the construction phase of The Development. Spill kits will also be established at proposed construction areas, for example, a spill kit will be established and mobilised as part of the turbine erection materials and equipment. Suitable receptacles for hydrocarbon contaminated materials will also be at hand.
- Significant hydrocarbon spill or leak **–** In the event of a significant hydrocarbon spillage, emergency responses will be escalated accordingly. Escalation will include measures such as installation of temporary sumps, drains or dykes to control the flow or migration of hydrocarbons and contaminated runoff will be contained, managed and pumped to a controlled area in line with Active Management including treatment through a suitably equipped treatment tank and Granular Activate Carbon (GAC) vessels. This process will be managed by the Environmental Clerk of Works (EnvCoW) in conjunction with a preidentified consultant (Environmental Clerk of Works (EnvCoW) specialist register) in regard to effective remediation, treatment and removal of hydrocarbon contaminated water and soils Excavation and appropriate disposal of contaminated soils will be required in this instance.
- If a significant hydrocarbon spillage does occur, the contractor on behalf of the developer will have an approved and certified clean-up consultancy available on 24-hour notice to contain and clean-up the spill. The faster the containment or clean-up starts, the greater the success rate, the lower the damage caused and the lower the cost for the clean-up.
- Cementitious material **–** Cement / concrete contamination incidents will be dealt with immediately as they arise. Spill kits will also be established at proposed construction areas, for example a spill kit will be established and mobilised as part of the turbine erection materials and equipment. Suitable receptacles for cementitious materials will also be at hand.

In the event of a significant contamination or polluting incident the relevant authorities will be informed immediately.

With reference to **Appendix 8.1**, localised stability issues are to be anticipated. In close proximity to surface water receptors this represents an acute risk to river water with potentially catastrophic impacts to downstream ecological attributes if not managed and isolated sufficiently.

9.9.1.5 Managing & Reporting Environmental Incidents

Environmental incidents including accidental spillages on soils (e.g., fuel), breeches of licence limits if applicable (discharge of trade effluent), and significant environmental incidents (e.g., landslide) will be reported to the Local Authority as part of emergency responses to such incidents. Incident notification will be escalated to relevant third parties where relevant e.g., Inland Fisheries Ireland (IFI) if surface water receptors are intercepted.

9.9.1.6 Construction Phase Residual Impacts

The residual impact on the surface water receiving environment resulting from the construction phase of the Project is anticipated to be a limited temporary decrease in water quality. A limited temporary decrease in water quality may arise due to a release of suspended solids and sediments to surface waters during excavations at the Site. The potential for release of elevated suspended solids is likely to be exacerbated following heavy rainfall events which occur after sustained dry periods. Any localised reduction in water quality will be mitigated against by the extensive control measures outlined in this chapter and also by natural dilution as distance from the point or diffuse source of contamination increases with distance from the Site.

Mitigation by avoidance and the implementation of physical control measures will ensure that contaminant concentrations, particularly elevated suspended solids entrained in run-off are reduced to below the relevant legislative screening criteria. The overall impact is anticipated to be **direct, negative, imperceptible**, and **temporary**.

Mitigation measures outlined in this report lay down the framework to reduce all potential impact of Project on Hydrological and Hydrogeological receptors. The Mitigated Potential Impacts lay down the achievable benchmarks provided measures are considered and implemented adequately.

9.9.2 Operational Phase

9.9.2.1 Increase in Hydraulic Loading Proposed Mitigation Measures

The principles of the mitigation measures described under **Section 9.6.1.2** (check dams, stilling ponds, attenuation lagoons etc.) are based on the control and management of runoff discharge rates, which ensure the regulating the speed of runoff within the drainage network, buffering the discharge from the drainage network where possible, and maintaining the natural hydrological regime. As such, the measures described with a view to controlling the release of suspended solids also mitigate against the potential for rapid runoff and rapid hydrological responses to rainfall potentially leading to flooding and erosion of the drainage network or downstream of the Wind Farm Development.

The same measures will be implemented with a view to mitigating against net increase surface water runoff arising from the development. For example, the following conceptual model will be applied at a proposed turbine hardstand location:

- Collector drains; allowing for 0.5 m depth, 1.0 m width, presume semi-circular, sectional area; c. 0.4 m^2. Presume 100 m length of collector drain; up to 40 m^3 capacity per 100 m, by 50% allowing for gradient equates to 20 m^3. Collector drains are not intended to store runoff, however the in line attenuation features, such as check dams and flow regulators will serve to reduce discharge rates dramatically, effectively backing up water and regulating the rate of discharge. The actual attenuation capacity of the drainage network and treatment trains will be calculated during the detailed design phase of the development.
- Check dams at regular intervals throughout the drainage network (existing, new clean collector and new dirty collector drains) will attenuate runoff intercepted by respective drainage channels.
- Dirty water collector drains (associated with construction areas) will direct runoff to established stilling ponds. Stilling ponds will reduce the velocity of runoff, further reducing the hydrological response to rainfall.
- Buffered outfalls to vegetated areas will utilise the infiltration capacity of the ground prior to the rejected rainfall eventually being intercepted by the receiving surface water system.
- Clean water collector drains will intercept clean runoff (upgradient of construction areas) and will direct runoff around construction areas. The runoff will be attenuated by means of check dams and intermittent buffered outfalls (**Appendix 9.6 – Tile 7**).

The Project will lead to an increase in impermeable surface area through the construction of hardstand areas within the Site. This in turn will lead to an increase in hydraulic loading by surface water runoff. Preliminary water balance calculations indicate that the worst-case net increase in surface water runoff volumes will be approximately 0.253 m^3/second (or 2.06%) relative to the area of the Site. The potential combined attenuation capacity of the proposed drainage infrastructure, checked dams, stilling ponds, etc. (**Appendix 2.1**) has been designed to attenuate net increase in water runoff during extreme storm events i.e., 1 in 100-year storm event plus a 20% allowance for global warming, as set out in **Appendix 9.1**.

9.9.3 Development Decommissioning and Restoration Phase/s

9.9.3.1 Decommissioning of Infrastructure

As discussed in Section 9.5.7, no new significant effect on the surface water and groundwater receiving environment are anticipated during the Decommissioning phase of the project. The Decommissioning phase of the project, as outlined in **Management Plan 6 -Decommissioning Plan, Appendix 2.1**, details the removal of Site infrastructure such as wind turbine and concrete plinths, removal of permanent met mast and the removal of all associated underground electrical and communications cabling.

The excavation of peat is expected during the Decommissioning phase, but, however, to a far less extent when compared to that of the construction phase. For instance it is proposed the turbine foundations will remain in situ and upon turbine dismantling, redressed with peat. Similarly, the movement of plant, vehicles and equipment is expected to be required during the Decommissioning phase, but to a far less extend than during the construction phase. As a result, there remains a risk of elevated suspended solids being discharged in surface water run-off to the downstream receiving environmental during the decommissioning phase. Additionally, the potential risk remains for spills of fuels hazardous chemicals which is a common risk to all developments. The mitigation measures outlined in this chapter will be implemented during the Decommissioning phase, as well as those outlined in the Decommissioning Plan (**Appendix 2.1**), to reduce the potential for such impacts.

In regard to cable ducting, for the Grid Connection route, it is envisaged cable joint bays will be left in-situ and cabling on site will be removed from the cable bays. The ground above original pulling pits/joint bays will be excavated to access the cable ducts using a mechanical excavator and will be fully re-instated once the cables are removed. Excavated material will be temporarily stored adjacent to the site of excavation at a height of less than 1 m and outside of any surface water buffer zone, and will be removed from the site appropriately for reuse elsewhere on site, reused on another site or disposed of as a waste (through appropriate classification and assessment).

9.9.3.2 Reinstatement of Hardstand Areas

In order to reduce the potential impact of excavating and removing the entirety of the crane hardstand areas, it is proposed that the majority of the stone structure of the individual crane hard- stands will be left in place, with topsoil and or peat being spread on top of the hardstand to form a vegetated surface layer. The top layer of the crane hardstand areas will have the rock/stone dug out and be left to revegetate naturally. Any reinstatement of topsoil and the restoration of vegetation will be kept consistent and compatible with surrounding vegetation, and will be agreed with the Environmental Engineer in advance of commencement. Reinstatement of Turbine Hardstand areas during the Decommissioning phase has the potential to result in soil creep, associated erosion and potential entrainment of elevated suspended solids in surface water run-off. This in turn has the potential to impact on the receiving surface water environment.

- A site specific Decommissioning Pan has also been developed prior to the commencement of any Decommissioning activities.
- Mitigation measures described in this chapter to reduce the potential for run-off of elevated suspended solids will be implemented.
- It is proposed that silt/sediment fences will be implemented along the perimeter of all access tracks and hardstand areas prior to decommissioning works and for the during the reinstatement works.
- Additional precautions such as the implementation of check dams, secured straw bales, sandbags, or settlement ponds should be implemented at areas where surface water runoff is likely to be intercepted by both natural and artificial drainage features.
- Any drains or outfalls which have the potential to draw water from reinstatement areas, or promote preferential surface water runoff flow paths through reinstatement areas will be removed, blocked or decommissioned as deemed required by the Environmental Engineer.
- The mitigation measures for the preparation of the hardstand area surfaces prior to material being deposited discussed in **Chapter 8: Soils and Geology** will be implemented.
- It is proposed that monitoring and maintenance of the reinstated areas will be conducted regularly following the initial stages of establishment to ensure that the potential for excessive surface water runoff eroding deposited material along preferential pathways is minimised.

It is proposed that the Site Access Tracks and associated drainage systems will serve ongoing forestry and agriculture activity in the area.

9.9.3.3 Reinstatement Residual Impacts

It is anticipated that the appropriate reinstatement of redundant hardstand areas will result in a net beneficial impact. This will be achieved through passive continuous improvements at the areas in question. Over time, the reinstated areas will become revegetated and will recover to become similar in appearance to the surroundings of the wider Site. The reinstatement of the Site areas will likely result in enhanced peatland/bog water levels at the Site. This will occur through the reintroduction of permeable layers at former hardstand areas which will in turn promote the filtration of potentially contaminated surface water runoff which may originate from reinstated areas. Therefore, the residual impact of reinstatement at site access tracks and former Turbine Hardstand areas is considered to be a **positive, localised and permanent** impact of the Development. However, it is important to note that reinstatement will be required to be managed similar to the construction phase, including appropriate construction phase mitigation and monitoring.

9.9.3.4 Development Decommissioning and Restoration Phase – Physical Infrastructure

No significant excavations will occur during the decommissioning phase, therefore, no new impacts are anticipated during the decommissioning phase of the Project on the hydrological and hydrogeological environment therefore no additional mitigation measures are required.

Deconstruction works during the Decommissioning phase of the Project pose similar hazards and risks associated with the construction phase but to a far lesser extent, for example, the potential for fuel spills from vehicles is valid but there will likely be less vehicles required. The principle mitigation measures described in this EIAR chapter will be implemented by means of the Decommissioning Plan **Appendix 2.1.**

9.9.4 Cumulative Effects

9.9.4.1 Water Quality

The phasing/commencement of any other permitted developments in the locality (**Appendix 2.2: Wind Farms within 20 km of the Development** and **Appendix 2.4: List of Projects for Cumulative Assessment)** could potentially result in the scenario where a number of other construction sites are in operation at the same time as the Project.

Considering cumulative effects of a range of pressures on the surface water network on a national scale, if an accidental release of contaminants were to occur, there is a potential to temporarily effect surface waterbodies in the catchment. However, the objectives of the outlined mitigation measures in this chapter and in the Flood Risk Assessment

(FRA) (**Appendix 9.1**), are to reduce any potential effect to acceptable levels, and to strive for net gains where possible. Therefore, the Project is not considered likely to significantly contribute to cumulative effects in terms of water quality nor flood risk.

With respect to hydrogeology, and the potential effects of the Project having been assessed as likely being to be minor and temporary, for example; in the event of a minor spill of fuel / hydrocarbons, the spill will be contained and remediated efficiently. Therefore, the development is not likely to contribute significantly to cumulative effects on groundwater quality, but the residual risk even if small in scale is important to consider in the context of the elevated sensitivity and importance of the receptor i.e. groundwater designated as drinking water on a national scale.

With the adequate application and execution of mitigation measures and achievement of mitigation objectives, the Project is not considered to contribute to cumulative surface water or groundwater effects potentially significantly.

In the event of accidental or temporary contamination incidents, water quality in downstream receptors can potentially be adversely impacted, particularly during the construction phase. Such incidents will detected quickly through ongoing monitoring and trigger an emergency response on site and escalation of Active Management on site (**Appendix 9.6 Tiles 7 – 9).** Assuming other, similar developments, construction activities and potential adverse impacts in the area, there is the potential for such incidents to have a cumulative impact on water quality to some degree if such incidents occur on multiple sites in a short period of time and within the same hydrological catchments. However, it must be noted that similar sporadic natured impacts are part of baseline conditions at the site, including, land reclamation, excavation of drainage, commercial forestry, agricultural practices.

Allowing for worst case whereby a contamination incident occurs, the incident will likely be minor and temporary and therefore will unlikely contribute significantly to cumulative effects in the associated surface water network. The risk of a major landslide or mass movement to occur as a function of the Project is generally low (**Appendix 8.1**).

9.9.4.2 Hydraulic Loading

Due to a net increase in impermeable surface at the Site as part of the Project a reduction in recharge to groundwater, and rapid transmission of runoff to surface water systems has the potential to significantly contribute to the cumulative / catchment of adverse impacts imposed on the surface water network in the catchments associated with the Project and the hydrological response to rainfall, (refer to Appendix 2.3 for permitted and operational wind farms within 20 km of the proposed Site). However, considering the pre-existing "Good" WFD status of the surface waters surrounding the Project, and the generally high-quality baseline water quality results outlined in **Section 9.4.8**, the potential for the Project to have adverse cumulative impacts on hydrology is limited to the construction phase. Considering cumulative impacts of pressures on the surface water network, if an accidental release of contaminants were to occur, there is a potential to temporarily impact surface waterbodies in the catchment. However, the objectives of the outlined mitigation measures in this chapter and in the Flood Risk Assessment (FRA), **Appendix 9.1**, are to reduce any potential impact to acceptable levels. Therefore, the Project is not considered likely to significantly contribute to cumulative effects in terms of water quality nor flood risk.

With respect to hydrogeology, and the potential effects of the Project having been assessed as being localised due to the overlying peat, slow recharge rates, high run-off rates and poor yielding underlying groundwater aquifer except for local zones, the Project is not considered to potentially significantly contribute to cumulative effects.

9.10 SUMMARY OF SIGNIFICANT EFFECTS

This chapter comprehensively assesses all scenarios within the Turbine Range which is described in **Section 9.2.1,** and a summary of unmitigated and mitigated impacts are presented in **Table 9.13: Summary of Potential Impacts on receiving environment from the Project in the absence of and with mitigation measures.**

There will be no change to the potential impacts or predicted effects irrespective of which turbine is selected within the Turbine Range because of the design phase mitigation measures which will be implemented prior to construction. All works will be outside of the 65 m buffer from watercourses and 20 m buffer from drains, where possible. Where this is not possible, additional mitigation measures such as increased use of Sustainable Drainage Systems (SuDS), will be implemented. Additionally, all temporary stockpiles will be at no less than 25 m from watercourses. This will be implemented regardless of the volume of excavated materials created as a result of the Turbine Range.

During both the construction and operational phases of the Project, activities will take place at the Site that will have the potential to significantly affect the hydrological regime and surface water quality at the Site or its vicinity. The significant potential impacts that could generally arise during the construction of infrastructure elements including the excavation activities associated with turbine foundations, cable trenches and, and works in close proximity to surface water or drainage network including watercourse crossings and culverts, as well as Operational and Decommissioning phases relate to sediment input from runoff and other pollutants such as hydrocarbons and cementitious substances, with hydrocarbons or chemicals spills to surface waters having the most potential for impact. There will be no change to the potential impacts or predicted effects irrespective of which turbine is selected within the Turbine Range.

This chapter identified the likely hydrological, and hydrogeological impacts of the Project. By summarising relevant guidance and legislation and outlining baseline information, it allowed for the assessment of the potential effects to be identified and their significance rated.

Elements of the design, construction, and operation of the Project that may potentially impact on the hydrogeological and water environment receptors have been identified and their pathways for impacts have been assessed. It has been determined that without mitigation, the Project would likely cause adverse impacts ranging from moderate to profound significance due to the sensitivity of the SAC hydrologically linked to elements of the Project, including the Grid Connection Route.

However, the implementation of mitigation through avoidance principles, pollution control measures, surface water drainage measures and other preventative measures have been incorporated into the Project design in order to minimise potential significant adverse impacts on water quality at the Site. A self-imposed 50 m stream buffer zone will be implemented at the Site which will result in the avoidance of sensitive hydrological features. Direct discharges to surface waters of dewatered loads will not be permitted under any circumstances. This in turn will reduce the potential for adverse impacts on downstream designated Sites. Layout design amendments along with the application of the specified mitigation during each phase of the Project have reduced the potential significance to all receptors related to the Project to **'neutral' or 'positive'**. The Project will not impact upon any surface water or groundwater body as it will not cause a deterioration of the status of the body and/or it will not jeopardise the attainment of a WFD 'Good' status. The Project will not cause it to deteriorate and will not in any way prevent it meeting the biological and chemical characteristics for WFD 'Good' status.

The drainage plan (Surface Water Management Plan) for the Site will be a key method through which sediment runoff arising from construction activities will be reduced and through which runoff rates will be controlled.

Overarching objectives of the CEMP and SWMP will be to adopt and implement Nature Based Solutions including the provision of extensive Sustainable Drainage System (SuDS) features. This approach will be adopted to the extent that mitigating against likely impacts such as net increase in surface water runoff and potential adverse impacts to surface water quality, will overshoot net adverse losses and provide beneficial impacts compared to baseline conditions.

Implementation of the control measures outlined in this EIAR are considered to result in a robust environmental management plan which will target and mitigate likely sources and pathways of contaminant arising at the site, and to actively manage and monitor systems on site to achieve no impact to the receiving surface water network. Short term minor releases are still possible, however with the monitoring and management, any potential issue arising will be addressed immediately and remedied in good time.

The Project as a whole, including the Turbine Delivery Route and Grid Connection Route are not likely to significantly impact groundwater quantities, quality or availability. The principal residual risk to groundwater posed by the Project is the use, storage and transfer of hydrocarbons (fuel) on site for plant equipment. In the unlikely event a spill occurs, the contaminant will be contained, managed and removed in good time.

Preliminary assessments conclude that the likelihood of exacerbating flood risk or behaviours at the site is very low, and the potential to exacerbate impacts on local receptors including dwellings is very low.

Table 9.13: Summary of Potential Impacts on receiving environment from the Project in the absence of and with mitigation measures.

		Qualifying Criteria Pre-Mitigation									Qualifying Criteria With Mitigation	
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Earthworks	Construction	Direct and Indirect *	Adverse	Large	Moderate to Profound	Development Footprint	Conforms to baseline e.g. Agri/forestry tracks or operations)	Unavoidable	Temporary	Yes	Adverse	Neutral to Slight
Release of Suspended Solids	Construction	Direct and Indirect *	Adverse	Small to Moderate	Moderate to Profound	Localised (Potentially Regional)	Conforms to baseline e.g. forestry tracks or operations)	Unavoidable	Temporary	Yes	Adverse	Neutral to Slight
Vehicular Movements	Construction	Direct and Indirect *	Adverse	Small to Moderate	Moderate to Profound	Localised (Potentially Regional)	Conforms to baseline e.g. forestry tracks or operations)	Unavoidable	Temporary	Yes	Adverse	Neutral to Slight
Release of Hydrocarbons (SW)	Construction	Direct and Indirect *	Adverse	Small	Moderate to Profound	Localised (Potentially Regional)	Contrast to Baseline	Likely	Permanent but Reversible	Yes	Adverse	Neutral to Slight
Release of Hydrocarbons and Storage (GW)	Construction	Indirect	Adverse	Small	Moderate to Profound	Localised (Potentially Regional)	Contrast to Baseline	Likely	Permanent but Reversible	Yes	Adverse	Neutral to Slight

		Qualifying Criteria Pre-Mitigation									Qualifying Criteria With Mitigation	
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Release of Horizontal Directional Drilling Materials	Construction	Direct	Adverse	Small	Slight	Localised (Potentially Regional)	Contrast to Baseline	Likely	Long Term to Permanent	Yes	Adverse	Neutral to Slight
Release of Drill Arisings	Construction	Direct and Indirect *	Adverse	Small	Moderate to Significant	Localised (Potentially Regional)	Contrast to Baseline	Likely	Temporary to Long Term Reversible	Yes	Adverse	Neutral to Slight
Release of Wastewater Sanitation Contaminants	Construction	Direct and Indirect *	Adverse	Small	Moderate to Significant	Localised (Potentially Regional)	Contrast to Baseline	Likely	Temporary to Long Term Reversible	Yes	Adverse	Neutral to Slight
Release of Construction or Cementitious Materials	Construction	Direct and Indirect *	Adverse	Small to Moderate	Moderate to Significant	Localised (Potentially Regional)	Contrast to Baseline	Likely	Temporary to Medium Term	Yes	Adverse	Neutral to Slight
Hydrologically Connected Designated Sites	Construction	Indirect	Adverse	Small to Moderate	Moderate to Profound	Localised (Potentially Regional)	Conforms to baseline e.g. cumulative upstream impacts	Likely	Temporary to Long-term	Yes	Adverse	Neutral to Slight
Local Groundwater Supplies (Wells)	Construction / Operational	Direct and Indirect *	Adverse	Small	Slight	Localised	Conforms to Baseline e.g. other shallow excavations	Unlikely	Temporary	Yes	Neutral	Neutral

		Qualifying Criteria Pre-Mitigation									Qualifying Criteria With Mitigation	
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Groundwater or Bog Water Associated with Wind Farm	Construction	Direct and Indirect *	Adverse	Small to Moderate	Moderate to Significant	Localised	Conforms to Baseline e.g. agri / peat drains / forestry drains. .	Likely	Permanent / Reversible	Yes	Slight Adverse / Small Beneficial	Slight / Neutral / Beneficial
Groundwater and Surface Water Associated with Grid Connection Cable Works	Construction	Direct and Indirect *	Adverse	Small	Slight	Localised (Potentially Regional)	Conforms to Baseline e.g. public roads and services	Likely	Temporary	Yes	Adverse	Neutral to Slight
Excavation Dewatering & Construction Water	Construction	Direct and Indirect *	Adverse	Small to Moderate	Moderate to Profound	Localised (Potentially Regional)	Contrast to Baseline	Likely	Temporary to Permanent	Yes	Adverse	Neutral to Slight
Diversion and Enhancement of Drainage	Construction	Direct and Indirect *	Adverse	Small	Moderate to Profound	Localised (Potentially Regional)	Conforms to Baseline e.g. Agri / peat drains / forestry drains. .	Unavoidable	Permanent	Yes	Adverse	Slight
Watercourse Crossings - Mapped Rivers	Construction	Direct and Indirect *	Adverse	Small to Moderate	Moderate to Profound	Localised (Potentially Regional)	Conforms to Baseline e.g. existing bridges and roads in area. .	Unavoidable	Permanent	Yes	Adverse	Slight
Watercourse Crossings - Drainage Features	Construction	Direct and Indirect *	Adverse	Small to Moderate	Moderate to Profound	Localised (Potentially Regional)	Conforms to Baseline e.g. Agri / peat drains / forestry drains.	Unavoidable	Permanent	Yes	Adverse	Slight

		Qualifying Criteria Pre-Mitigation									Qualifying Criteria With Mitigation	
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Watercourse Crossings - Grid Connection Route (HDD)	Construction	Direct and Indirect *	Adverse	Small	Moderate to Profound	Localised (Potentially Regional)	Contrast to Baseline	Unavoidable	Permanent	Yes	Adverse	Slight
Increased Hydraulic Loading & Flood Risk	Operational	Direct and Indirect *	Adverse	Small	Slight	Localised (Potentially Regional)	Conforms to Baseline e.g. existing forestry tracks.	Unavoidable	Permanent	Yes	Neutral to Beneficial	Neutral to Beneficial

Note:
*** Includes Indirect / Secondary impacts to receptors downstream of the Project. For example: Contaminants intercepted by surface water features or groundwater bodies can have a potential effect on downstream sensitive receptors or regional groundwater aquifers depending on the environmental circumstances.**

9.11 REFERENCES

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10 AIR QUALITY AND CLIMATE

10.1 INTRODUCTION

This chapter assesses the impacts of the Project (**Figure 1.2**) on air and on climate in Section 10.2 and 10.3 respectively. The Project refers to all elements of the application for the construction of Inchamore Wind Farm (**Chapter 2: Project Description**). Where negative effects are predicted, the chapter identifies appropriate mitigation strategies therein. The assessment considers the potential effects during the following phases of the Project:

- Construction of the Project;
- Operation of the Project, and
- Decommissioning of the Project.

Common acronyms used throughout this EIAR can be found in **Appendix 1.2.** This chapter of the EIAR is supported by Figures provided in Volume III and by the following Appendix documents provided in Volume IV of this EIAR:

- **Appendix 10.1 Scottish Government – Carbon Calculator Input and Output Data**

10.1.1 Statement of Authority

This chapter has been prepared by Jennings O'Donovan & Partners Limited. It was prepared jointly by Mr. David Kiely and Ms. Sarah Moore, with the assistance of Ms. Shirley Bradley.

Mr. David Kiely has undertaken EISs/ EIARs for wind farms throughout Ireland. He has 39 years' experience in the civil engineering and environmental sector and has obtained a Bachelor of Engineering Degree in Civil Engineering and a Master of Science degree in Environmental Protection. David has overseen the development of over 50 wind farms from feasibility, planning and environmental assessment through to construction including air and climate assessments for other wind farms.

Ms. Sarah Moore is a Senior Environmental Consultant and holds a Bachelor (Hons.) Degree in Environmental Science from University of Limerick and a MSc (Dist) in Environmental Engineering from Queen's University, Belfast. She has worked in environmental consultancy for over fourteen years and has prepared AA Screenings, Environmental Reports and EIARs and air and climate assessments for other wind farms.

Ms. Shirley Bradley is a Graduate Environmental Scientist with a First-Class Honours Degree (BSc. Hons) in Environmental Science from the Institute of Technology, Sligo. She was also awarded with the Governing Body award for a BSc in Environmental Protection. Shirley's key capabilities are in report writing, assisting Senior Consultants and GIS.

10.1.2 Assessment Structure

In line with the revised EIA Directive and current EPA guidelines listed in **Chapter 1**, **Section 1.6** the structure of this Air and Climate chapter is as follows:

- Assessment Methodology and Significance Criteria;
- Description of baseline conditions at the Site;
- Identification and assessment of impacts to air and climate associated with the Project, during the construction, operational and decommissioning phases of the Project;
- Mitigation measures to avoid or reduce the impacts identified;
- Identification and assessment of residual impact of the Project considering mitigation measures, and
- Identification and assessment of cumulative impacts if and where applicable.

The desktop study as outlined in Section 10.2 and 10.3 together with the other assessments detailed in this chapter are considered adequate to allow the Local Authority to carry out an adequate assessment of the Project.

10.2 AIR QUALITY

10.2.1 Assessment Methodology

This assessment of air quality involved the following:

- A desk study of the air quality baseline in the area of the Project and nationally;
- An evaluation of potential effects;
- An evaluation of the significance of effects, and
- The identification of measures to avoid and mitigate potential effects.

10.2.2 Relevant Legislation and Guidance

The Ambient Air Quality and Clean Air for Europe (CAFE) Directive (Directive 2008/50/EC) incorporates revised provisions for sulphur dioxide (SO_2), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), benzene (C_6H_6) and carbon monoxide (CO). This replaced the Air Quality Framework Directive (96/62/EC) and first three Daughter Directives (1999/30/EC, 2000/69/EC, 2002/3/EC). The Fourth Daughter Directive (2004/107/EC) will be incorporated into the CAFE Directive at a later date and stands alone as a separate EU Directive.

The Fourth Daughter Directive (2004/107/EC) relates to arsenic (As), cadmium (Cd), nickel (Ni), and mercury (Hg)_and polycyclic aromatic hydrocarbons (PAH) in ambient air and has been transposed into Irish legislation by the 'Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations 2009 (S.I. No. 58 of 2009)'.

The CAFE Directive was transposed into Irish legislation by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011) as amended by the Air Quality Standards (Amendments) and Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations, 2016 (S.I. 659 2016).

The Clean Air for Europe (CAFE) Directive (Directive 2008/50/EC on ambient air quality), (as amended by Directive EU 2015/1480) encompasses the following elements:

- The merging of most of the existing legislation into a single Directive (except for the Fourth Daughter Directive) with no change to existing air quality objectives.
- New air quality objectives for $PM_{2.5}$ (fine particulate matter) including the limit value and exposure concentration reduction target
- The possibility to discount natural sources of pollution when assessing compliance against limit values
- The possibility for time extensions of three years (for particulate matter PM_{10}) or up to five years (nitrogen dioxide, benzene) for complying with limit values, based on conditions and the assessment by the European Commission.

The limit values of the CAFE Directive are set out in **Table 10.1**. Limit values are presented in micrograms per cubic metre (µg/m^3) and parts per billion (ppb). The notation PM_{10} is used to describe particulate matter or particles of ten micrometres or less in aerodynamic diameter. $PM_{2.5}$ represents particles measuring less than 2.5 micrometres in aerodynamic diameter.

Table 10.1: Limit values of CAFE Directive 2008/50/EC (Source: EPA)

Pollutant	Limit Value Objective	Averaging Period	Limit Value (µg/m^3)	Limit Value (ppb)	Basis of Application of Limit Value
Sulphur Dioxide (SO_2)	Protection of human health	1 hour	350	132	Not to be exceeded more than 24 times in a calendar year
Sulphur Dioxide (SO_2)	Protection of human health	24 hours	125	47	Not to be exceeded more than 3 times in a calendar year
Sulphur Dioxide (SO_2)	Protection of vegetation	Calendar Year	20	7.5	Annual mean

Pollutant	Limit Value Objective	Averaging Period	Limit Value (µg/m^3)	Limit Value (ppb)	Basis of Application of Limit Value
Sulphur Dioxide (SO_2)	Protection of vegetation	1 Oct to 31 Mar	20	7.5	Winter mean
Nitrogen dioxide (NO_2)	Protection of human health	1 hour	200	105	Not to be exceeded more than 18 times in a calendar year
Nitrogen dioxide (NO_2)	Protection of human health	Calendar year	40	21	Annual mean
Nitric oxide (NO) + Nitrogen dioxide (NO_2)	Protection of ecosystems	Calendar year	30	16	Annual mean
PM_{10}	Protection of human health	24 hours	50	-	Not to be exceeded more than 35 times in a calendar year
PM_{10}	Protection of human health	Calendar year	40	-	Annual mean
$PM_{2.5}$ - Stage 1	Protection of human health	Calendar year	25	-	Annual mean
$PM_{2.5}$ - Stage 2	Protection of human health	Calendar year	20	-	Annual mean
Lead (Pb)	Protection of human health	Calendar year	0.5	-	Annual mean
Carbon Monoxide (CO)	Protection of human health	8 hours	10,000	8620	Not to be exceeded
Benzene (C_6H_6)	Protection of human health	Calendar year	5	1.5	Annual mean

Table 10.2 presents the limit and target values for ozone as per the Ambient Air Quality and Cleaner Air for Europe (CAFÉ) Directive (2008/50/EC).

Table 10.2: Target values for Ozone Defined in Directive 2008/50/EC

Objective	Parameter	Target Value from 2010	Target Value from 2020 onwards
Protection of human health	Maximum daily 8- hour mean	120 µg /m^3 not to be exceeded more than 25 days per calendar year averaged over 3 years	120 µg /m^3
Protection of vegetation	*AOT_{40} calculated from 1 hour values from May to July	18,000 µg /m^3 h^{-1} averaged over 5 years	6,000 µg /m^3 h^{-1}
Information Threshold	1-hour average	180 µg /m^3	180 µg /m^3
Alert Threshold	1-hour average	240 µg /m^3	240 µg /m^3

*AOT_{40} is a measure of the overall exposure of plants to ozone. It is the sum of the excess hourly concentrations greater than 80 µg/m^3 and is expressed as µg/m^3 hours.

10.2.3 Air Quality & Health

Environmental Protection Agency (EPA, 2020)[1], European Environmental Protection Agency (EEA, 2020)[2] and World Health Organisation (WHO, 2014) reports estimate that poor air quality accounted for premature deaths of approximately 600,000 people in Europe in 2012, with 1,300 Irish deaths predominantly due to fine particulate matter ($PM_{2.5}$) in 2020 and 30 Irish deaths attributable to Ozone (O_3) in 2016[3][4]. Fine particulate matter, ozone, along with others including carbon dioxide (CO_2), nitrogen oxides (NO_x) and sulphur oxides (SO_x) are produced during the burning of fossil fuels for energy generation, transport or home heating. There are no such emissions associated with the operation of wind turbines. Therefore, the construction of wind turbines such as in the Development will result in lower environmental levels of such parameters, and consequential beneficial effects on human health.

[1] Ireland's Environment – An Integrated Assessment 2020, EPA, 2020, accessed 04th July 2021
[2] EEA (European Environment Agency), 2020b. Air Quality in Europe 2020. EEA Report No. 09/2020. EEA, Copenhagen, accessed 04th July 2021
[3] https://www.euro.who.int/en/health-topics/environment-and-health/air-quality/news/news/2014/03/almost-600-000-deaths-due-to-air-pollution-in-europe-new-who-global-report, [Accessed 19/11/2022
[4] Irelands Environment 2016 – An Assessment', EPA, 2016, [Accessed 19/10/2022]

10.2.4 Air Quality Zones

The EPA has designated four Air Quality Zones for Ireland:

- Zone A: Dublin City and environs
- Zone B: Cork City and environs
- Zone C: 16 urban areas with population greater than 15,000
- Zone D: Remainder of the country

These zones were defined to meet the criteria for air quality monitoring, assessment and management described in the Framework Directive and Daughter Directives. The Development lies within Zone D, which represents rural areas located away from large population centres.

10.2.5 Existing Air Quality Conditions

Generally, Ireland is recognised as having some of the best air quality in Europe. However, from time to time, and under certain weather conditions, it is possible to experience some air pollution in the larger towns and cities. The most recent published report on air quality in Ireland is the 'Air Quality in Ireland 2021' report published by the EPA in 2022[5]. This report provides an overview of the ambient air quality in Ireland in 2020. It is based on monitoring data from 87 stations across Ireland. The measured concentrations are compared with both EU legislative standards and WHO air quality guidelines[6] for a range of air pollutants. The closest monitoring site to the Project within the same air quality zone is Macroom. Macroom was one of nine EU monitoring sites brought online in 2019. Results from the monitoring campaign during 2021 show:

- No levels above the EU limit value (in **Table 10.1**) were recorded at any of the ambient air quality network monitoring sites in Ireland in 2021.
- WHO guideline values were exceeded at a number of monitoring sites for PM_{10}, $PM_{2.5}$, ozone (O_3), NO_2, sulphur dioxide (SO_2) and PAHs.
- The annual mean PM_{10} and $PM_{2.5}$ levels for Macroom were 14 µg/m^3 and 9 µg/m^3 respectively. These values are below the limit values set out by Directive 2008/50/EC as per **Table 10.1**. However, the $PM_{2.5}$ is above the World Health Organization (WHO) guideline[7] of 5 µg/m^3 annual mean for $PM_{2.5}$.

[5] https://www.epa.ie/publications/monitoring--assessment/air/EPA-Air_Quality_in-Ireland-Report_2021_-interactive-pdf.pdf [Accessed 19/11/2022]
[6] https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health [Accessed 19/11/2022]
[7] https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health [Accessed 14/11/2022]

10.2.6 Do Nothing Impact

If the Project was not to proceed, the opportunity to reduce emissions of carbon dioxide (CO_2), nitrogen oxides (NO_x), and sulphur dioxide (SO_2) to the atmosphere would be lost due to the continued dependence on electricity derived from coal, oil and gas-fired power stations, rather than renewable energy sources such as the Project. This would result in an indirect, negative impact on air quality.

10.2.7 Potential Impacts of the Project

10.2.7.1 Construction Phase

Dust Emissions

The main potential source of impacts on air quality during construction is dust. There is potential for the generation of dust from excavations and from construction including construction of access roads and hardstands and the trench for the cable ducting for the grid connection.

The potential nuisance issues arising from this are dependent on the terrain, weather conditions, (i.e., dry and windy conditions), and the proximity of receptors. Dust from cement can cause ecological damage if allowed to migrate to water courses, though it is proposed that ready-mix concrete will be used with no on-site batching taking place. Therefore, this will not be a potential source of emissions. Potentially dust generating activities are as follows:

- Earth moving and excavation plant and equipment for handling and storage of soils and subsoils.
- Transport and unloading of stone materials for access track construction.
- Rock that is suitable will be extracted from borrow pit, turbine foundation areas and the sub-station and this will be used in the construction of tracks and hardstands.
- Vehicle movements over dry surfaces such as access tracks and public roads.

The potential impact from dust becoming friable and a nuisance to workers and local road users, if unmitigated, is considered, a slight, negative, short-term, direct impact during the construction phase.

Friable dust cannot remain airborne for a very long time. The distance it can travel depends on the particle sizes, disturbance activities and weather conditions. Larger dust particles tend to travel shorter distances than smaller particles. Particle sizes greater than 30 µm will generally deposit within approximately 100 m of its source, while particles between 10-30 µm travel up to approximately 250-500 m and particle sizes of less than 10 µm can travel up to approximately 1 km [8].

Generally, (depending on the conditions outlined), dust nuisance is most likely to occur at sensitive receptors within approximately 100 m of the source of the dust. It is considered that the principal sites of friable dust generation will be the turbine bases and hardstands, and also along new access roads. All turbines are situated greater than 740 m away from inhabited dwelling houses and therefore these principal sites of dust generation are greater than 100 m distant from these sensitive receptors. In addition, vegetation such as trees and hedgerows in the vicinity will help to mitigate any airborne dust migrating off the Site. Any effects of dust on vegetation will be confined to the construction and possibly the decommissioning phases and be short-term, slight, negative impact.

If unmitigated, there would also be dust deposition arising from mud on public roads, resulting from traffic leaving the construction site. Impacts from dust deposition at sensitive receptors would give rise to nuisance issues for residents of those properties. The impact would be short-term, temporary and slight negative impact on sensitive receptors.

Exhaust Emissions

Emissions from plant and machinery, including trucks, during the construction of the Project are a potential impact. The engines of these machines produce emissions such as carbon dioxide (CO_2), carbon monoxide (CO), Nitrogen Oxides (NO_x), and Particulate Matter (PM_{10} and $PM_{2.5}$).

Particulate Matter ("PM") less than ten micrometres in size (PM_{10}) can penetrate deep into the respiratory system increasing the risk of respiratory and cardiovascular disorders. PM_{10} arises from direct emissions of primary particulate such as black smoke and formation of secondary Particulate Matter in the atmosphere by reactions of gases such as sulphur dioxide (SO_2) and ammonia (NH_3). The main sources of primary PM_{10} are incomplete burning of fossil fuels such as coal, oil and peat and emissions from road traffic, in particular diesel engines. Other sources of particulates include re-suspended dust from roads. Natural Particulate Matter includes sea-salt and organic materials such as pollens.

Nitrogen oxides (NO_x), include the two pollutants, nitric oxide (NO) and nitrogen dioxide (NO_2). Anthropogenic (human) activities such as power-generation plants and motor vehicles are the principal sources of nitrogen oxides through high temperature combustion.

[8] http://www.dustscan.co.uk/Dust-Info/Definitions [Accessed 14/11/2022]

Nitrogen oxides are an important air pollutant by themselves but can also react in the atmosphere to contribute to the formation of tropospheric ozone (ozone in the air we breathe) and acid rain. Short-term exposure to nitrogen dioxide is associated with reduced lung function and airway responsiveness, and increased reactivity to natural allergens. Long-term exposure is associated with increased risk of respiratory infection in children.

The construction phase is likely to result in an increase in exhaust emission from construction vehicles and transport vehicles associated with the site works. The impact on air quality from an increase in exhaust emissions will be a short-term, slight negative impact.

10.2.7.2 Operational Phase

Dust Emissions

There will be a small number of light vehicles accessing the Site during the operational phase. This could lead to some localised dust being generated, though this will be small and sporadic as only approximately one to two site visits per week will occur at the Development. In the unlikely event that a turbine or elements of a turbine need to be replaced during the lifetime of the wind farm, there would be significantly less traffic than during the initial construction phase. There would only be one turbine delivered, compared to five turbines and the Site Access Roads and other site infrastructure will already have been established. Therefore, the operational phase will have an imperceptible negative impact.

10.2.7.3 Decommissioning Phase

Impacts during the decommissioning phase of the Project are anticipated to be less than those arising during the construction phase. The decommissioning phase will be as follows:

- Removal of five wind turbines and concrete plinths.
- Removal of permanent meteorological mast.
- Removal of all associated underground electrical and communications cabling connecting the wind turbines to the wind farm substation. Ducting is to remain *in-situ.*

All other elements of the Project will remain in-situ. The Site Access Roads and associated drainage systems will serve ongoing forestry and agriculture activity in the area. All other hard surfaced areas will be allowed to revegetate naturally.

The decommissioning phase would be expected to last approximately 2-3 months, and any air quality impacts would be predicted to be imperceptible.

10.2.8 Mitigation Measures and Residual Effects

10.2.8.1 Construction Phase Mitigation

The main potential impact during the construction phase of the Project will be from dust nuisance at sensitive receptors close to the Site. Good practice site procedures will be followed by the appointed contractor to prevent dirt and dust being transported onto the local road network. Good practice site control measures will comprise the following:

- Site Access Roads will be upgraded and built in the initial construction phases. These roads will be finished with graded aggregate which compacts, preventing dust.
- Approach roads and construction areas will be cleaned on a regular basis to prevent build-up of mud and prevent it from migrating around the Site and onto the public road network.
- Wheel wash facilities will be provided near the Site entrance to prevent mud/dirt being transferred from the site to the public road network.
- Public roads along the construction haul route will be inspected and cleaned daily. In the unlikely event that dirt/mud is identified on public roads, the roads will be cleaned. The wheel wash facility will be investigated, and the problem fixed to prevent this from happening again.
- During periods of dry and windy weather, there is potential for dust to become friable and cause nuisance to nearby residences and users of the local road network. This requires wetting material and ensuring water is supplied at the correct levels for the duration of the work activity. The weather will be monitored so that the need for damping down activities can be predicted. Water bowsers will be available to spray work areas (wind turbine area and grid connection route) and haul roads to suppress dust migration from the Site.
- Vehicles delivering materials to the site will be covered appropriately when transporting materials that could result in dust, e.g., crushed rock or sand.
- Exhaust emissions from vehicles operating within the site, including trucks, excavators, diesel generators or other plant equipment, will be controlled by the Contractor by ensuring that emissions from vehicles are minimised through regular servicing of machinery.
- All machinery when not in use will be turned off.
- Ready-mix concrete will be delivered to the Site and no batching of concrete will take place on the Site. Only washing out of chutes will take place on site and this will be undertaken at a designated concrete washout facility at the contractor's compound. The concrete wash water will be disposed of at a licensed facility as outlined in the Construction Environment Management Plan (CEMP) – Management Plan 5 Waste Management Plan (**Appendix 2.1**)

- Speed restrictions of 15 km/h on access roads will be implemented to reduce the likelihood of dust becoming airborne. Consideration will be given to how on-site speed limits are policed by the Contractor and referred to in the toolbox talks.
- Stockpiling of materials will be carried out in such a way as to minimise their exposure to wind. Stockpiles will be covered with geotextiles layering and damping down will be carried out when weather conditions require it.
- Earthworks and exposed areas/soil stockpiles will be re-vegetated to stabilise surfaces as soon as practicable.
- An independent, qualified Geotechnical Engineer will be contracted for the detailed design stage of the project and geotechnical services and will be retained throughout the construction phase, including monitoring and supervision of construction activities on a regular basis. The methodology statement will be signed off by a suitably qualified Geotechnical Engineer.
- A complaints procedure will be implemented on site where complaints will be reported, logged and appropriate action taken.

10.2.8.2 Operational Phase Mitigation

As the operation of the proposed wind farm will have positive impacts on air quality, mitigation measures are considered unnecessary. Where turbine components are being replaced the same mitigation measures as per the construction phase will apply.

10.2.8.3 Decommissioning Phase Mitigation

Mitigation measures during the decommissioning phase will be similar to those employed during the construction phase as outlined above.

10.2.9 Cumulative Effects

In terms of cumulative impacts, negative cumulative impacts in relation to air quality would only occur if a large development was located in the vicinity of the Site and in the process of construction at the same time as the Project. The developments considered as part of the cumulative effect assessment are described in **Appendix 2.3** and **Appendix 2.4**. There are a number of existing, consented and proposed wind energy developments within 20 kilometres of the Site as listed in **Appendix 2.3**.

In a worst-case scenario cumulative air impacts may arise if the construction, operational and maintenance period and decommissioning of any of the projects listed in **Appendix 2.3** occur simultaneously with the construction of the Project. The existing and consented wind energy developments within 20 kilometres of the Site as listed in **Appendix 2.3** have been considered for cumulative air quality effects. Only those wind energy developments that would be under construction at the same time as the Project are relevant in the context of cumulative effect.

The consented (not yet built) and the proposed wind energy developments within 20 kilometres of the Site:

- Coolea (consented);
- Coolknoohil Inchee (consented);
- Cummeennabuddoge (proposed);
- Dereenacrinnig (consented);
- Gneeves Milstreet (consented);
- Gortnakilla, Clonkeen Killarney (consented);
- Gortyrahilly (proposed); and
- Knocknamork (consented).

These wind energy developments range from 1.9 km to 14.9 km distance from the Development. Given the distances from the Site, they are not in the direct vicinity of the Development. Even if construction of these wind energy developments was to take place at the same time as construction of the Project, given the distances from the Site, there would not be any cumulative air quality effects.

During the operational phase emissions of carbon dioxide (CO_2), nitrogen oxides (NO_x), and sulphur dioxide (SO_2) or dust emissions from the Development and other projects listed in **Appendix 2.3**, will result from the operation and maintenance vehicles onsite. However, these emissions will be minimal. Therefore, there will be a long-term imperceptible negative cumulative impact on air quality and climate.

Cumulative impacts during the decommissioning phase will be similar to the construction phase although slightly less as a result of the reduced works required during the decommissioning phase as some infrastructure will be left in-situ e.g., Turbine Foundations and the Site Access Roads.

The nature of the Project and other energy developments within 20 kilometres are such that, once operational, they will have a cumulative long-term, significant, positive effect on the air quality.

10.2.10 Residual Impacts of the Project

The use of plant and machinery during the construction phase is not likely to have a significant impact on air quality in the area, both in terms of dust generation and exhaust emissions. Overall, with mitigation in place this impact is assessed as slight/imperceptible, negative, direct and temporary/short-term in nature.

During the operational phase of the Project exhaust emissions will arise from occasional machinery use and Light-Good Vehicles (LGV) that will be required for occasional onsite maintenance works. The impact will be a Long-term imperceptible negative.

However, the wind energy created by the Project will avoid the production of electricity from coal, oil or gas-fired power stations resulting in emission savings of carbon dioxide (CO_2), nitrogen oxides (NO_x), and sulphur dioxide (SO_2). This will lead to a Long-term Significant Positive Impact on air quality.

The decommissioning phase impacts and consequential effects will be similar to the construction stage, albeit of less impact as the works required will be less as described in **Chapter 2: Project Description**. For example, the turbine foundations will remain in-situ and will be covered with earth and reseeded as appropriate. The substation building will also be left in-situ. This means there will be no additional excavation works required for the decommissioning of the turbine foundations and the substation and there will be no additional truck movements that would be required for the demolition and removal of these pieces of infrastructure. The mitigation measures outlined for the construction phase of the Project will be implemented during the decommissioning phase thereby minimising any potential impacts.

10.2.11 Summary of Significant Effects

This assessment has identified no potentially significant effects, given the mitigation measures embedded in the design which will be implemented in the Project.

10.2.12 Statement of Significance

The Project has been assessed as having no significant direct or indirect effects on air quality during the construction, operation or decommissioning phases of the Project.

10.3 CLIMATE AND GREENHOUSE GASES

Greenhouse gases, if released in excessive amounts, can lead to increases in global temperatures known as 'global warming' or the 'greenhouse effect' which can influence the climate.

There are a wide range of gases known as greenhouse gases. The most critical greenhouse gases are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). There are also other greenhouse gases known as F-Gases, man-made gases used in refrigeration and air conditioning appliances. Greenhouse gases produced by human activities are changing the composition of the earth's atmosphere. Human activities that produce greenhouse gases include:

- Carbon dioxide emissions through burning fossil fuels such as coal, oil and gas and peat
- Methane and nitrous oxide emissions from agriculture
- Emissions through land use changes such as deforestation, reforestation, urbanization, desertification

Current projections indicate that continued emissions of greenhouse gases, including the burning of fossil fuel to produce electricity, will cause further warming and changes to our climate. Climate is predicted to have indirect and direct impacts on Ireland including:

- Rising sea-levels threatening habitable land and particularly coastal infrastructure;
- Extreme weather, including more intense storms and rainfall affecting our land, coastline and seas;
- Further pressure on our water resources and food production systems with associated impacts on fluvial and coastal ecosystems;
- Increased chance and scale of river and coastal flooding;
- Greater political and security instability;
- Displacement of population and climate refugees;
- Heightened risk of the arrival of new pests and diseases;
- Poorer water quality, and
- Changes in the distribution and time of lifecycle events of plant and animal species on land and in the oceans[9]

Climate change means a significant change in the measures of climate, such as temperature, rainfall, or wind, lasting for an extended period – decades or longer. Earth's climate has changed naturally many times during the planet's existence. However, currently

[9] Climate Action Plan 2019 – To Tackle Climate Breakdown, Department of Environment, Climate and Communications, https://www.gov.ie/en/publication/ccb2e0-the-climate-action-plan-2019/, [Accessed 14/11/2022]

human activities are significantly contributing to climate change through greenhouse gas emissions. The global average temperatures have now increased by more than 1°C since pre-industrial times.

At the Paris climate conference (COP21) in 2015, 195 countries adopted the first-ever universal, legally binding global climate deal. The agreement sets out a global action plan to put the world on track to avoid dangerous climate change by limiting global warming to below 2°C above pre-industrial levels and to limit the increase to 1.5°C. Under the agreement, Governments also agreed on the need for global emissions to peak as soon as possible, recognising that this will take longer for developing countries and to undertake rapid reductions thereafter in accordance with the best available science.

The Glasgow Climate Pact (COP26) of 2021 aims to limit the rise in global temperature to 1.5°C and finalise the outstanding elements of the Paris Agreement. The Glasgow Climate Pact is manifested across three United Nations climate treaties, including the United Nations Framework Convention on Climate Change (the COP), the Kyoto Protocol (the CMP), and the Paris Agreement (the CMA).

The United Nations Climate Change Conference (COP27) held in November 2022 resulted in countries delivering a package of decisions that reaffirmed their commitment to limit global temperature rise to 1.5°C above pre-industrial levels. The package also strengthened action by countries to cut greenhouse gas emissions and adapt to the inevitable impacts of climate change, as well as boosting the support of finance, technology and capacity building needed by developing countries. Governments took the ground-breaking decision to establish new funding arrangements, as well as a dedicated fund, to assist developing countries in responding to loss and damage.

The Climate Action Plan 2021 as set out by the Department of the Environment, Climate and Communications provides a detailed plan for Ireland. It plans for taking decisive action to achieve a 51% reduction in overall greenhouse gas emissions by 2030 and setting us on a path to reach net-zero emissions by no later than 2050, as committed to in the Programme for Government and set out in the Climate Act 2021. This Plan makes Ireland one of the most ambitious countries in the world on climate.

The provision of the Project will have a long-term positive impact by providing a sustainable energy source. Should the Project not proceed, fossil fuel power stations will be the primary alternative to provide the required quantities of electricity. This will further contribute to greenhouse gas and other emissions. It will also hinder Ireland in its commitment to meet its target to increase electricity production from renewable sources and to reduce greenhouse gas emissions as agreed at the Paris climate conference (COP21) in 2015 and Glasgow Climate Pact (COP26) in November 2021.

10.3.1 Relevant Legislation and Guidance

Greenhouse gases are the subject of international agreements, such as the United Nations Framework Convention on Climate Change, Kyoto Protocol and the Paris Agreement. The Glasgow Climate Pact is manifested across these three United Nations climate treaties. These agreements along with International and National Policy and Legislation are discussed in the **Planning Statement**. This section will examine the Carbon losses and savings from this Project and its impact on the Climate.

10.3.2 Assessment Methodology

This assessment of climate involved the following:

- A desk study of the climate baseline in the area of the Project and nationally;
- Evaluation of potential effects;
- Evaluation of the significance of effects, and
- Identification of measures to avoid and mitigate potential effects.

10.3.3 Existing Climate

The Köppen climate classification divides regions of the globe based on seasonal precipitation and temperature patterns. The five main groups are tropical, dry, temperate, continental, and polar. The Irish climate is defined as a temperate oceanic climate on the Köppen climate classification system[10]. Ireland’s climate is mild, moist and changeable with abundant rainfall and a lack of temperature extremes. The country generally receives cool summers and mild winters and it is considerably warmer than other areas on the same latitude. Ireland’s land mass is warmed by the North Atlantic Current all year and as a result does not experience a great annual range of air temperatures.

Nationally, the mean air temperature is generally between 9 and 11 °C. Annual rainfall totals on the west coast generally average between 1,000 mm and 1,400 mm with the wettest months being December and January and April being the driest month. The prevailing wind direction is between south and west. Average wind speed ranges from 3 m/s in south Leinster to 8 m/s in the extreme north of the country.

[10] https://www.britannica.com/science/Koppen-climate-classification/World-distribution-of-major-climatic-types, [Accessed 14/11/2022]

For the purpose of the assessment of changes to the climate, meteorological data from the nearest meteorological station to the Project, Cork Airport monitoring station, over a period of 1991-2021 is shown in **Table 10.3**. Cork Airport is located 51 km south-east of the Project and is the closest Met Éireann climate station.

The mean annual air temperature as shown in **Table 10.3** between 1991 and 2021 was 9.975°C. Mean monthly temperatures ranged from 5.8°C in January to 15.2°C in July. Mean annual rainfall over this period was 1240.7 mm, with a maximum monthly mean rainfall of 136.3 mm in December and a minimum monthly mean rainfall of 82 mm in June[11].

[11] https://www.met.ie/climate/30-year-averages, [Accessed 14/11/2022]

Table 10.3: Cork Airport Meteorological Station Data Averages (1991- 2021)

Month	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Maximum Temperature (°C)	Mean Minimum Temperature (°C)	Precipitation Amount (mm)	Grass Minimum Temperature (°C)	Mean Wind Speed (knot)	Highest Gust (knot)	Sunshine Duration (hours)
January	5.8	12.2	-1.8	8.3	3.2	130.4	-6.1	10.9	53.9	62.0
February	5.9	12.3	-1.5	8.6	3.1	103.1	-5.7	11.0	51.0	73.9
March	6.9	14.2	-1.1	9.9	3.8	91.1	-5.3	10.5	49.3	109.3
April	8.5	16.6	0.3	12.0	5.1	84.4	-4.3	9.8	45.3	162.0
May	10.9	20.1	2.8	14.5	7.3	83.3	-1.3	9.4	41.1	191.2
June	13.5	22.0	6.0	17.1	9.9	82.0	1.7	8.9	37.6	184.0
July	15.2	22.9	8.0	18.7	11.6	85.5	3.9	8.5	35.7	165.0
August	15.0	22.5	7.9	18.5	11.5	95.2	3.6	8.5	37.8	158.6
September	13.3	20.6	5.9	16.6	10.1	90.7	1.3	8.8	40.0	127.5
October	10.6	16.9	2.9	13.5	7.7	134.3	-1.4	9.7	48.8	99.1
November	7.8	14.1	0.3	10.4	5.2	124.4	-3.8	10.1	48.9	75.1
December	6.3	12.4	-0.9	8.7	3.9	136.3	-4.7	10.9	52.6	54.4

10.3.4 Calculating Carbon Losses and Savings

10.3.4.1 Carbon Calculator

To assess the impact of the Project on the climate, the carbon emitted or saved as a result of the Project was determined using a carbon calculator. The Scottish Government have produced an online carbon calculator which aims to assess, in a comprehensive and consistent way, the carbon impact of wind farm developments. This is done by comparing the carbon costs of wind farm developments with the carbon savings attributable to the wind farm. The carbon calculation takes into account the carbon released from a number of sources during the construction, operational and decommissioning stages. These include the effects of drainage works on peat soils, forestry felling, losses associated with harvesting and transport of felled trees, changes in land use and wind turbine manufacture, transportation and construction. Also included in the assessment tool is the assessment of peat disturbance. The Scottish calculator is used as no carbon calculator specific to Ireland has been developed and the peat habitat of Scotland is similar to Ireland.

Assessments are also carried out to estimate the carbon saving over the lifetime of the wind farm, compared to electricity produced using fossil fuel. The assessment of carbon savings relates to the capacity of the wind farm over the number of years for which it is operational, site improvement works, (i.e., peatland improvement, habitat creation, etc.), forestry felling, and site restoration works, (i.e., removal of infrastructure and restoration of previous site conditions), when the wind farm will be decommissioned.

The completed worksheet, including the assumptions used in the model, is provided in **Appendix 10.1** of this EIAR. The model calculates the total carbon emissions associated with the Project including manufacturing of the turbine technology, transport, construction of the Project and tree felling. The model, which is assessed for both the lower range (5.6 MW) and the higher range (6.6 MW) of turbine, accounts for improvement works (see **Appendix 5.5 Habitat Enhancement Plan**) and the years taken for the site to return to its original characteristics but does not factor in the potential re-use of turbine components. All metal components can be recycled, while there is limited potential for the recycling/reuse of the fibreglass blades.

The model also calculates the carbon savings associated with the Project against three comparators:

i. Coal fired Electricity Generation;
ii. Grid mix of Electricity Generation, and

iii. Fossil fuel mix of Electricity Generation (oil, gas and coal)[12].

This is to compare this renewable source of electricity generation to traditional methods of electricity generation to assess the carbon savings and losses.

10.3.4.2 Carbon Losses

The potential carbon losses were assessed for the Project.

The main CO_2 losses due to the Project are summarised in **Table 10.4**. A copy of the input and output data is provided in the completed worksheet in **Appendix 10.1**.

Table 10.4: Carbon Losses

Origin of Losses	Total CO_2 Losses (tonnes CO_2 equivalent)	
	Lower Range Output	Higher Range Output
Turbine manufacture, construction and decommissioning	25,341	30,013
Losses due to Backup	18,543	21,854
Losses due to reduced carbon fixing potential	731	731
Losses from soil organic matter	14,691	14,691
Losses due to Dissolved Organic Carbon (DOC) and Particulate Organic Carbon (POC) leaching	2,216	2,216
Felling of Forestry	11,074	11,074
Total Expected Losses	72,597	80,580

The worksheet model calculated that the Project is expected to give rise to 72,597 tonnes of CO_2 equivalent losses at the lower range (5.6 MW) and 80,580 tonnes of CO_2 equivalent losses at the higher range (6.6 MW) over its 35-year life. Of this total figure, the proposed wind turbines directly account for tonnes, or 35% at the lower range and tonnes, or 37% at the higher range. Losses due to backup account for 18,543 tonnes, or 25% at the lower range and 21,854 tonnes or 27% at the higher range.

[12] Ireland's energy imports comprise oil (56%), gas (31%) and coal (10%). http://ireland2050.ie/present/oil-and-gas/?q=where-does-ireland-get-its-electricity#:~:text=Ireland%20has%20only%20small%20proven,%25)%20and%20coal%20(10%25, [Accessed 14/11/22]

Losses from soil organic matter, reduced carbon fixing potential, DOC and POC leaching and the felling of forestry accounting for the remaining 39% or 28,712 tonnes at the lower range and 36% or 28,712 tonnes at the higher range. The figure tonnes of CO_2 arising from ground activities associated with the Project is calculated based on the entire Project footprint being "Acid Bog", as this is one of only two choices, the other being Fen. The habitat that will be impacted by the Project footprint comprises predominantly agricultural land and commercial forestry rather than the acid bog assumed by the model that gives rise to the tonnes (lower and higher range) and therefore the actual CO_2 losses are expected to be lower than this value.

The figures discussed above are based on the assumption that the hydrology of the Site and habitats within the site are not restored on decommissioning after its expected 35-year useful life. However, at the end of the 35-year lifespan of the Project, the turbines may be replaced with newer models subject to a consent for the same being obtained. This would mean the carbon losses associated with not restoring the habitats hydrology at the Site would be offset by the carbon-neutral energy that the new turbines would generate.

10.3.4.3 Carbon Savings

The carbon calculator assessed the carbon savings of the Project for habitat improvement works as 5,709 tonnes of CO_2 per year at the higher and lower range. However, the carbon calculator is pre-loaded with information specific to the CO_2 emissions from the United Kingdom's electricity generation plant, which is used to calculate emissions savings from proposed wind farm projects in the UK and similar data was not available for the Irish electricity generation plant. Therefore, these CO_2 emissions savings from the Project were calculated separately from the worksheet.

According to the model described above, the Project will give rise to total losses of 72,597 tonnes (lower range) or 80,580 tonnes (higher range) of carbon dioxide.

A simple formula is used to calculate carbon dioxide emissions reductions resulting from the generation of electricity from wind power rather than from carbon-based fuels such as peat, coal, gas and oil.

The formula is:

$$CO_2 \text{ (in tonnes)} = \frac{(A \times B \times C \times D)}{1000}$$

where:

A = The maximum capacity of the wind energy development in MW

B = The capacity or load factor, which takes into account the availability of wind turbines and array losses etc.

C = The number of hours in a year

D = Carbon load in grams per kWh (kilowatt hour) of electricity generated and distributed via the national grid.

For the purposes of this calculation, the rated capacity of the Project is assumed to be approximately 28 MW at the lower range and 33 MW at the higher range. A load factor of 0.35 (or 35%) has been used for the Project.

There has been a strong reduction in the CO_2 emissions intensity of electricity generation, especially after 2016, with intensity falling below 300 g CO_2/kWh for the first time in 2020. It is now less than a third of its 1990 value[13]. These falls are due to increased use of higher-efficiency gas turbines, increased electricity generated from zero-carbon renewable sources, especially wind. The most recent data for the carbon load of electricity generated in Ireland is for 2021 and was published in Sustainable Energy Authority Ireland's (SEAI) December 2022 report, Energy in Ireland. The emission factor for electricity in Ireland in 2021 was 348 g CO_2/kWh. The number of hours in a year is 8,760.

[13] Energy-Related CO_2 Emissions in Ireland 2020 Companion Note to 2020 National Energy Balance October 2021, Sustainable Energy Authority of Ireland
Online: https://www.seai.ie/publications/Energy-CO2-emissions-2020-Short-Note-FINAL.pdf [Accessed 14/11/2022]

The calculation for carbon savings at the lower range and higher range are therefore as follows:

$$CO_2 \text{ (in tonnes)} = \frac{(28 \times 0.35 \times 8{,}760 \times 348)}{1000}$$

= 29,875 tonnes per annum at the lower range

$$CO_2 \text{ (in tonnes)} = \frac{(33 \times 0.35 \times 8{,}760 \times 348)}{1000}$$

= 35,210 tonnes per annum at the higher range

Based on this calculation, approximately 29,875 (lower range) or 35,210 (higher range) tonnes of carbon dioxide will be displaced per annum from the largely carbon-based traditional energy mix by the Development.

Therefore, including the carbon savings for the habitat improvements works 5,709 tonnes (lower range) and 5,709 tonnes (higher range) it is estimated that 1,051,334 tonnes (lower range) or 1,238,059 tonnes (higher range) of carbon dioxide will be displaced over the proposed 35 year lifetime of the wind farm.

The Scottish Government carbon calculator as presented above calculated 72,597 (lower range) and 80,580 (higher range) tonnes of CO_2 will be lost to the atmosphere due to changes in the peat environment and due to the construction and operation of the Project. This represents 7% (lower range) and 7% (higher range) of the total amount of carbon dioxide emissions that will be offset by the Project. The 72,597 (lower range) and 80,580 (higher range) tonnes of CO_2 that will be lost to the atmosphere due to changes in the peat environment and due to the construction and operation of the Project will be offset by the Project in approximately 29 months of operation at the lower range and 27 months of operation at the higher range.

10.3.5 Do Nothing Impact

If the Project was not to proceed, greenhouse gas emissions, e.g., carbon dioxide, carbon monoxide and nitrogen oxides associated with construction and decommissioning works would not arise. However, the greenhouse gas savings that would arise from the operation of the Project would also be lost leading to a long-term, moderate, negative impact.

10.3.6 Potential Impacts of the Project

10.3.6.1 Construction Phase

Greenhouse gas emissions, e.g., carbon dioxide (CO_2), carbon monoxide (CO) and nitrogen oxides (NO_x) are associated with vehicles and plant utilised for construction activities. This potential impact will be slight, given the insignificant quantity of greenhouse gases that will be emitted, and will be restricted to the duration of the construction phase. Therefore, this is a short-term, slight, negative impact. Mitigation measures to reduce this impact are outlined in **Section 10.2.9**.

10.3.6.2 Operation Phase

The Project is a renewable energy project in that it will generate electricity from a renewable source. This energy generated will be in direct contrast to traditional energy and the associated emission of greenhouse gases from electricity-generating stations dependent on fossil fuels, thereby having a positive impact on the climate. The Project will displace carbon dioxide from fossil fuel-based electricity generation, over the proposed 35-year lifespan of the Project. The Project will assist in reducing carbon dioxide (CO_2) emissions (30,038 tonnes per annum at the lower range or 35,373 tonnes per annum at the higher range) that would otherwise arise if the same energy that the Project will generate were otherwise to be generated by conventional fossil fuel plants. This is a long-term, moderate, positive effect on the climate.

10.3.6.3 Decommissioning Phase

Any impacts that occur during the decommissioning phase are similar to that which occur during the construction phase. The mitigation measures prescribed for the construction phase of the Project will be implemented during the decommissioning phase thereby minimising any potential impacts.

10.3.7 Mitigation Measures

It is considered that the Project will have an overall positive impact in terms of carbon reduction and climate.

The Project will assist Ireland in meeting a 51% reduction in overall greenhouse gas emissions by 2030. Also, it will aid in increasing the onshore wind capacity, as per the Climate Action Plan 2023 (CAP2023). The CAP 2023 commits Ireland to installing up to 9 GW of onshore wind capacity by 2030, in order to support the reduction in Ireland's greenhouse gas emissions.

10.3.7.1 Construction Phase

All construction vehicles and plant will be maintained in good operational order while onsite, thereby minimising any emissions that arise.

10.3.7.2 Operation Phase

The operation phase of the Project will have a positive impact on the climate due to the displacement of fossil fuels and therefore no mitigation is necessary for this phase.

10.3.7.3 Decommissioning Phase

Mitigation measures during the decommissioning phase will be similar to those employed during the construction phase as outlined above.

10.3.8 Cumulative Effects

Potential cumulative effects on the climate between the Project and other developments in the vicinity were also considered as part of this assessment. The other developments considered as part of the cumulative effects assessment are described in **Appendix 2.4**.

During the construction phase of the Project and other developments within 20 kilometres of the proposed turbines that are yet to be constructed, there will be minor exhaust emissions from construction plant and machinery and dust emissions from construction activities. In a worst-case scenario if any of these developments were constructed at the same time as this Project there will be short-term slight negative cumulative impact on climate due to exhaust and dust emissions.

The nature of the Project is such that, once operational, it will have a long-term, moderate, positive impact on the air climate. It is considered that the cumulative impact will be positive in terms of carbon reduction and the climate also.

During the operational phase emissions of carbon dioxide (CO_2), nitrogen oxides (NO_x), and sulphur dioxide (SO_2) or dust emissions from the Project and other projects listed in **Appendix 2.2** and **Appendix 2.4**, will result from the operation and maintenance vehicles onsite. However, these emissions will be minimal. Therefore, there will be a long-term imperceptible negative cumulative impact on the climate.

Cumulative impacts during the decommissioning phase will be similar to the construction phase although slightly less as a result of the reduced works required during the decommissioning phase as some infrastructure will be left in-situ e.g., turbine foundations and the site roads.

The nature of the Project and other energy developments within 20 kilometres are such that, once operational, they will have a cumulative long-term, significant, positive effect on climate.

10.3.9 Residual Impacts of the Project

10.3.9.1 Construction Phase

There will be a short-term imperceptible negative impact on Climate as a result of greenhouse gas emissions.

10.3.9.2 Operational Phase

There will be a long-term, moderate, positive impact on Climate as a result of reduced greenhouse gas emissions.

10.3.9.3 Decommissioning Phase

Any impacts and consequential effects that occur during the decommissioning phase are similar to that which occur during the construction phase, albeit of less impact. For example, turbine foundations and site roads will be left in-situ. No forest felling will take place during the decommissioning phase.

10.3.10 Summary of Significant Effects

This assessment has identified no potential significant effects, given the mitigation measures embedded in the design and recommended for the implementation of the Project.

10.3.11 Statement of Significance

It is estimated that 1,051,334 tonnes (lower range) or 1,238,059 tonnes (higher range) of carbon dioxide will be displaced over the proposed 35-year lifetime of the wind farm. The Project has been assessed as having the potential to result in a short-term imperceptible, negative impact on Climate during construction. There will be long-term moderate, positive impact on Climate as a result of reduced greenhouse gas emission during the operational phase.

Potential cumulative impact of the Project with other energy developments including wind and solar within 20 kilometres on climate was assessed as having a long-term, significant, positive impact on the Climate.

11 NOISE AND VIBRATION

11.1 INTRODUCTION

This chapter of the EIAR assesses the effects of the Project in terms of noise and vibration impacts. The Project refers to all elements of the Development, the Grid Connection Route and the Turbine Delivery Route (see **Chapter 2: Project Description**).

The assessment will consider the potential effects during the following phases of the Development:

- Construction of the Project;
- Operation of the Project, and
- Decommissioning of the Project.

Any effects arising as a result of the future decommissioning of the Project, are considered to be no greater than the effects arising during construction.

Common acronyms used throughout this EIAR can be found in **Appendix 1.2**. This chapter of the EIAR is supported by the **Figures 1, 2 and 3** in **Volume III** and the following Appendices documents provided in Volume IV of this EIAR:

- **Appendix 11.1**: Photos of noise monitors in-situ
- **Appendix 11.2**: Methodology for calculating wind shear from different hub heights, calculating to hub height and standardising to 10 m height wind speed
- **Appendix 11.3**: Calibration certificates of noise instruments
- **Appendix 11.4**: Candidate turbine manufacturer's noise emission data
- **Appendix 11.5**: Predicted noise levels for 102.5 m hub height

11.1.1 Statement of Authority

This section of the EIAR has been prepared by Brendan O'Reilly of Noise and Vibration Consultants Ltd and Shane Carr of Irwin Carr Ltd. Brendan has a Master's degree in noise and vibration from Liverpool University and over 40 years' experience in noise and vibration control (including many years' experience in preparation of noise impact statements) and has been a member of a number of professional organisations including the SFA, ISEE and IMQS. Brendan was an associate consultant in the EPA, 2003 'Environmental Quality Objectives, Noise in Quiet Areas'. Brendan has considerable experience in the assessment of noise impact and has compiled studies for more than 100 wind farm developments. Brendan carried out the baseline study and contributed to the report.

Irwin Carr Consulting is based in Northern Ireland. The company has a proven track record in noise impact assessments throughout the UK and Ireland, with extensive knowledge of the issues in relation to noise from wind energy developments.

Shane Carr carried out the noise modelling in this assessment and contributed to the report. Shane is a Director in Irwin Carr Consulting, primarily responsible for environmental noise and noise modelling. He has over 25 years' experience working in both the public and private sectors having previously obtained a BSc (Hons) Degree in Environmental Health and a Post-Graduate Diploma in Acoustics. Shane has been responsible for undertaking and reviewing noise impact assessments on numerous large scale wind farms throughout the UK and Ireland.

11.1.2 Assessment Structure

This Chapter contains the following sections:

- Assessment Methodology and Significance Criteria – a description of the methods used in the baseline surveys and in the assessment of the significance of effects.
- Baseline Description - a description of the noise baseline of the receiving environment based on the results of surveys, desk information and consultations, and a summary of any information required for the assessment that could not be obtained.
- Assessment of Potential Effects - identifying the ways in which noise receptors could be affected by the Project, including a summary of the measures taken during design to minimise noise and vibration effects.
- Mitigation Measures and Residual Effects - a description of measures recommended to off-set potential negative effects and a summary of the significance of the effects of the project after mitigation measures have been implemented.
- Cumulative Effects – identifying the potential for effects of the EIA Development to combine with those from other wind farm developments.
- Summary of Significant Effects.
- Statement of Significance.

11.1.3 Acoustic Terminology

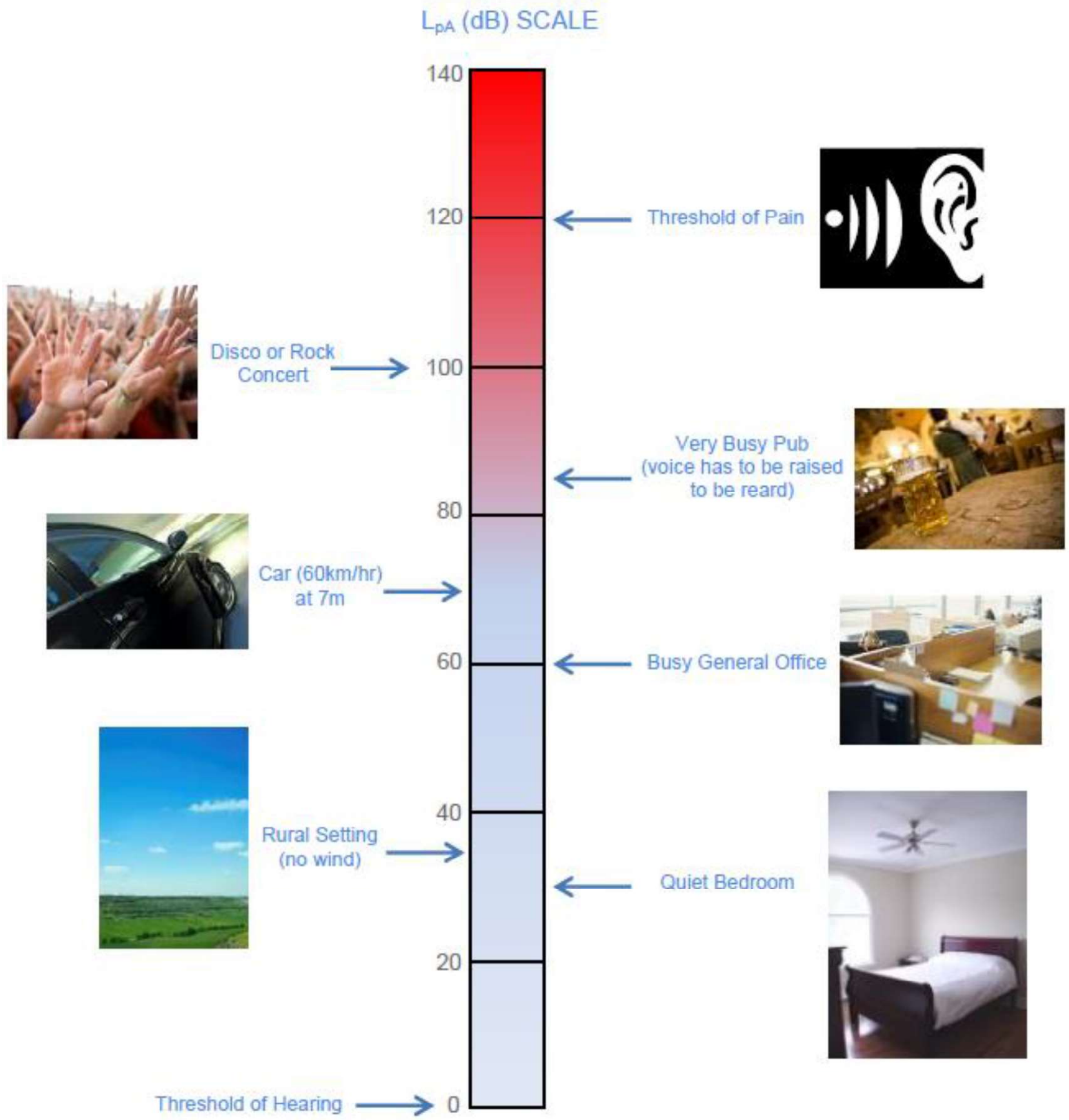
Sound is simply the pressure oscillations that reach our ears. These are characterised by their amplitude, measured in decibels (dB), and their frequency, measured in Hertz (Hz). Noise is unwanted or undesirable sound, it does not accumulate in the environment, is transitory, fluctuates, and is normally localised. Environmental noise is normally assessed in terms of A-weighted decibels, dB (A), when the 'A weighted' filter in the measuring device elicits a response which provides a good correlation with the human ear. The criteria for environmental noise control are of annoyance or nuisance rather than damage. In general, a noise level is liable to provoke a complaint whenever its level exceeds by a certain margin, the pre-existing noise level or when it attains an absolute level. A change in noise level of 3 dB (A) is 'barely perceptible', while an increase in noise level of 10 dB (A) is perceived as a twofold increase in loudness. A noise level in excess of 85 dB (A) gives a significant risk of hearing damage. Construction and industrial noise sources are normally assessed and expressed using equivalent continuous levels, LAeq[1]. Wind turbine source noise is generally expressed in Leq dBA in sound power levels (L_{WA} dB).

Sound Power Level (L_{WA} dB) is a measure of the acoustic energy emitted from a source of noise, expressed in decibels. Sound power level refers to the source and sound pressure level is measured by a sound level meter at a distance from a source. Sound power is distance independent, whereas sound pressure is the distance-dependent effect.

Operational wind turbine noise is assessed using the LA90[2] descriptor, which allows reliable measurements to be made without corruption from relatively loud transitory noise events from other sources. The LA90 should be used for assessing both the wind energy development noise and background noise as stated in the Wind Energy Development Guidelines, Guidelines for Planning Authorities June 2006. As discussed in ETSU-R-97[3] the LA90 is 1.5-2.5dBA less than the LAeq measured over the same period. In this assessment, the difference between LAeq and LA90 is assumed to be 2dBA, which is the value most commonly applied in wind farm assessments and is accepted under best practice guidelines (Section 11.4). Wind turbine noise levels are given as sound power levels (LWA) in dB at integer wind speeds up to maximum LWA levels which is no more than 10 m/s wind speed at 10 m height. The EPA gives a dBA scale and indicative noise levels, (EPA 2016[4]). The L_{PA} (dB) scale denotes sound pressure level in dBA. **Table 11.1** gives L_{PA} (dB) scale and indicative noise levels.

[1] L_{Aeq} is defined as being the A-weighted equivalent continuous steady sound level that has the same sound energy as the real fluctuating sound during the sample period and effectively represents a type of average value.
[2] LA90, or L90dBA is defined as the noise level equaled or exceeded for 90% of the measurement interval and with wind farm noise the interval used is 10 minutes.
[3] ETSU-R-97, The Assessment & Rating of Noise from Wind Farms, June 1996
[4] EPA Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)

Table 11.1: L_{PA} (dB) scale and indicative noise levels



11.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

11.2.1 Assessment Methodology

This assessment has involved the following elements, further details of which are provided in the following sections:

- Legislation and guidance review
- Desk study, including review of available maps and published information
- Field work;
- Description of effects for construction, operation and decommissioning phases;

11.3 DESCRIPTION OF EFFECTS

The significance of effects of the Project is described in accordance with the EPA guidance document '*Guidelines on the information to be contained in the Environmental Impact Assessment Reports (EIAR), EPA May 2022*'. The details of the methodology for describing the significance of effects are provided in Table 3.4: Section 3.7.3 of the EPA 2022 document.

11.4 RELEVANT LEGISLATION AND GUIDANCE REVIEW

The noise assessment is carried out in accordance with the guidance and consideration of the following documents, with references given where relevant in the various Sections of the report:

- Wind Energy Development Guidelines[5] (the 2006 Guidelines);
- ETSU-R-97[6]: The Assessment & Rating of Noise from Wind Farms (ETSU-R-97);
- The Institute of Acoustics (IOA) Good Practice Guide (GPG) to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise including Supplementary Guidance Note 4: Wind Shear'[7] (the IOA GPG);
- ISO 1996[8]Acoustics-Description and Measurement of Environmental Noise - Part 1: Basic Quantities and Procedures (ISO 1996);
- WHO 2018 Environmental Noise Guidelines for European Region (WHO 2018).
- Draft Revised Wind Energy Development Guidelines December 2019 (DRWEDG, 2019);
- National Roads Authority (NRA) Guidelines for Treatment of Noise and Vibration in National Road Schemes, 2004.

A discussion on interrelationship between the Wind Energy Development Guidelines 2006, the WHO 2018 document and the Draft Revised Wind Energy Development Guidelines December 2019, is provided below.

11.4.1 Wind Energy Development Guidelines 2006

The following are a number of key extracts from the 2006 Guidelines in relation to noise impact:

[5] Department of Environment, Heritage and Local Government: Wind Energy Development Guidelines, Guidelines for Planning Authorities 2006 Energy
[6] ETSU-R-97: Acoustics-The Assessment & Rating of Noise from Wind Farms: ETSU for the DTI, UK, 1996
[7] Institute of Acoustics (2013) A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise
[8] ISO 1996/1- Acoustics-Description and Measurement of Environmental Noise - Part 1: Basic Quantities and Procedures

General Noise Impact

"*Noise impact should be assessed by reference to the nature and character of noise sensitive locations*."

"*Separate noise limits should apply for day-time and for night-time*"

"Noise limits should be applied to external locations and should reflect the variation in both turbine source noise and background noise with wind speed."

Measurement Units

"The descriptor [LA90 10min] which allows reliable measurements to be made without corruption from relatively loud transitory noise events from other sources, should be used for assessing both wind energy development noise and background noise."

Specific Noise Limits

"Noise limits should be applied to external locations and should reflect the variation in both turbine source noise and background noise with wind speed."

"In general, a lower fixed limit of 45 dB(A) or a maximum increase of 5 dB(A) above background noise at nearby noise sensitive locations is considered appropriate to provide protection to wind energy development neighbours.

However, in very quiet areas, the use of the margin of 5 dB(A) above the background noise at nearby noise sensitive properties is not necessary to offer a reasonable degree of protection and may unduly restrict wind energy developments. Instead in low noise environments where background noise is less than 30 dB(A), it is recommended that the daytime level of LA90,10min of the wind energy development noise should be limited to an absolute level within the range 35-40 dB(A)".

"During the night the protection of external amenity becomes less important and the emphasis should be on preventing sleep disturbance. A fixed limit of 43 dB(A) L90,10min which will protect sleep inside properties during the night"

The 2006 Guidelines do not specify daytime or night-time hours. However, it is considered good practice to follow the framework given in ETSU-R-97 and IOA Good Practice Guide where daytime and night-time hours are specified. The limits are based on the prevailing background noise level for 'quiet daytime' periods, defined in ETSU-R-97 as:

- Quiet waking hours or quiet day-time periods are defined as:
- All evenings from 18:00 to 23:00hrs
- Saturday afternoon from 13:00 to 18:00hrs and all-day Sunday 07:00 to 18:00hrs
- Night-time is defined as 23:00 to 07:00hrs

Recent An Bord Plenala Decision (September 2022, ABP-309306-21) has included an additional limit of *40 dB(A) L90,10min for wind speeds of less than 5 m/s at 10 m height.*

11.4.2 WHO 2018

The most recent WHO 2018 Guidelines: 'Environmental Noise Guidelines for the European Region' gives a conditional recommendation requiring substantial debate with a limit of 45 dB Lden which is based on low quality evidence. This is an annual average noise level, based on wind speed and direction in the vicinity of the SiteS with no specific limits for night.

11.4.3 DRWEDG 2019

Draft Revised Wind Energy Development Guidelines December 2019 (DRWEDG 2019)
There have been a number of draft guidelines over the years with the latest one being the *Draft Revised Wind Energy Guidelines December 2019.* These guidelines are currently subjectsubject to review and are liable to change. This assessment is based on the current guidance and best practice outlined in **Section 11.4.1.**

11.5 DESKTOP STUDY

The Study Area has been defined such that the predicted noise results have been included for all the residential receptors within 2 km of the wind farm. Where the noise levels meet the relevant noise limits at the nearest locations, it will also meet the relevant noise limits at more distant residential locations. On this basis four locations for noise monitoring were selected by inspection of site maps and by identifying the nearest receptors surrounding the wind turbines. The validation of selected locations was made with a visit to the Noise Study Area. The locations selected are considered representative of the local noise environment and are as shown in **Figure 11.1**.

11.6 ACQUISITION AND ANALYSIS OF BACKGROUND NOISE DATA

The 2006 Guidelines, ETSU-R-97 and the IOA Good Practice Guide recommend the measurement and use of wind speed data, against which background noise measurements are correlated. The IOA Good Practice Guide Supplementary Guidance Note 4[9] (**Appendix 11.2**) gives the methodology to account for wind shear, calculation to hub height and to standardise 10 m height wind speed.

A wind meteorological mast centrally located within the Site during the noise survey was used for wind data measurements at hub heights of 80 m and 110 m with wind shear derived

[9] IOA, A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise- Supplementary Guidance Note 4: Wind Shear

and used to calculate the proposed hub height wind speeds of 110.5 m and 102.5 m (refer to **Appendix 11.5** for prediction using a 102.5 m hub height). The derived charts provided analysis of the baseline noise data which was carried out using the 110.5 m hub height.

For each 10-minute interval the mean wind speed was calculated to the 110.5 m hub height using a specified procedure which takes account of wind shear, with the result then standardised to 10 m height wind speed. A plot of standardised wind speed is made against background noise levels acquired in the noise survey to derive a best-fit polynomial line /curve. From this polynomial line / curve noise levels are derived for integer wind speeds between 3 and 12 m/s.

The procedures to calculate wind shear hub height wind speed and to calculate standardised 10 m height wind speed is undertaken according to the method given in the Supplementary Guidance Note 4[10].

11.7 PREDICTION OF WIND TURBINE NOISE LEVELS

The predicted noise levels are based on the methodology given in the IOA Good Practice Guide. Noise level calculations are based on ISO 9613-2[11] which provides a prediction of noise levels likely to occur under worst-case down-wind conditions.

SoundPLAN version 8.2 software package, produced by Braunstein & Berndt GmbH was used to calculate the noise level at the receptors. The propagation model calculates the predicted sound pressure levels by taking the source sound power level for each turbine in their respective octave bands and subtracting a number of attenuation factors according to the following formulae:

Predicted Octave Band Noise level = LW +D – (A_{geo} +A_{atm} +A_{gr} + A_{br} +A_{mis})

The predicted octaves from each of the turbines are summed to give the predicted noise level expressed as dBA.

No allowance has been made for the character of noise emitted by the turbines, however in general the emissions from wind turbines are broadband in nature. In the unlikely event of a turbine exhibiting clearly tonal components at any receptor, the turbine will be turned down or stopped until such tonality is ameliorated. A guarantee will be sought in the procurements

[10] IOA, A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise- Supplementary Guidance Note 4: Wind Shear

[11] ISO 9613-2 Acoustics -Attenuation of sound during propagation outdoors, Part 2: General Method of Calculation

of the turbine to be used onsite, stating that there will be no clearly tonal or impulsive components audible at any noise sensitive receptor location.

A_{geo} –Geometric Spreading

Geometric (spherical) spreading from a simple free-field point source result in attenuation over distance according to:

Lp = Lw – (20 log R + 11)

Where:

Lp = sound pressure level

Lw = sound power level

R = distance from the turbine to receiver

D – Directivity Factor

The directivity factor allows for adjustment where the sound radiated in the direction of the receptor is higher than that for which the sound power level is specified. In this case, the sound power levels are predicted as worst case propagation conditions, i.e. all receptors are assumed to be in downwind conditions.

A_{gr} - Ground Effects

Ground effect is the result of sound reflected by the ground interfering with the sound propagating directly from the turbine to receiver. The prediction of ground effects is complex and depends on the source height, receiver height, propagation height between the source and receiver and the intervening ground conditions.

Ground conditions are described according to a variable defined as G, which varies between 0 for hard ground and 1 for soft ground. Although in reality the ground is predominately porous, it has been modelled as mixed 50% hard and 50% porous corresponding to a ground absorption coefficient of 0.5. Our predictions have been carried out using a source height corresponding to the proposed height of the turbine nacelle, a receiver height of 4 m and an assumed ground factor of G=0.5 as recommended in the IOA Good Practice Guide.

A_{bar}- Barrier Attenuation

The effect of a barrier (including a natural barrier) between a noise source and receptor is that noise will be reduced according to the path difference (difference between the direct distance between source to receptor and distance between source and receptor over the barrier). The reduction is relative to the frequency spectrum of the sound and may be predicted according to the method given in ISO 9613. In practice, barriers can become less effective in downwind conditions. A barrier can be very effective when it lies within a few metres of the receptor. In the prediction model, zero attenuation is given for barrier effects, which is a worst-case scenario setting.

A_{atm} - Atmospheric Absorption

Sound emergency through the atmosphere is attenuated by conversion of sound energy to heat. This energy is dependent on the temperature and relative humidity of the air, but only weakly on ambient pressure through which the sound is travelling and is frequency dependent with increasing attenuation towards higher frequencies. The attenuation by atmospheric absorption A_{atm} in decibels during propagation through distance in metres is given by:

$A_{atm} = d \times \alpha$,

α = atmospheric absorption coefficient in dBm^{-1}

d = distance from turbine

Values of α from ISO 9613 Part 1, corresponding to a temperature of 10^0C and a relative humidity of 70% has been used for these predictions and are given in **Table 11.2** below. These values are recommended in the IOA Good Practice Guide.

Table 11.2: Frequency dependent atmospheric attenuation coefficients (dB/m)

Octave Band Centre Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Atmospheric Absorption Coefficient (dB/m)	0.0001	0.0004	0.001	0.0019	0.0037	0.0097	0.0328	0.117

A_{misc} – Miscellaneous Other Effects

ISO 9613 includes effects of propagation through foliage, industrial plants and housing as additional attenuation effects. These have not been included here and any such effects are unlikely to significantly reduce noise levels below those predicted.

The ISO 9613-2 standard calculates under downwind propagation conditions and therefore predicts the average downwind sound pressure level at each dwelling. The model assumes that the wind is directly downwind from each turbine to each dwelling. The prediction model is calculated as a worst-case scenario.

The predicted noise levels $L_{Aeq\ 10min}$ are converted to the required $L_{A90,10min}$ by subtracting 2 dBA.

11.8 AERODYNAMIC MODULATION OR AERODYNAMIC NOISE

Aerodynamic noise originates from the flow of air over, under and around the blades and is generally broadband in character. It is directly linked to the movement of the rotors through the air and will occur to varying degrees whenever the turbine blades move. Aerodynamic noise is generally both broadband i.e., it does not contain a distinguishable note or tone, and of random character, although the level is not constant and fluctuates in time with the movement of the blades. The dominant character of such aerodynamic noise is therefore normally a 'swish' type of sound, which is familiar to most people who have stood near to a large wind turbine.

The sound level of aerodynamic noise from wind turbine blades is not completely steady but is modulated (fluctuates) in a cycle of increased and then reduced level, sometimes called "*blade swish*", typically occurring in step with the angle of rotation of the blades and so being periodic at the rotor's rotational speed. For typical commercial turbines, this is at a rate of around once or twice per second. This phenomenon is known as Amplitude Modulation of Aerodynamic Noise or more succinctly by the acronym AM.

In early wind turbine designs, where the rotor was positioned downwind of the tower, a pronounced 'beat' was audible as each blade passed through the turbulent wake shed from the tower. However, this effect does not exist for the upwind rotor designs found on the majority of modern wind farms including the proposed wind farm where the air flow to the blades is not interrupted by the tower structure. Instead, it seems that aerodynamic modulation is due to fluctuation of the primary mechanisms of aerodynamic noise generation i.e., the blade swish mentioned above.

The Temple Group[12] undertook a review of Renewable UK's Research into Amplitude Modulation and concluded the following:

The distinction between normal AM i.e., blade swish (NAM) and other AM (OAM) is important as they are caused by different mechanisms and have separate impacts. Normal AM (NAM) is a commonly occurring typical characteristic of wind turbine noise that occurs persistently for long periods. NAM or "swish" usually disappears at around 3 to 4 rotor lengths from the turbines, except in crosswind conditions.

[12] Report for Renewable UK by Temple Group (Dani Fliumicelli). *Summary of Research into Amplitude Modulation of Aerodynamic Noise from Wind Turbines*, Wind Turbine Amplitude Modulation: *Research to Improve Understanding as to the cause and Effec*t, Dec'2013.

Based on the evidence available, it was recognised that even at those wind farm sites where OAM has been reported to be an issue, its occurrence may be relatively infrequent.

The study reports that the occurrence and intensity of OAM is dependent on a number of interacting factors that are specific to a location and it is not feasible to reliably predict the occurrence of OAM at another location simply by cross checking whether similar conditions that arise at a location where OAM has occurred might arise at the new location.

Normal Amplitude Modulation (NAM) is a fundamental component of wind turbine noise and can be heard in proximity to virtually all wind turbine installations. The 2007[13] Salford University Report found instances of "enhanced" AM which occurred at larger distances, but relatively infrequently and at only a small minority of sites. These characteristics are consistent with and can be explained by OAM.

As described previously, many risk factors have been considered for OAM. However, no single item or specific combination of items have been found to be the controlling factors whereby the occurrence, duration and intensity of OAM at a particular location can be reliably predicted in advance of a wind turbine or wind farm being installed. In the very unlikely event that OAM arises, mitigation measures will be put in place appropriate to the cause and effect of OAM.

Salford University in 2007, found that out of 133 operational wind farms investigated, 27 were associated with noise complaints, but OAM was considered to be a factor in noise complaints at only four sites and a possible factor in a further eight locations. The research has shown that OAM is a rare and unlikely occurrence at operational wind farms.

11.9 LOW FREQUENCY NOISE AND VIBRATION

There is always low frequency (or infrasound) noise present in the ambient quiet background. It is generated by natural sources such as distant road traffic, wind effects through air and vegetation, wave motion, water flow in streams and rivers. There are also low frequency emissions from many sources found in modern life, such as household appliances (e.g. washing machines, air conditioners, fridges, heating systems, extraction systems, electric or battery clocks), water flowing through pipes within the home and in water flow from municipal water supply. Vibration of elements of structures (low frequency) is generated in one's home by way of normal routine activity, like climbing stairs, closing doors, traveling in a car, etc.

[13] Research into Aerodynamic Modulation of Wind Turbine Noise. Report by University of Salford

The frequency range of audible noise is in the range of 20 to 20,000Hz and low frequency noise is generally from about 2 to 200Hz with infrasound typically of frequencies below 20Hz. There appears to be little or no agreement about the biological effects of low frequency noise on human health and there is evidence to suggest that there are no serious consequences to people's health from infrasound exposure.

A study of low frequency noise (infrasound) and vibration around a modern wind farm was carried out for ETSU and reported in ETSU W/13/00392/REP – '*Low Frequency Noise and Vibration Measurements at a Modern Wind Farm*'[14]. The results showed levels of infrasound to be below accepted thresholds of perception even on the Site. Furthermore, a document prepared for the World Health Organisation, states that *'there is no reliable evidence that infrasound below the hearing threshold produce physiological or psychological effects'.*

Significant research carried out on low frequency noise has been in the area of blasting (air overpressure) which falls into a very low frequency range (2-40Hz), although with a considerably higher magnitude – typically in a range of 110-125dB. Interestingly most microphones recording air-overpressure (low frequency sound) is linear down to 2Hz with a range that does not go below 88dB, as below that value trigger will occur by relatively low wind speeds (a gust of wind at 9 m/s equates to an air overpressure of 133dB). Wind in the natural environment, along with streams and rivers, generates elevated levels of low frequency (infrasound) yet nobody complains about these sources. Low frequency sound is generated from wind effects on vegetation close to receptors in the wind speed range that turbines operate in, yet nobody complains about wind (or rivers or streams) being the cause of sickness.

<u>South Australian Environment Protection Authority (EPA) Infrasound Study</u>

A report released in January 2013 by the South Australian EPA[15] found that the level of infrasound from wind turbines is insignificant and no different to any other sources of noise, and that the worst contributors to household infrasound are air-conditioners, traffic and noise generated by people. The study included several houses in rural and urban areas, houses both adjacent to a wind farm, away from turbines and measured the levels of infrasound with the wind farms operating and also switched off. There were no noticeable differences in the level of infrasound under all these different conditions. In fact, the lowest levels of infrasound were recorded at one of the houses closest to a wind farm, whereas the highest levels were found in an urban office building. The South Australian study found: '*the contribution of wind turbines to the measured infrasound levels is insignificant in comparison with the background level of infrasound in the environment*'.

[14] ETSU W/13/00392/REP – '*Low Frequency Noise and Vibration Measurements at a Modern Wind Farm'.*
[15] http://www.epa.sa.gov.au/environmental_info/noise/wind_farms

Massachusetts Institute of Technology (MIT)

A report by an Independent Expert Panel prepared for Massachusetts Department of Health (2012)[16] which consisted of a panel that included seven individuals with backgrounds in public health, epidemiology, toxicology, neurology and sleep medicine, neuroscience, and mechanical engineering, all considered independent experts from academic institutions. The report found that *'there is insufficient evidence that the noise from wind turbines is directly (i.e., independent from an effect on annoyance or sleep) causing health problems or disease'* and '*available evidence shows that infrasound levels near wind turbines cannot impact the vestibular system'*.

Technical Research Centre of Finland

A long-term study into so-called "wind turbine syndrome"[17] health problems supposedly caused by low-frequency sound from spinning blades has concluded that this "infrasound" has absolutely no physical impact on the human body.

The study conducted by the Technical Research Centre of Finland (VTT) and others, commissioned by the Finnish government, found that infrasound sound waves with frequencies below the range of human hearing cause no measurable changes in the human body, and cannot in any way be detected by the human ear.

Infrasound measurements were taken inside and outside local dwellings near two Finnish wind farms, as well as inside the facilities and beyond them, for 308 days.

"Infrasound samples representing the worst-case scenarios were picked out from the measurement data and used in the listening tests," said VTT.

"The participants in the listening tests were divided into two groups based on how they reported wind turbine infrasound related symptoms: people who suffered from those and people who never had symptoms.

"The participants were unable to make out infrasonic frequencies in wind turbine noise, and the presence of infrasound made no difference to how annoying the participants perceived the noise, and their autonomous nervous system did not respond to it. There were no differences between the results of the two groups". "No evidence of health effects of wind turbine infrasound was found."

[16] A Wind Turbine Health Impact Study: Report of Independent Expert Panel in January 2012 prepared for the Massachusetts Department of Environmental Protection, Massachusetts Department of Health

[17] Infrasound Does Not Explain Symptoms Related to Wind Turbines, Finnish Government, June 2020, https://www.vttresearch.com/en/news-and-ideas/vtt-studied-health-effects-infrasound-wind-turbine-noise-multidisciplinary.

11.10 FIELD WORK

Baseline noise monitoring was undertaken at four locations between 14th October and 9th November 2020. The Lidar system which monitored wind speed and direction recorded continuously between 14th October and 29th October 2020 at the same 10-minute intervals, so noise analysis was confined to this period. Noise data was recorded for a representative range of wind speeds during the period.

11.11 CONSULTATION

Consultation was initiated by the Developer's Community Liaison Officer with local residents to obtain permission to install noise monitors at four locations for baseline noise monitoring. Access to the nearest dwellings was carried out with permission from the householders and landowners.

11.12 NOISE ASSESSMENT METHODOLOGY

In summary, the assessment process comprises:

- Identification of potential receptors, i.e., houses and other potentially noise-sensitive locations;
- Measurement of existing background noise levels at representative locations close to the Site;
- Prediction of the likely noise levels of wind turbines at each receptor;
- Comparison of the predicted levels with noise limits, and
- Description of effects of construction and operation

The 38kV substation is considered. However, it is discounted from the noise assessment as the noise emissions are very low compared to the wind turbines i.e., less than 25dBA at 150 m and will have negligible impact at the nearest noise sensitive receptor H2 which is 641 m away.

Potential receptors in the area surrounding the Project were initially identified from Ordnance Survey maps, google maps, EPA maps and Site visits. Background measurements were carried out at four locations as detailed in **Table 11.12**.

The method of measuring background noise is described in ISO 1996 and ETSU-R-97. In practice, it means carrying out continuous monitoring of background noise levels at receptors for a period that includes a range of wind speeds which at minimum correspond to the maximum sound power of the candidate turbines being proposed which is usually a 2 to 4 weeks duration. The candidate turbine assessed reaches maximum sound power level at a mean wind speed of 5 m/s at 10 m height. The maximum sound power level does not increase above 5 m/s.

The method of predicting noise levels of wind turbines at receptors is discussed in **Section 11.7**. This method was applied to the calculations for both contour plots and individual receptor predictions.

There are a range of turbines that fit within the proposed Turbine RangeR (**Chapter 2: Project Description**) available on the market. The final turbine choice will be made through a commercial tender process. For EIA noise assessment purposes, a hypothetical candidate turbine, the Nordex N149 has been selected as it reflects a worst-case scenario for the technical assessment as it generates the highest sound power levels of all turbines within the proposed range being considered. This chapter comprehensively assesses all scenarios within the Turbine Range as well as all associated works.

A variation in hub height will not change the maximum sound power level of a turbine. However, a hub height wind speed of 110.5 m for the N149 when calculated to a 10 m height wind speed will give marginally different noise levels at the low wind speeds of 3 m/s and 4 m/s (10 m height) than if calculated from a hub height wind speed of 102.5 m. The marginal variation for the N149 is in the order giving lower levels of 0.8 dB at 3 m/s and 0.7 dB at 4 m/s for the hub height of 102.5 m. At 5 m/s (10 m height) and above the maximum sound power level does not change. A difference in sound power levels less than 1 dB are negligible to the human ear. All turbines to be used will have as best practice Serrations Trailing Edge (STE) fitted as standard, which reduces the sound power levels of each turbine. **Table 11.3** provides details of the candidate turbine used for the noise assessment.

A copy of the manufacturer's noise specification of the turbine used in the assessment are given in the **Appendix 11.4**.

Table 11.3: Candidate Turbine Assessed

Turbine Manufacturer	Model	Turbine Output (MW)	Sound Power Level at Source dB LWA
Nordex	149-Mode 0	5.X	105.6

The Nordex N149 turbine has a range of hub heights, however the proposed hub heights range between 102.5 m and 110.5 m. A wind farm noise assessment is based on a standardised noise level referenced to a wind speed at 10 m height. The change in hub height does not therefore change the maximum sound power level of any specific turbine.

The maximum sound power level of the Nordex 149 in Mode 0 is similar for hub heights of 102.5 m and 110.5 m at 105.6 dBA. At lower wind speeds there is a small variation in the sound power levels due to variation in hub height when it is standardised to a 10 m wind speed. The manufacturer's data gives the sound power levels at hub height and at varying wind speeds. **Table 11.4** and **Table 11.5** give the sound power levels at varying wind speeds at standardised 10 m height wind speed for hub heights of 102.5 m and 110.5 m using the methodology in the IOA Good Practice Guide and given in **Appendix 11.2**.

The prediction modelling is based on all the turbines operating at full power (maximum sound power output) in standard Mode 0. The IOA Good Practice Guide recommends that an uncertainty value is required to be added to the turbine emission data prior to modelling. Depending on the type of manufacturer's data, the uncertainty value will range from 0 to 2 dBA. However, for the Nordex N149 in Mode 0 an uncertainty value of 2 dBA is added in line with guidance. **Table 11.4** gives the maximum sound power levels at varying wind speeds (presented at standardised 10 m height) for the Nordex N149 with a hub height of 110.5 m.

Table 11.4: Noise Emission Levels, Nordex N149 with STE in Mode 0

Standardised 10 m height Wind Speed, ms^{-1}	3	4	5	6	7	8	9+
Sound Power Level, dB LWA, derived from 110.5 m hub height	97.4	103.8	105.6	105.6	105.6	105.6	105.6
Uncertainty added and conversion of LAeq to LA90 made	97.4	103.8	105.6	105.6	105.6	105.6	105.6

Table 11.5 gives the maximum sound power levels at varying wind speeds presented at standardised 10 m height for the Nordex N149 with a hub height of 102.5 m.

Table 11.5: Noise Emission Levels, Nordex N149 with STE in Mode 0

Standardised 10 m height Wind Speed, ms^{-1}	3	4	5	6	7	8	9+
Sound Power Level, dB LWA, derived from 102.5 m hub height	96.6	103.1	105.6	105.6	105.6	105.6	105.6

Uncertainty added and conversion of LAeq to LA90 made	96.6	103.1	105.6	105.6	105.6	105.6	105.6

The standardised sound power level at the lowest hub height (102.5 m) is 0.8 dB lower at 3 m/s and 0.7 dB lower at 4 m/s. At 5 m/s and above there is no change in the maximum sound power level in either turbine due to hub height (see **Table 11.4** and **Table 11.5**).

The octave band values at maximum sound power levels are given in **Table 11.6** with uncertainty values of 2 dB added and conversion of LAeq to LA90 added as input to the prediction model which is best practice.

Table 11.6: Octave Band Spectrum of Nordex N149 with STE in Mode 0

Octave Band Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Sound Power Level, dB LWA 8 ms^{-1}	86.9	93.5	97.2	99.3	100.6	98.7	89.1	81.2
Uncertainty added to octaves and conversion of LAeq to LA90	86.9	93.5	97.2	99.3	100.6	98.7	89.1	81.2

11.12.1 Cumulative Assessment

Cumulative effects from any existing, consented or application-stage wind farms within 3 km of identified noise-sensitive receptors have been taken into consideration as the potential for cumulative effects beyond this distance is considered negligible. On this basis, the cumulative effect of 9 no. wind farms located west to south-west of the Project are assessed. The wind farms comprise Vestas V90 each rated at 3MW and the Kilgarvan Wind Farm which comprises V52's each rated at 0.85MW.

The octave band spectrum of the Vestas V90, 3.0MW wind turbines (80 m HH) is given in **Table 11.7**.

Table 11.7: Octave Band Spectrum of Vestas V90 3MW at maximum LWA

Standardised 10 m height Wind Speed, ms^{-1}	4	5	6	7	8	9	10	10+
Sound Power Level, dB LWA 8 ms^{-1}	97.9	100.9	104.2	106.1	107	106.9	105.6	105.2
Uncertainty added and conversion of LAeq to LA90	97.9	100.9	104.2	106.1	107	106.9	105.6	105.2

The octave band values are given in **Table 11.7** with uncertainty values added and conversion for LAeq to LA90 made for input to the prediction model.

Table 11.8: Octave Band Spectrum of Vestas V90-3MW

Octave Band Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Sound Power Level, dB LWA 8 ms^{-1}	92.0	94.1	97.2	99.6	101.8	100.5	95.7	86.7
Uncertainty added to octaves and conversion of LAeq to LA90	92.0	94.1	97.2	99.6	101.8	100.5	95.7	86.7

The octave band values for the Vestas V52 are given in **Table 11.9** with uncertainty values and conversion for LAeq to LA90 added as input to the prediction model.

Table 11.9: Octave Band Spectrum of Vestas V52-0.85MW

Octave Band Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Sound Power Level, dB LWA 8 ms^{-1}	80.8	87.8	94.5	100.1	99.8	95.9	89.5	79.3
Uncertainty added to octaves and conversion of LAeq to LA90	80.8	87.8	94.5	100.1	99.8	95.9	89.5	79.3

11.13 NOISE LIMITS

The method of deriving operational noise limits is described in **Section 11.2.3** and is based on the current 2006 guidelines, background noise levels and recent 2022 An Bord Pleanála noise limits listed in planning decision conditions. The 2022 An Bord Pleanála decision (26th September 2022- 309306-21) introduced an additional limit of 40 dBA for wind speeds below 5 m/s. The noise limits proposed for the Inchamore Wind Farm is:

'Wind turbine noise arising from the proposed development, by itself or in combination with other existing or permitted wind energy development in the vicinity, shall not exceed:

- 43 dB(A) L90,10min limit for all wind speeds at 5 m/s and above and,
- 40 dBA L90,10min limit for wind speeds below 5 m/s. A 43 dB(A) L90,10min limit protects sleep at night.

11.14 CONSTRUCTION ASSESSMENT METHODOLOGY

11.14.1 Relevant Guidance

There is no published national guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. However, the National Roads Authority (NRA) give limit values which are deemed acceptable (the NRA Guidelines)[18]. Guidance to predict and control noise is also given in BS 5228:2009-1+A1:2014[19].

11.14.2 NRA Guidelines for the Treatment of Noise and Vibration in National Road Schemes

The NRA Guidelines provide noise limits which are acceptable and states that where it is deemed necessary to predict noise levels associated with construction noise that this should be done in accordance with BS 5228:2009-1+A1:2014.

11.14.3 BS 5228;2009-1+A1 ;2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites

Part 1 of BS5228 deals with noise prediction and control. It recommends procedures for noise control in respect of construction operations. The standard stresses the importance of community relations, and states that early establishment and maintenance of the relations throughout the carrying out of Site operations will go some way towards allaying people's concerns. Some of the more relevant factors that are likely to affect the acceptability of construction noise are:

- The attitude of local receptors to the Development;
- Site location relevant to noise sensitive receptors;
- Duration of Site operations;
- Hours of work, and
- The characteristics of the noise produced.

[18] National Roads Authority, *Guidelines for Noise and Vibration in National Road Schemes, October 2004.*
[19] BS 5228-1: 2009 Code of Practice for Noise and Vibration Control on Construction and Open Sites: *Code of Practice for Basic Information and Procedures for Noise Control*.

Recommendations are made regarding the supervision, planning, preparation and execution of works, emphasising the need to consider noise at every stage of the activity. Measures to control noise are described including:

- Control of noise at source by:
- Substitution of plant or activities by less noisy ones;
- Modification of plant or equipment by less noisy ones;
- Using noise control enclosures;
- Siting of equipment and its method of use;
- Maintenance of equipment, and
- Controlling the spread of noise by increasing distance between plant and receptors, or by the provision of acoustic screening.

Methods of calculating the levels of noise resulting from construction activities are provided, as are updated source levels for various plant, equipment and construction activities in Section 11.16.1.

11.14.4 Construction and Decommissioning Noise Assessment Methodology

The NRA guidelines for construction noise which are considered acceptable are given in **Table 11.10**.

Table 11.10: Noise levels that are acceptable based on the NRA Guidelines

Day / Times	Guideline Limits
Monday to Friday 07:00 – 19:00hrs 19:00 – 22:00hrs	 70dB LAeq, (1h) and LAmax 80dB *60dB LAeq, (1h) and LAmax 65dB*
Saturday 08:00 – 16:30hrs	 65dB LAeq,1h and LAmax75dB
Sunday and Bank Holidays 08:00 – 16:00hrs	 *60dB LAeq,1h and LAmax 65dB*

*Construction at these times, other than required by an emergency works, will normally require explicit permission from the relevant local authority.

<u>Construction Times for Development</u>

Except for emergencies, delivery of concrete for foundations, or delivery of turbines, the normal construction times for the Project are:

Monday to Friday: 07.00 to 19.00hrs, Saturday 08.00 to 13.00hrs with no work on Sunday, or Bank Holidays

Part 1 of BS 5228 also provides example criteria which have been applied in this assessment for the significance of noise effects from construction activities. Noise levels generated by construction activities are considered significant if:

- The LAeq, period level of construction noise exceeds lower threshold values of 65dB during daytime, 55dB during evenings and weekends or 45dB at night.

Construction noise from wind farm development, or decommissioning is not considered an intensive activity. The main noise sources will be associated with the excavation of the borrow pit which includes blasting and crushing, construction of the turbine foundations, and hardstands, while lower levels are generated by activity such as access roads and the 38kV Substation (construction of the Substation will generate no more noise than construction of a bungalow). Grid connection from the substation will involve cable being laid underground along the grid route. A temporary construction compound will also be put in place.

Decommissioning will be in the same order but less intensive than construction activity and will have similar potential effects.

Significant quantity of material for Site Access Roads, turbine bases and turbine hardstands will be taken from the sites borrow pit, thereby reducing the local traffic flow due to the reduction of material imported. Imported materials to site will be along the local roads with the most intensive trucking (and highest noise levels) being generated by delivery of concrete for turbine foundations **–** this activity will be over a short period of 5 days duration.

11.14.5 Blasting Vibration in Borrow Pit

Rock material for the Project Infrastructure will be sourced from a borrow pit on Site which will require blasting. Material excavated in the borrow pit will be used within the Site (refer to **Chapter 2: Projection Description**). The main use of excavated material will be for new Site Access Roads, Turbine Hardstands and Turbine Foundations. Most blasts will be of duration of less than 1 second with maximum duration less than 1.5 seconds.

<u>Ground Vibration</u>

Ground vibration is caused by the imperfect utilisation of the explosive energy released from the fragmentation of rock during blasting operations. The energy that is unused in the fragmentation of rock propagates as an elastic disturbance away from the shot area as seismic waves. These waves, which radiate in a complex manner, diminish in strength with distance from the source. The theory relative to this motion is based on an idealised (sinusoidal) vibratory motion. When these waves come into contact with a free face, physical motion results as the energy induces oscillation in the ground surface. Blasting vibration is a surface wave type, which incorporates components of both body and surface motion.

Ground vibration itself is in-audible, however air vibrations (air overpressure) both audible and sub-audible usually accompany it. The resulting impacts of blasting vibration are often characterised as being impulsive and of short duration, usually less than 2 seconds. It is difficult for the average lay person to differentiate between the various types of vibrations (ground vibration and air overpressure) as humans commonly associate the level of vibration with the 'loudness' of a blast. Ground vibration from blasting at any receptor point is influenced in the main by:

- the maximum instantaneous charge of explosives usually referred to as MIC;
- the medium between blast source and receptor point and,
- the distance between the receptor point and the blast source.

Ground vibration control is based on reducing and controlling the weight of explosives detonated per delay. In any given situation large amounts of explosives can be detonated using time delay intervals (greater than 8millie-second) between specific charges within the overall blast. The level of ground vibration is directly related to the maximum charge weight per delay (MIC) and numerous studies have shown that peak particle velocity (PPV) is directly related to the MIC.

Air Overpressure Noise

A blast causes a diverging shock-wave front that quickly reduces to the speed of sound, and an air blast is then propagated through the atmosphere as sound waves. Air blast or air overpressure is the term used to describe the low frequency high energy air vibrations generated by blasting detonation. Just as with ground vibration, these pressure waves can be described with time histories where the amplitude is air pressure instead of particle velocity. Air blasts are characterised by containing a larger proportion of its energy in the sub-audible spectrum, below 20 Hz. Because the waves associated with air blasts are essentially outside the audible spectrum (below 20 Hz), a separate unit of measure, pressure is reported.

Air overpressure (sound waves) can be reported in two distinct units of measurements, pressure (psi) or decibels (dB). A wind speed of 9 /s produces a pressure equal to 133.7 dB (0.014 psi). Although such wind is comparable in amplitude to a strong air-blast, its effects are not as noticeable because of the relatively slow rate of wind speed change and the corresponding minor or non-existent rattling, compared with the rapid rise time (impulsive) of an air blast transient. The principal factors governing air blasts are:

(a) the type and quantity of explosives;
(b) the degree and type of confinement (stemming);
(c) the method of initiation (not-use of exposed detonating cord etc.);
(d) local geology, topography and distance, and
(e) atmospheric conditions.

Lowering the MIC, use of chipping as stemming, not using exposed detonating cord (which is now best practice) and large distance from blasts to receptors are factors which reduce ground vibration and air-overpressure. Atmospheric conditions can partly be controlled by blasting in mid-day when temperature inversions are more infrequent.

11.14.5.1 Ground Vibration and Air Overpressure Guidelines

There are many different standards and recommendations being used internationally, however, most of these standards and recommendations are derived from the considerable work carried by the US Bureau of Mines (USBM). The USBM Report of Investigation 8507[19] gives practical safe criteria for blasts that generate low frequency ground vibrations (<40Hz). These are 19 mm/sec for modern houses and 12.7 mm/sec for older houses. Since 1993 British Standards Institute have adopted BS 7385 Part 2: 1993[20] this is based predominately on a literature review of the considerable work of the USBM. BS 7385 states that there should typically be no cosmetic damage if transient vibration does not exceed 15 mm/s at low frequencies rising to 20 mm/s at 15 Hz and 50 mm/s at 40 Hz and above. The guidelines relate to relatively modern buildings and should be reduced to 50% or less for more critical buildings (residential buildings do not constitute critical buildings in this context)'. The NRA published guidelines also contains information on permissible construction ground vibration levels and are given in **Table 11.11**.

[19] Siskind, D. E, Stagg, M. S., Kopp, and Dowding, C. H. (1980) '*Structure Response and Damage Produced by Ground Vibration From Surface Mine Blasting*' U .S Bureau of Mines RI 8507

[20] British Standard BS 7385-1:1993- Evaluation and Measurement for vibration in buildings-Part 2: Guide to damage levels from ground borne vibration

Table 11.11: Allowable Vibration During Road Construction in order to minimise the Risk of Building Damage

Allowable vibration velocity (Peak Particle Velocity) at the closest part of any sensitive property to the source of vibration at a frequency of		
Less than 10Hz	10 to 50Hz	50 to 100Hz+
8 mm/s	12.5 mm/s	20 mm/s

The guidance does not give limits for air overpressure; however limits are given by the EPA[21] which states:

'The air overpressure arising from the blasts shall not exceed 125dB (lin) max peak with a 95% confidence limit when measured outside the nearest house to the blast'.

11.14.6 Evaluation of Potential Effects

The potential effects of construction are evaluated by comparing the predicted noise levels against the guideline limits given in **Table 11.10, Table 11.11** and sample criteria in Part 1 of BS 5228 in **Section 11.14.4.**

The potential operational effects are evaluated by comparing the predicted noise levels against the day and night-time noise limit given in **Section 11.15.5**. The predicted noise levels are carried out according to the IOA Good Practice Guide as detailed in **Section 11.7** and potential impacts are assessed against the noise limits at the nearest receptors.

11.14.6.1 Sensitivity

The sensitivity of the Project during construction is based on the guideline values in **Table 11.10, Table 11.11** and sample criteria in Part 1 of BS 5228. The sensitivity of the Development during operation is based on the noise limits in **Section 11.15.5**.

11.14.6.2 Magnitude

The magnitude of potential effects of construction is based on the values in **Table 11.16.** The magnitude of the potential effects of the Project during operation is based on the values in **Table 11.17** and **Table 11.19.**

11.14.6.3 Significance Criteria

The significance of construction is based on the potential effects based on the predicted values and compliance with the guideline limits in **Table 11.10, Table 11.11** and sample criteria of in Part 1 of BS 5228.

[21] EPA 2006, Environmental Management Guidelines-Environmental Management in the Extractive Industry (Non-Scheduled Industry)

The significance of the potential effects of the Project have been assessed by taking into account the noise limits at receptors and the degree to which compliance has been met.

11.15 BASELINE DESCRIPTION

11.15.1 Identification of Potential Receptors

A number of predictions were prepared for the layout of the proposed 55 turbine wind farm. Based on the initial layout, potential noise-sensitive receptors (which included occupied and un-occupied properties) were identified from maps. Receptor locations were verified through aerial mapping, Eircode searches and specific site visits.

11.15.2 Selection of Baseline Noise Survey Locations

Four baseline noise survey locations were selected on the basis of their location relative to the proposed 5 turbine locations and are shown in **Table 11.12**. **Figure 11.1** shows the four noise monitoring locations in relation to the Project.

Baseline Noise Survey

Baseline noise measurements were analysed for the period 14th to 29th October 2020 at locations given in **Table 11.12** and shown in **Figure 11.1**. The baseline survey monitoring locations were carried out at receptor houses H2, H3, H4 and H18 (photos of monitors in-situ in **Technical Appendix 11.1**.

Table 11.12: Baseline Noise Survey

Location	ITM Reference	Description of Location
H2	513445, 578031	Microphone 1.2-1.5 m height, front garden facing Site
H3	513072, 579801	Microphone 1.2-1.5 m height, 40 m from dwelling facing Site
H4	514329, 579384	Microphone 1.2-1.5 m height, side of dwelling facing Site
H18	511689, 577885	Microphone 1.2-1.5 m height, at side dwelling facing Site

The survey was carried out in accordance with ISO 1996, ETSU-R-97 and the IOA Good Practice Guide with the following implemented:

- Measurement of background noise levels at 10-minute intervals was undertaken using Type 1 instruments.
- Concurrent measurements of 10-minute interval mean wind speed / direction were recorded from the existing met mast located on the sites. The methodology is given in **Section 11.6.**

- The background noise measurement recorded continuously included 10-minute intervals, as LA90, 10min along with a series of other parameters including LAeq,10min.
- Noise measurements were recorded at a height of 1.2-1.5 m above ground level and more than 5 m from any reflective surface other than the porous ground.
- An electronic rain gauge was installed at receptor H2 to monitor rainfall at 10-minute intervals over the duration of the noise survey. Rain data which impacted on noise levels were removed from the noise data set prior to analysis.
- The wind speed was taken from the Lidar (located onsite which had measurements at 110 m and 80 m height.
- Wind shear calculated from the two different wind speed heights at 10 min intervals was used to extrapolate to the hub height wind speed followed by calculation to standardised 10 m height using the methodology given in the IOA Supplementary Guidance Note 4.
- The standardised 10 m wind speed was plotted against the background noise levels using a best-fit polynomial line.

Instrumentation Used

The following instrumentation was used in the baseline survey measurements:

- Four Larson Davis Precision Integrating Sound Level Analyser/Data logger with 1/2" Condenser Microphones. All microphones were fitted with double skin windscreens based on that specified in W/31/00386/REP22'.
- Calibration Type: Larson Davis Precision Acoustic Calibrator
- Rain Gauge Type: Davis Instruments Vantage Pro2 weather station.

All acoustic instrumentation was calibrated before and after each survey and the drift of calibration was less than 0.2dB. Survey measurement data and calibration certificates of the acoustic instruments are included in **Appendix 11.4**.

11.15.3 Prevailing Background Noise Levels

Table 11.13 gives the background noise levels obtained for daytime, night-time and background plus 5 at the four baseline measurement locations.

The WEDG06 states:

[22] W/31/00386/REP 'Noise Measurements in Windy Conditions'.

In general, a lower fixed limit of 45 dB(A) or a maximum increase of 5dB(A) above background noise at nearby noise sensitive locations is considered appropriate to provide protection to wind energy development neighbours. However, in very quiet areas, the use of a margin of 5dB(A) above background noise at nearby noise sensitive properties is not necessary to offer a reasonable degree of protection and may unduly restrict wind energy developments which should be recognised as having wider national and global benefits. Instead, in low noise environments where background noise is less than 30 dB(A), it is recommended that the daytime level of the LA90, 10min of the wind energy development noise be limited to an absolute level within the range of 35-40 dB(A).

The daytime background noise levels are above LA30dB at all locations above wind speed of 5 m/s, therefore the site was not considered a low noise environment.

Table 11.13: Prevailing Background Noise Levels

Monitoring Location	Prevailing Background (B/G) noise levels LA90dB, 10min Standardised Mean 10 m Height Wind Speed, (m/s)									
		4	5	6	7	8	9	10	11	12
H4	Day	31.0	30.9	31.6	33.1	35.0	37.1	39.2	41.0	42.3
	B/G+5	36.0	35.9	36.6	38.1	40.0	42.1	44.2	46.0	47.3
H4	Night	28.2	27.5	28.1	29.4	31.5	33.9	36.6	39.3	41.7
	B/G+5	33.2	32.5	33.1	34.4	36.5	38.9	41.6	44.3	46.7
H3	Day	26.8	28.2	30.8	33.9	37.2	40.1	42.0	42.6	41.3
	B/G+5	31.8	33.2	35.8	38.9	42.2	45.1	47.0	47.6	46.3
H3	Night	25.8	26.9	28.7	31.0	33.6	36.4	39.0	41.3	43.1
	B/G+5	30.8	31.9	33.7	36.0	38.6	41.4	44.0	46.3	48.1
H2	Day	31.5	31.6	32.1	33.0	34.4	36.3	38.8	41.9	45.6
	B/G+5	36.5	36.6	37.1	38.0	39.4	41.3	43.8	46.9	50.6
H2	Night	29.5	29.2	29.9	31.4	33.5	36.0	38.6	41.1	43.3
	B/G+5	34.5	34.2	34.9	36.4	38.5	41.0	43.6	46.1	48.3
H18	Day	29.9	30.6	31.5	32.6	34.0	35.4	36.9	38.4	39.8
	B/G+5	34.9	35.6	36.5	37.6	39.0	40.4	41.9	43.4	44.8
H18	Night	27.3	26.8	27.8	29.7	32.4	35.4	38.4	41.1	43.2
	B/G+5	32.3	31.8	32.8	34.7	37.4	40.4	43.4	46.1	48.2

Location H4

The house is located on the side of a slope approximately 330 m from the N22 Road. The noise monitor was located at the side of the house facing towards the Project. The main noise sources would have been from the N22 and small nearby streams. Because of the pandemic the N22 traffic flow was very low and this was due to travel restrictions in place.

Location H3

The house is located on the top of elevated ground. The noise monitor was located approximately 30 m from the side of the house facing towards the Project. The main noise sources were domestic activity, distant road traffic and sheep in the field.

Location H2

The house is located on relatively flat ground. The noise monitor was located in the front of the house facing towards the Project and away from locations where local sheep were roaming freely. The main source of noise was from domestic activity and sheep.

Location H18

The house is located cut into the side of a slope with little vegetation close by. The noise monitor was located at the back of the house facing towards the Project. The main source of noise was from local domestic fowl.

11.15.4 Noise Assessment Locations

The nearest receptors to the Project were selected for assessment and represent the properties most likely to be affected by potential effects. Measured background noise levels are representative of the background noise environments surrounding the development.

Should the predicted operational noise levels from the Project comply with the requirements of the WEDG06 at the closest receptors, it may be assumed that the predicted noise levels at receptors further away from the Project will also comply, due to the attenuation of turbine noise levels with distance. The locations are given in **Table 11.10**.

11.15.5 Noise Limits

The noise limits for the Project are based on the limits contained within the Wind Energy Development Guidelines 2006 and the background levels obtained in **Table 11.13.** A lower fixed limit of 45 dBA for daytime could be applied, however a more stringent limit is applied with the lowest background noise levels obtained at location H3 used as the basis for the assessment at all receptors with a limit of 43 dBA being applied for day and night at all wind speeds at 5 m/s and above, with a limit of 40 dBA applied for wind speeds of less than 5 m/s. **Table 11.14** gives the derived noise limits.

In summary, the assessment is made against a 43 dB(A) L90,10min limit for all wind speeds at 5 m/s and above and 40 dBA L90,10min limit for wind speeds below 5 m/s.

Table 11.14: Derived Background Noise Levels Used in Assessment

Monitoring Location		Prevailing Background (B/G) noise levels LA90dB, 10min Standardised Mean 10 m Height Wind Speed, (m/s)								
		4	5	6	7	8	9	10	11	12
H3	Day	27	28	31	34	37	40	42	43	41
	B/G+5	32	33	36	39	42	45	47	48	46
Noise Limit		40	43	43	43	43	43	43	43	43
H3	Night	26	27	29	31	34	36	39	41	43
	B/G+5	31	32	34	36	39	41	44	46	48
Noise Limit		40	43	43	43	43	43	43	43	43

11.15.6 Development Design Mitigation

The preferred turbine model, yet to be decided, will be fitted with Serrated Trailing Edge (STE) as is best practice. A serrated extension of the trailing edge to the rotor blades mitigates noise emission by effectively breaking up the turbulence on the tooth flanks into smaller eddies. The intensity of the pressure fluctuations is reduced which mitigates the noise emissions. Since the intensity of the noise emissions is largely dependent on the flow speed, STE is only installed on the outer rotor blade area where the rotary speed is highest. Typically, STE will reduce the noise levels by 2-3dBA.without reduction of energy output.

11.16 ASSESSMENT OF POTENTIAL EFFECTS

11.16.1 Construction and Decommissioning Noise Levels

As has been previously stated, the construction process associated with wind farms is not considered intensive and is temporary works most of which is carried out a considerable distance from receptors (**Table 11.16**). The main noise sources will be associated with the construction of the turbine foundations, turbine hardstands, grid connection, extraction and processing in the borrow pit location, with lesser sources being site access roads, construction of a 38kV substation, compound and the widening of a road along the turbine delivery route. Accessing stone material from the borrow pit will significantly reduce road traffic flow on local roads. The maximum noise levels from construction traffic to Site will be due to a very short period when ready-mix trucks deliver concrete for the turbine bases. The delivery of turbines by large trucks travelling at very low speed will generate very low levels of noise.

Table 11.15 indicates typical construction range of noise levels for these types of activity (levels from author's database and BS 5228). Predictions are made for receptors nearest to the borrow pit processing, turbine bases / hardstands activity and for receptors at varying distance from the grid connection route. The construction of a substation is considerably less intensive and will generate lower levels than the construction of a small bungalow.

Table 11.15: Typical Noise Levels from Construction Works

Activity	L_{Aeq} at 10 m
Foundation works: trucks pouring concrete, tracked excavator operating	70-84dBA
Large tracked excavator removing topsoil, subsoil for foundation.	80- 87dBA
Rock breaker, vibrating rollers, trucks loading and tipping material	76-89dBA
Grid Connection: Trenching: Tracked excavator 14t, pneumatic breaker, vibratory roller 4t, truck loading	71-74dBA
Horizontal Directional Drilling: Rig HPU* (diesel), mud pump, diesel generator and tractor.	70-75dBA
Construction of compound (Loading / tipping, excavator and Vibratory roller	80- 87dBA
Borrow Pit Processing (Portable crusher, screener, truck loading by excavator, front end loader, dump truck)	78-86dBA
Material spreading in Borrow Pit (Tipping, excavator, dumper)	70-83dBA
Felling of trees in Forest- Chain-saw cutting trees[20]	60-66dBA
Road widening for Turbine delivery: excavator dump truck, lorry tipping, roller	82-87dBA

* Hydraulic power unit (measurements taken on 22nd March 2022 with HDD giving 71dBA without tractor).
NB: Predicted noise levels assumes that there are no barrier/berm attenuation effects.

The difference in noise levels between two locations can be calculated as:

$$\mathbf{L}_{p2} - \mathbf{L}_{p1} = 10 \log (R_2 / R_1)^2 - (A_{atm} + A_{gr} + A_{br} + A_{mis})$$

[20] Inac TAS, Abdulllah E, AKAY, 2018, Bursa Technical University, Bursa Turkey Analysis of Noise level caused by a chainsaw during tree felling operations, IARC

$= 20 \log (R_2 / R_1) - (A_{atm} + A_{gr} + A_{br} + A_{mis})$

where:

L_{p1} = sound pressure level at location 1

L_{p2} = sound pressure level at location 2

R_1 = distance from source to location 1

R_2 = distance from source to location 2

and where:

A_{atm} = Attenuation due to air absorption

A_{gr} = Attenuation due to ground absorption

A_{br} = Attenuation provided by a barrier

A_{mis} = Attenuation provided by miscellaneous other effects

In the calculation attenuation by A_{atm}, A_{gr} and A_{mis} is assumed as 0.

Table 11.16 gives the noise levels predicted from construction activity at the nearest receptors. The maximum construction noise levels are at receptors listed in **Table 11.16.** At receptor locations further away, noise levels will be less than that predicted.

Table 11.16: Predicted Construction Noise Levels

Nearest Receptor	Activity	Distance to Activity (m)	LAeq dB 1hr range
H1H1	Foundation works: trucks pouring concrete, tracked excavator operating	753	30-44
H1H1	Rock breaking, vibratory roller, trucks loading/tipping	753	40-47
H6	Borrow Pit Spreading/tipping peat	600	39-47
H6	Borrow Pit Processing (Portable crusher, screener, truck loading by excavator, front end loader, dump truck)	600	47-50
Grid connection Receptor	Excavator 14t, pneumatic breaker pneumatic breaker, vibratory roller 4t, truck loading.	166	44-47

Nearest Receptor	Activity	Distance to Activity (m)	LAeq dB 1hr range
Horizontal directional drilling (HDD) Stream 1 N22 crossing Stream 2 Stream 3	Rig HPU* (diesel), Mud Pump, Diesel generator, tractor, dumper	 3,767 777 2,877 2,880	 15-20 41-46 18-23 18-23
H3	Construction of compound (Loading / tipping, excavator, Vibratory roller	541	42-49
Nearest receptor	Road widening for turbine delivery: Excavator dump truck, lorry tipping, vibratory roller	434434	4545-50
H1	Felling of trees in forest	472	22-28

The predicted noise levels in **Table 11.16** are well below the guideline values given in **Table 11.10** at the nearest receptors and accordingly at all other receptors further away.

Construction Traffic

The delivery of turbines to the site will generate low level traffic noise as the vehicles carrying the turbines will move slowly along the local roads where impact is expected to be greatest. The main (maximum) construction noise generated by traffic to the Site will be due to ready-mix trucks delivering concrete for the foundation of the turbines. The concrete pour for each individual turbine will be required to be completed in a short a period as possible (usually within 10 hours). For five turbines the concrete pour will last for a total of five days.

Each turbine will require a pour of 900 m^3 of concrete while each ready-mix truck has a capacity of 8 m^3. For delivery of concrete the timeframe envisaged for each turbine concrete pour is taken as 10 hrs. This equates to an average of 36.4 movements per hour on local roads (37 movements used in calculations).

The general expression for predicting the 1 hr LAeq alongside a haul road used by single engine items of mobile plant is:

$L_{Aeq} = L_{WA} - 33 + 10\log_{10}Q - 10\log_{10}V - 10\log_{10}d$ where:

L_{WA} is the sound power level of the truck, in decibels (dB);

Q is 37, the number of vehicles per hour;

V is 50, the average vehicle speed, in kilometres per hour (km/h);
d is the distance of receiving position at 20 m from the centre of haul road, in metres (m).

LAeq = 105-33 + 10log 37 – 10log50 – 10log20 = 57.7 LAeq 1hr.

At 10 m from the roadside the noise levels from delivery trucks equate to 60.7 LAeq 1hr. The trucking for the concrete pour will extend for a total of 5 days (1 day for each turbine). In practice the levels generated by truck movement should be lower than predicted due to the smooth surface on the local roads. The maximum noise levels from temporary construction traffic is within the guidelines givenn in **Table 11.10.**

<u>Grid Connection-Cable laying by trenching</u>

Cable laying and trenching will move along the grid route from the substation on site to the Ballyvouskill 220kV Substation. The maximum noise levels will pertain for no more than 0.5 days equivalent (4 hours) at any single receptor along the route except where HDD is required. Construction noise levels are based on continuous operation. In practice most plant will operate at a maximum level for short intervals. The nearest receptor is located 166 m from the grid route therefore mitigation will not be required. The grid route (trenching) will progress at a rate between 100-200 m each day so duration of maximum levels will be no more than 4 hours at any location.

<u>Grid Connection- Horizontal Drilling</u>

Horizontal or directional drilling is required at four locations where the grid connection requires undergrounding. The nearest receptor to horizontal drilling activity is 777 m from the N22. The noise levels predicted at all locations are well within the NRA construction guidelines without any amelioration required. The works associated with this activity is temporary and expected to continue for no more than a couple of weeks. All drilling activity will be carried out during daytime.

The predicted construction noise levels are well within the NRA guidelines for daytime for all activity and within the lower threshold of 65 dBA, as defined in BS 5228-1:2009, the noise levels from this temporary activity are therefore considered as not significant**.**

11.16.2 Assessment of Construction and Decommissioning Noise

The maximum predicted site construction noise levels are at H1, H3, H6, H19 and at receptors along the Grid Route. The nearest receptor to the road widening for the turbine delivery route is 434 m away with the nearest receptor to HDD activity at 777 m. The maximum predicted noise levels will exist for no more than one week equivalent (12 hours x 5 days) at all receptors except along the grid route when duration will be no more than 4 hours at any receptor. The maximum predicted noise levels from traffic delivering materials including trucking along the grid route will be below the predicted levels from concrete delivery for turbine bases.

The predicted noise levels are well within the NRA guidelines given as acceptable and below the lower threshold of 65 dBA, as defined in BS 5228-1 and therefore these temporary works are considered not significant**.**

Ground vibration from rock breaking will be below the threshold of sensitivity to humans of 0.2 mm/s peak particle velocity at all receptors[23] due to distances to nearest receptors.

The effects of noise and vibration from onsite construction activities are therefore considered not significant. The effects for Decommissioning will be similar to construction, but of shorter duration as significant elements of the Project will be left in place such as access roads, turbine foundations and the substation building (Refer to **Section 11.6.5**).

11.16.3 Description of Effects

The criteria for description of effects for all construction noise activity and the potential worst-case effects, at the nearest receptors is given below.

Quality	Significance	Duration
Negative	Not Significant	Temporary

11.16.4 Assessment of Blasting Ground Vibration and Air Overpressure

Blasting in the borrow pit location is in excess of 600 m from the nearest receptor. Ground vibration levels are controlled by the maximum charge weight of explosives per delay used in a blast and will easily be kept below the lower guideline values of 8 mm/sec peak particle velocity given in **Table 11.11.** Blasting, including design is only carried out by suitable qualified certified personnel. The levels of air overpressure will be kept within the EPA's guidance value of 125 dB (lin).

The effects of blasting vibration and air overpressure from the project is at a distance greater than 600 m and is therefore considered not significant and will be kept well within the recommended guidelines described in **Section 11.14.5.1**.

[23] Wiss, J. F., and Parmelee, R. A.. (1974) Human Perception of Transient Vibrations, "*Journal of Structural Division*", ASCE, Vol 100, No. S74, PP. 773-787

The criteria for description of effects for vibration (blasting) and the potential worst-case effects, at the nearest receptors is given below.

Quality	Significance	Duration
Negative	Not significant	Momentary

11.16.5 Decommissioning

Noise effects during decommissioning of the Project are likely to be of a similar nature to that during construction. It is likely that the duration of decommissioning will be shorter than that during construction and there will be no blasting. Decommissioning will involve the removal of five wind turbines. Turbine bases (excluding plinths) will be left in place and revegetated. It is proposed to leave roadways and drainage in place. Meteorological mast structure and the underground electrical and communications cabling connecting the wind turbines to the wind farm substation will be removed. All other elements of the proposed development including the on-site substation and site ducting, will remain in-situ. The Site Access Roads and associated drainage systems will serve ongoing forestry and agriculture activity in the area. All other hard surfaced areas will be allowed to revegetate naturally.

Any legislation, guidance or best practice relevant at the time of decommissioning will be complied with.

11.16.6 Predicted Operational Noise Levels

Table 11.17 gives the predicted noise levels at all locations within 2 km of the Development at varying wind speeds for each receptor location at a hub height of 110.5 m. The predicted noise levels for a turbine hub height of 102.5 m is given in **Appendix 11.5.** A noise contour map of the 5 turbine Development at maximum sound power output at a wind speed of 8 m/s at 10 m height is presented in **Figure 11.2**. The noise contour map in **Figure 11.2** assumes that all turbines are simultaneously downwind at the same time to each location which results is an overprediction of the noise levels.

Table 11.17: Predicted Noise Levels at Varying Wind Speeds for Hub Height of 110.5 m Standardised 10 m Height Wind Speed

	ITM	ITM	3m/s	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H1	512160	578211	31.5	37.9	39.7	39.7	39.7	39.7	39.7
H2	513445	578031	31.9	38.3	40.1	40.1	40.1	40.1	40.1

	ITM	ITM	3m/s	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H3	513072	579801	31.2	37.6	39.4	39.4	39.4	39.4	39.4
H4	514329	579384	30.8	37.2	39	39	39	39	39
H5	514339	577982	29.0	35.4	37.2	37.2	37.2	37.2	37.2
H6	514756	578856	28.8	35.2	37	37	37	37	37
H7	513435	577744	29.4	35.8	37.6	37.6	37.6	37.6	37.6
H8	512511	577570	27.7	34.1	35.9	35.9	35.9	35.9	35.9
H9	513762	577696	28.4	34.8	36.6	36.6	36.6	36.6	36.6
H10	513449	577603	28.2	34.6	36.4	36.4	36.4	36.4	36.4
H11	513566	577655	28.4	34.8	36.6	36.6	36.6	36.6	36.6
H12	514700	579510	27.1	33.5	35.3	35.3	35.3	35.3	35.3
H13	513505	577609	28.1	34.5	36.3	36.3	36.3	36.3	36.3
H14	513565	577612	28.1	34.5	36.3	36.3	36.3	36.3	36.3
H15	512009	577691	26.7	33.1	34.9	34.9	34.9	34.9	34.9
H16	513794	577514	26.9	33.3	35.1	35.1	35.1	35.1	35.1
H17	511756	577894	26.6	33	34.8	34.8	34.8	34.8	34.8
H18	511689	577885	26.1	32.5	34.3	34.3	34.3	34.3	34.3
H19	513838	580300	26.0	32.4	34.2	34.2	34.2	34.2	34.2
H20	513548	577431	26.7	33.1	34.9	34.9	34.9	34.9	34.9
H21	514950	577873	24.4	30.8	32.6	32.6	32.6	32.6	32.6
H22	515053	579406	24.9	31.3	33.1	33.1	33.1	33.1	33.1
H23	513747	577308	25.5	31.9	33.7	33.7	33.7	33.7	33.7
H24	514759	577513	23.7	30.1	31.9	31.9	31.9	31.9	31.9
H25	513572	577269	25.5	31.9	33.7	33.7	33.7	33.7	33.7
H26	513974	577197	24.4	30.8	32.6	32.6	32.6	32.6	32.6
H27	515322	579275	23.4	29.8	31.6	31.6	31.6	31.6	31.6
H28	513631	577179	24.8	31.2	33	33	33	33	33
H29	515488	579130	22.6	29	30.8	30.8	30.8	30.8	30.8
H30	514568	577209	22.8	29.2	31	31	31	31	31
H31	514413	577149	23.0	29.4	31.2	31.2	31.2	31.2	31.2
H32	511831	577246	23.3	29.7	31.5	31.5	31.5	31.5	31.5
H33	515603	579094	21.9	28.3	30.1	30.1	30.1	30.1	30.1
H34	512444	580689	23.5	29.9	31.7	31.7	31.7	31.7	31.7
H35	515614	578103	21.3	27.7	29.5	29.5	29.5	29.5	29.5
H36	515672	578122	21.0	27.4	29.2	29.2	29.2	29.2	29.2
H37	515646	578046	21.0	27.4	29.2	29.2	29.2	29.2	29.2
H38	515525	579630	21.5	27.9	29.7	29.7	29.7	29.7	29.7
H39	515332	577403	20.7	27.1	28.9	28.9	28.9	28.9	28.9

11.16.7 Operational Noise Assessment

An assessment was made of the predicted operational noise levels from the Development against noise limits in the Wind Energy Development Guidelines 2006, background noise level and the recent September 2022 ABP decision discussed above. All predicted noise levels are within limits. **Table 11.18** gives the difference (margin) between the predicted noise level in **Table 11.17** and noise limits for each receptor. A negative margin indicates that the predicted noise levels are within the lower 40 dBA at wind speeds below 5 m/s and below 43 dBA all other wind speeds.

As can be seen from **Table 11.18** the predicted noise levels at all receptors are lower than the noise limits in all cases, at all wind speeds, and are therefore compliant with the noise limits and are not significant in terms of EIAR Regulations. The predicted noise levels assume that all 55 turbines are directly down-wind and the potential for negative impacts is negligible.

Table 11.18: Margin between predicted noise levels, LA 90, 40dB limit for wind speeds less than 5 m/s and LA90, 43dB at all other wind speeds

	ITM	ITM	3m/s	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H1	512160	578211	-8.5	-2.1	-3.3	-3.3	-3.3	-3.3	-3.3
H2	513445	578031	-8.1	-1.7	-2.9	-2.9	-2.9	-2.9	-2.9
H3	513072	579801	-8.8	-2.4	-3.6	-3.6	-3.6	-3.6	-3.6
H4	514329	579384	-9.2	-2.8	-4	-4	-4	-4	-4
H5	514339	577982	-11.0	-4.6	-5.8	-5.8	-5.8	-5.8	-5.8
H6	514756	578856	-11.2	-4.8	-6	-6	-6	-6	-6
H7	513435	577744	-10.6	-4.2	-5.4	-5.4	-5.4	-5.4	-5.4
H8	512511	577570	-12.3	-5.9	-7.1	-7.1	-7.1	-7.1	-7.1
H9	513762	577696	-11.6	-5.2	-6.4	-6.4	-6.4	-6.4	-6.4
H10	513449	577603	-11.8	-5.4	-6.6	-6.6	-6.6	-6.6	-6.6
H11	513566	577655	-11.6	-5.2	-6.4	-6.4	-6.4	-6.4	-6.4
H12	514700	579510	-12.9	-6.5	-7.7	-7.7	-7.7	-7.7	-7.7
H13	513505	577609	-11.9	-5.5	-6.7	-6.7	-6.7	-6.7	-6.7
H14	513565	577612	-11.9	-5.5	-6.7	-6.7	-6.7	-6.7	-6.7
H15	512009	577691	-13.3	-6.9	-8.1	-8.1	-8.1	-8.1	-8.1
H16	513794	577514	-13.1	-6.7	-7.9	-7.9	-7.9	-7.9	-7.9
H17	511756	577894	-13.4	-7	-8.2	-8.2	-8.2	-8.2	-8.2
H18	511689	577885	-13.9	-7.5	-8.7	-8.7	-8.7	-8.7	-8.7

	ITM	ITM	3m/s	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H19	513838	580300	-14.0	-7.6	-8.8	-8.8	-8.8	-8.8	-8.8
H20	513548	577431	-13.3	-6.9	-8.1	-8.1	-8.1	-8.1	-8.1
H21	514950	577873	-15.6	-9.2	-10.4	-10.4	-10.4	-10.4	-10.4
H22	515053	579406	-15.1	-8.7	-9.9	-9.9	-9.9	-9.9	-9.9
H23	513747	577308	-14.5	-8.1	-9.3	-9.3	-9.3	-9.3	-9.3
H24	514759	577513	-16.3	-9.9	-11.1	-11.1	-11.1	-11.1	-11.1
H25	513572	577269	-14.5	-8.1	-9.3	-9.3	-9.3	-9.3	-9.3
H26	513974	577197	-15.6	-9.2	-10.4	-10.4	-10.4	-10.4	-10.4
H27	515322	579275	-16.6	-10.2	-11.4	-11.4	-11.4	-11.4	-11.4
H28	513631	577179	-15.2	-8.8	-10	-10	-10	-10	-10
H29	515488	579130	-17.4	-11	-12.2	-12.2	-12.2	-12.2	-12.2
H30	514568	577209	-17.2	-10.8	-12	-12	-12	-12	-12
H31	514413	577149	-17.0	-10.6	-11.8	-11.8	-11.8	-11.8	-11.8
H32	511831	577246	-16.7	-10.3	-11.5	-11.5	-11.5	-11.5	-11.5
H33	515603	579094	-18.1	-11.7	-12.9	-12.9	-12.9	-12.9	-12.9
H34	512444	580689	-16.5	-11.1	-11.3	-11.3	-11.3	-11.3	-11.3
H35	515614	578103	-18.7	-12.3	-13.5	-13.5	-13.5	-13.5	-13.5
H36	515672	578122	-19.0	-12.6	-13.8	-13.8	-13.8	-13.8	-13.8
H37	515646	578046	-19.0	-12.6	-13.8	-13.8	-13.8	-13.8	-13.8
H38	515525	579630	-18.5	-12.1	-13.3	-13.3	-13.3	-13.3	-13.3
H39	515332	577403	-19.3	-12.9	-14.1	-14.1	-14.1	-14.1	-14.1

Charts 11.1 to **11.8** (outlined below) of this section plot the derived background noise, background + 5dBA levels and noise limits.

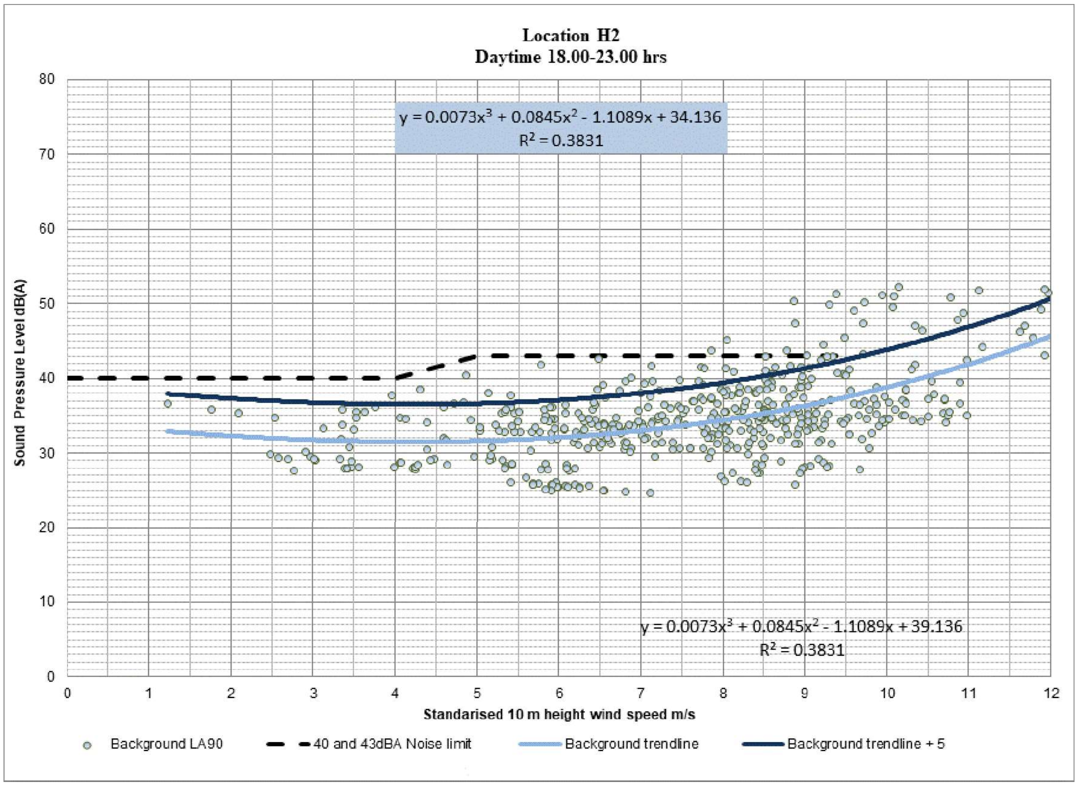


Chart 11.1: Quiet Daytime derived background for House H2

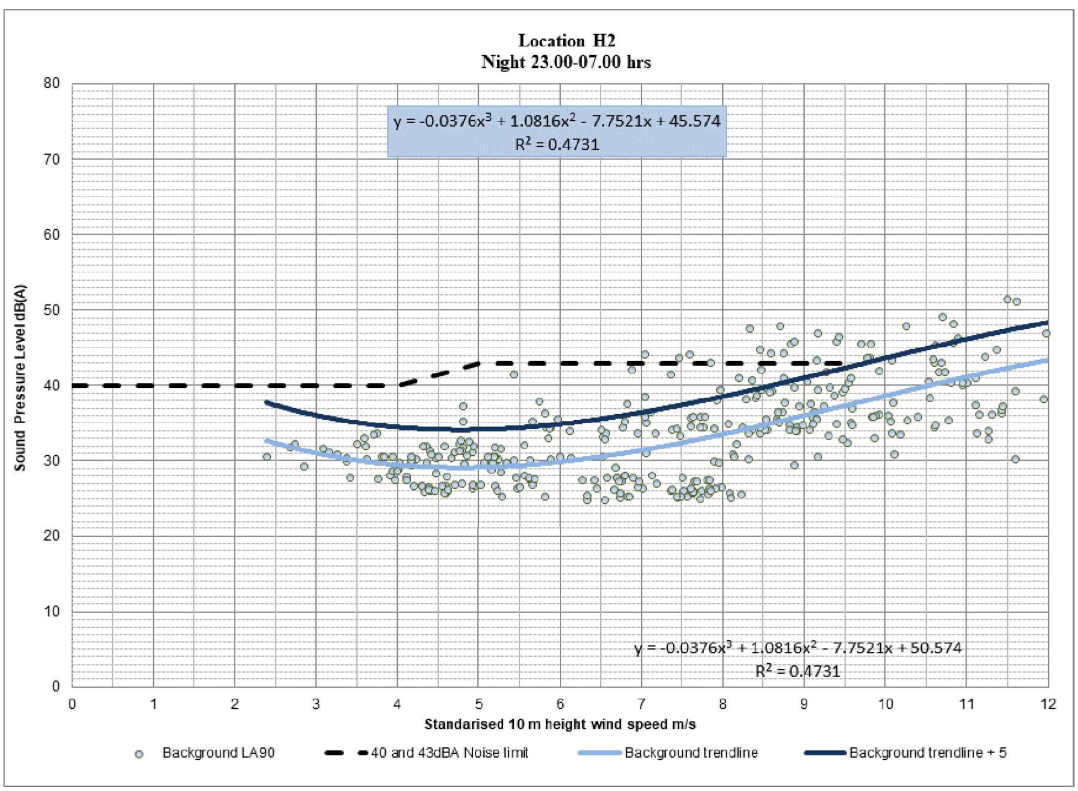


Chart 11.2: Night-time derived background for House H2

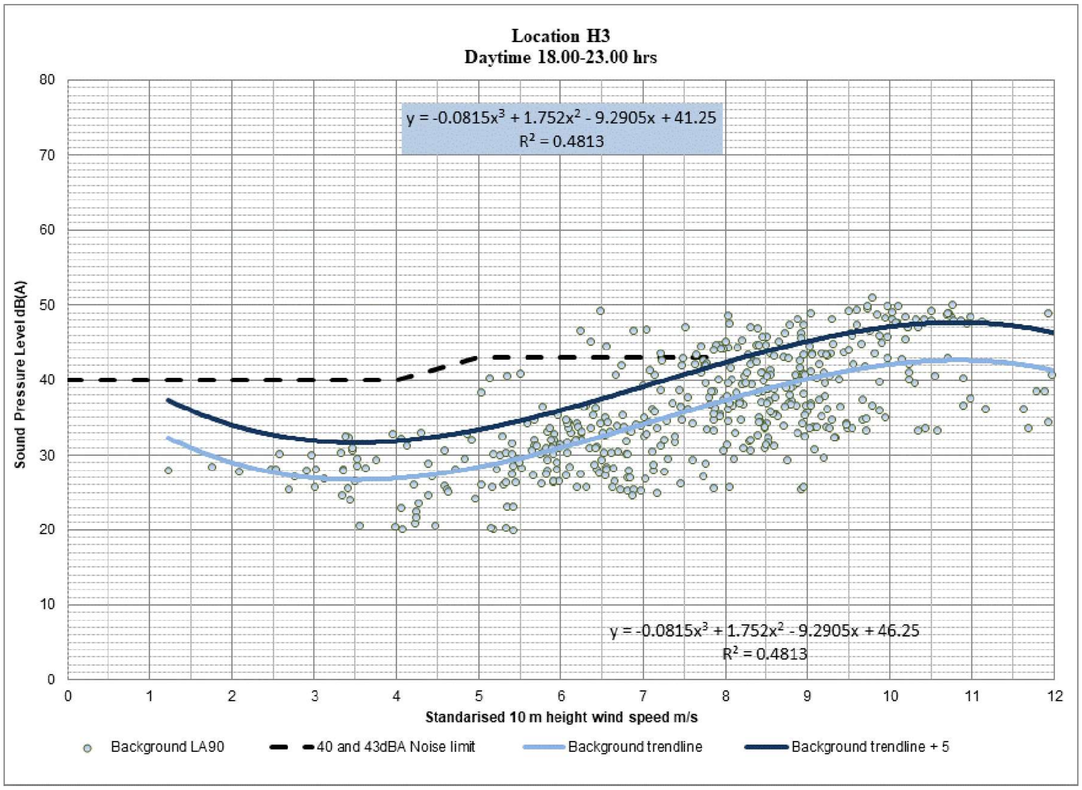


Chart 11.3: Quiet Daytime derived background for House H3

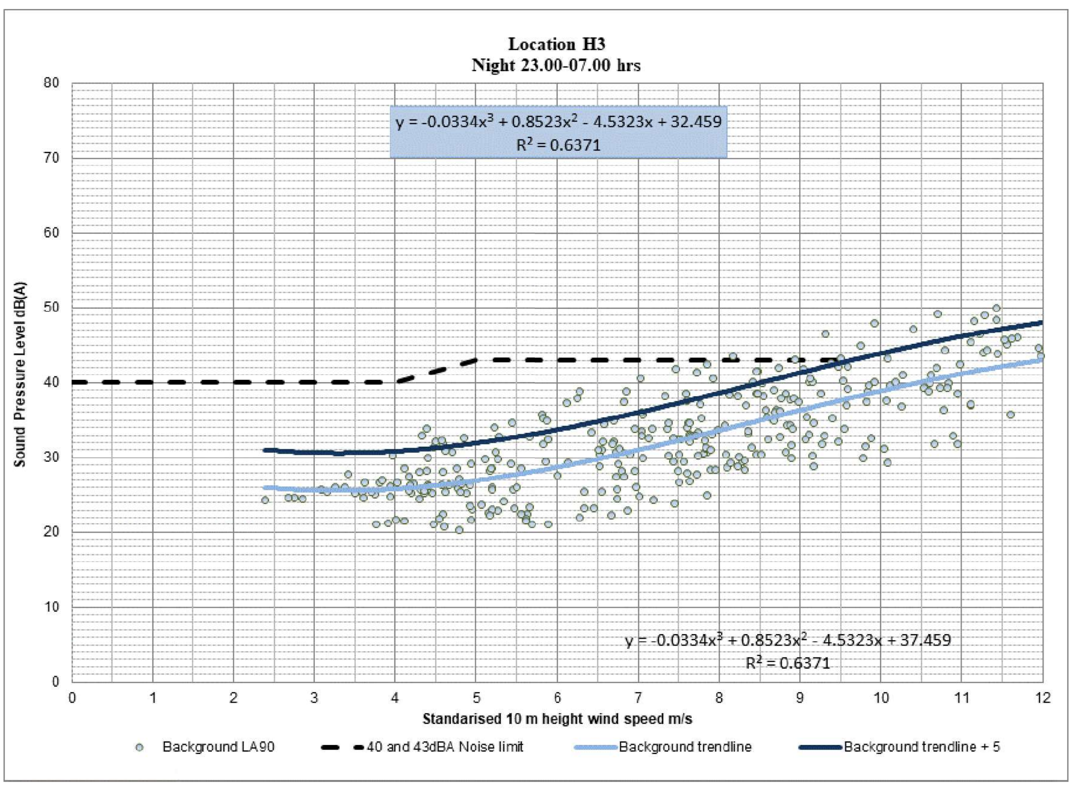


Chart 11.4: Night-time derived background for House H3

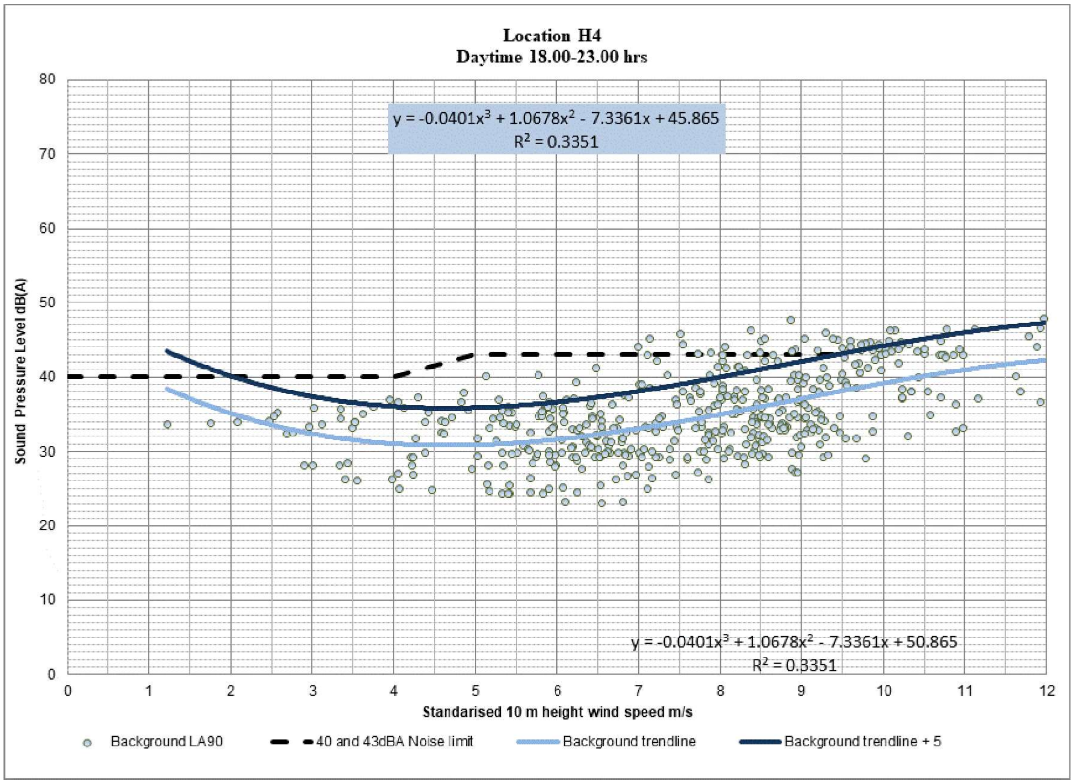


Chart 11.5: Quiet Daytime derived background for House H4

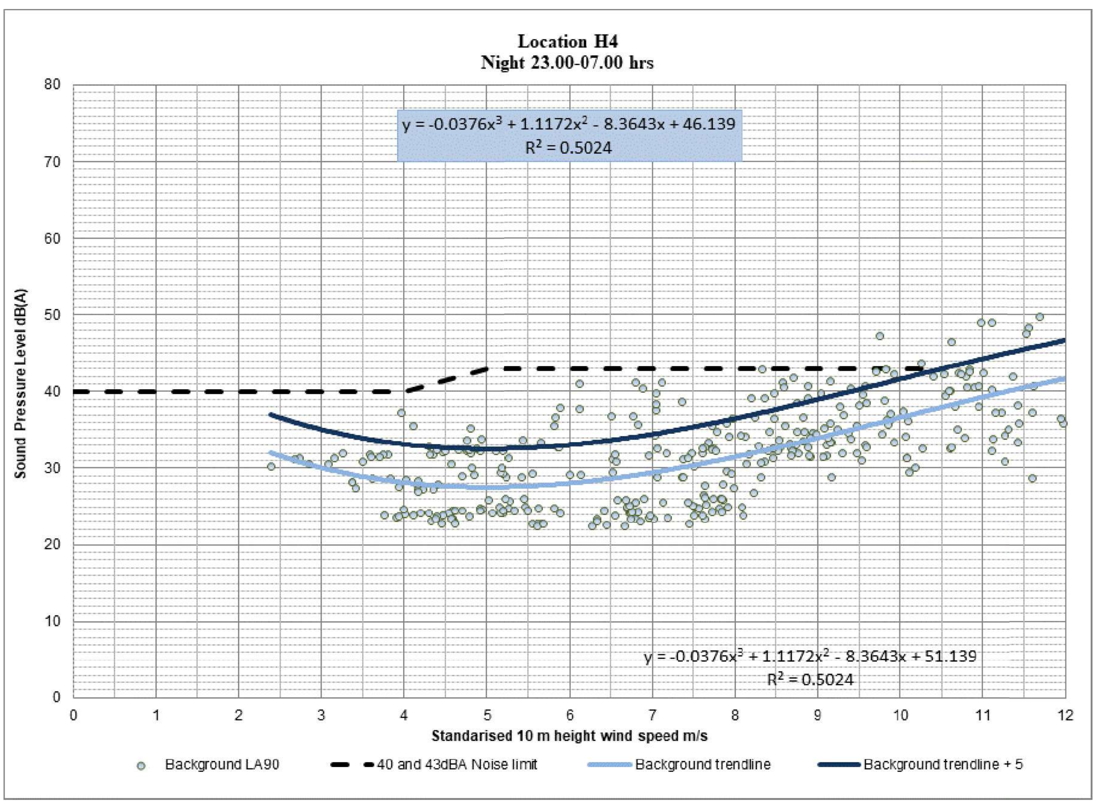


Chart 11.6: Night-time derived background for House H4

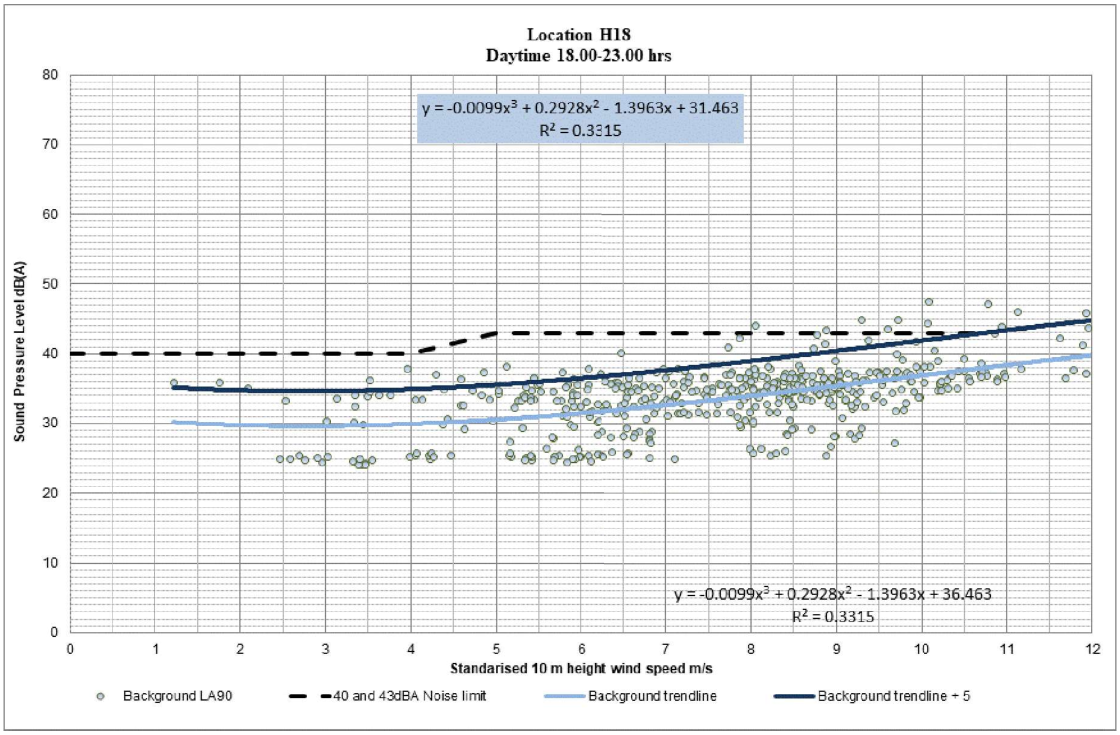


Chart 11.7: Quiet Daytime derived background for House H18

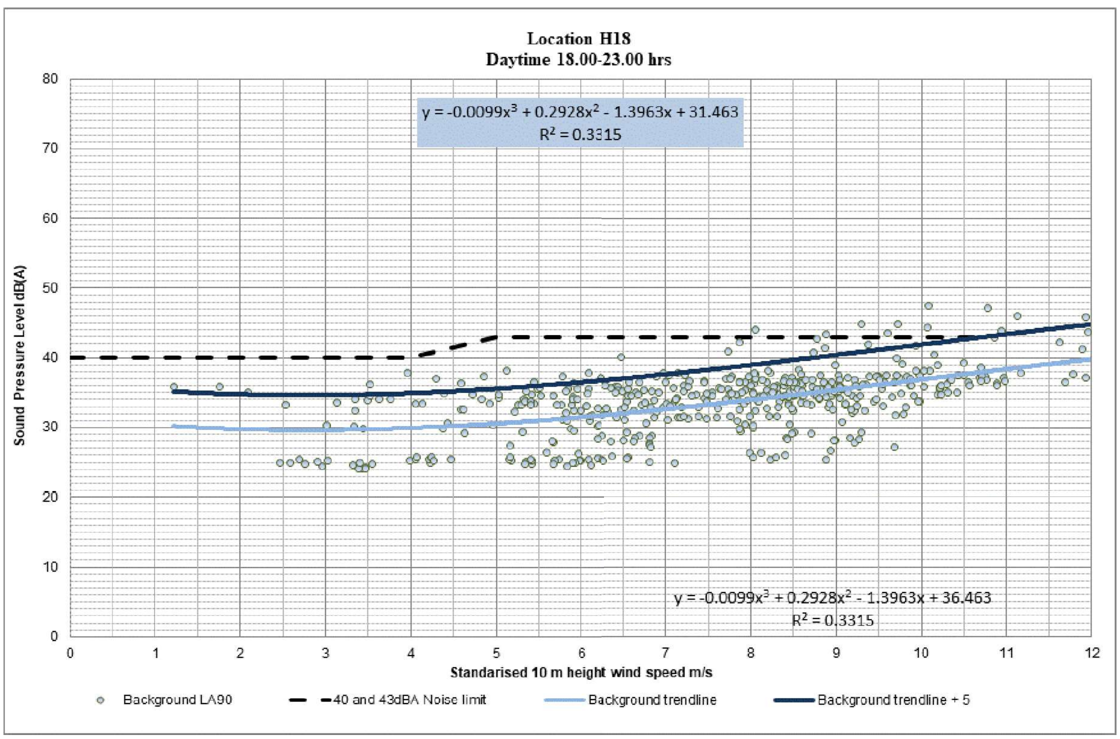


Chart 11.8: Night-time derived background for House H18

11.16.8 Cumulative Effects Assessment

There are 27 No. wind farms within a 20 km radius of the Development (detailed in **Appendix 2.2**). An assessment of these wind farm locations with regards to wind direction was completed to determine which have the potential for cumulative noise effects. The identified wind farms which were then assessed for cumulative effects are:

- Coolea (single turbine)
- Coolknoohil Inchee (2 turbines)
- Coolknoohil (11 turbines)
- Coomagearlahy Kilgarvan (15 turbines)
- Glanlee I (6 turbines)
- Gortnakilla, Clonkeen (4 turbines)
- Inchee, Poulbatha & Foilgreana (6 turbines)
- Inchincoosh Kilgarvan (6 turbines)
- Rosseigtragh, Lettercannon, Kilgarvan (7 turbines)

An assessment of the cumulative effects of noise from Inchamore wind farm together with the cumulative turbines of the aforementioned wind farms in the vicinity has been undertaken (see **Figure 11.3**).

11.16.8.1 Cumulative Assessment locations

The same receptor locations are considered in the cumulative assessment. The assessment is a worst-case scenario with the assumption made that the predicted noise levels to receptors are downwind from all wind farms and individual turbines at the same time, a scenario that cannot occur in practice.

11.16.8.2 Noise Limits

The noise limits are the same as that used for Inchamore Wind farm.

11.16.8.3 Cumulative Noise levels

Table 11.19 gives details of the predicted cumulative noise levels for the nearest receptors with the highest predicted noise levels. The receptor locations are the same as used in **Table 11.17.**

Table 11.19: Predicted cumulative noise levels at varying standardised 10 m height wind speed

	ITM	ITM	3m/s	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H1	512160	578211	32.8	38.2	40.2	40.7	41.1	41.3	41.3
H2	513445	578031	32.4	38.4	40.2	40.4	40.6	40.7	40.7
H3	513072	579801	31.5	37.7	39.5	39.6	39.7	39.8	39.8
H4	514329	579384	30.9	37.2	39.0	39.1	39.1	39.1	39.1
H5	514339	577982	29.4	35.5	37.3	37.5	37.6	37.7	37.7
H6	514756	578856	28.9	35.2	37.0	37.1	37.1	37.1	37.1
H7	513435	577744	30.3	36.0	37.9	38.2	38.5	38.7	38.7
H8	512511	577570	30.1	34.8	36.8	37.7	38.4	38.8	38.8
H9	513762	577696	29.2	35.0	36.9	37.2	37.5	37.7	37.6
H10	513449	577603	29.3	34.9	36.8	37.2	37.6	37.8	37.8
H11	513566	577655	29.4	35.0	36.9	37.3	37.6	37.8	37.8
H12	514700	579510	27.3	33.5	35.3	35.4	35.5	35.5	35.5
H13	513505	577609	29.2	34.8	36.7	37.1	37.4	37.7	37.6
H14	513565	577612	29.1	34.8	36.6	37.1	37.4	37.6	37.6
H15	512009	577691	30.6	34.3	36.5	37.9	38.9	39.4	39.4
H16	513794	577514	28.1	33.6	35.5	36.0	36.3	36.6	36.5
H17	511756	577894	31.2	34.6	36.8	38.4	39.5	40.1	40.0
H18	511689	577885	31.3	34.3	36.6	38.3	39.5	40.2	40.1
H19	513838	580300	26.3	32.5	34.3	34.4	34.5	34.5	34.5
H20	513548	577431	28.2	33.5	35.4	36.0	36.4	36.7	36.7
H21	514950	577873	24.8	30.9	32.7	32.9	33.0	33.1	33.1
H22	515053	579406	25.1	31.3	33.2	33.2	33.3	33.3	33.3
H23	513747	577308	27.1	32.3	34.3	35.0	35.4	35.7	35.7
H24	514759	577513	24.5	30.3	32.2	32.5	32.7	32.9	32.9
H25	513572	577269	27.3	32.4	34.4	35.1	35.7	36.0	36.0
H26	513974	577197	26.2	31.3	33.2	34.0	34.5	34.8	34.8
H27	515322	579275	23.5	29.8	31.6	31.7	31.7	31.7	31.7
H28	513631	577179	26.9	31.8	33.8	34.6	35.2	35.5	35.5
H29	515488	579130	22.6	29.0	30.8	30.8	30.8	30.8	30.8
H30	514568	577209	24.3	29.6	31.5	32.1	32.6	32.8	32.8
H31	514413	577149	24.6	29.8	31.8	32.4	32.9	33.2	33.2
H32	511831	577246	30.5	32.6	35.1	37.4	38.8	39.5	39.4
H33	515603	579094	22.0	28.3	30.1	30.1	30.1	30.1	30.1
H34	512444	580689	24.7	30.2	32.1	32.5	32.8	33.1	33.0
H35	515614	578103	21.4	27.7	29.5	29.5	29.5	29.5	29.5

	ITM	ITM	3m/s	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H36	515672	578122	21.1	27.4	29.2	29.2	29.2	29.2	29.2
H37	515646	578046	21.1	27.4	29.2	29.2	29.2	29.2	29.2
H38	515525	579630	21.6	27.9	29.7	29.7	29.7	29.7	29.7
H39	515332	577403	21.0	27.2	29.0	29.1	29.2	29.3	29.2

A noise contour map of the cumulative effects of all turbines is presented with a maximum sound power output at a wind speed of 8+ms^{-1} at 10 m height in **Figure 11.3**. The contour map in **Figure 11.3** assumes that all turbines are simultaneously downwind at the same time to each location which results in an overprediction of the noise levels.

11.16.8.4 Cumulative Noise Assessment

Table 11.20 gives the difference (margin) between the predicted noise level in **Table 11.19** and noise limits for each receptor. A negative margin indicates that the predicted noise levels are within the lower 40 dBA L90 limit at wind speeds below 5 m/s and within the 43 dBA L90 limit at all other wind speeds.

Table 11.20: Margin between predicted cumulative noise levels, LA 90, 40 dB limit at wind speeds less than 5 m/s and LA90, 43 dB for all other Wind Speeds

	ITM	ITM	3m/s	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H1	512160	578211	-7.2	-1.8	-2.8	-2.3	-1.9	-1.7	-1.7
H2	513445	578031	-7.6	-1.6	-2.8	-2.6	-2.4	-2.3	-2.3
H3	513072	579801	-8.5	-2.3	-3.5	-3.4	-3.3	-3.2	-3.2
H4	514329	579384	-9.1	-2.8	-4.0	-3.9	-3.9	-3.9	-3.9
H5	514339	577982	-10.6	-4.5	-5.7	-5.5	-5.4	-5.3	-5.3
H6	514756	578856	-11.1	-4.8	-6.0	-5.9	-5.9	-5.9	-5.9
H7	513435	577744	-9.7	-4.0	-5.1	-4.8	-4.5	-4.3	-4.3
H8	512511	577570	-9.9	-5.2	-6.2	-5.3	-4.6	-4.2	-4.2
H9	513762	577696	-10.8	-5.0	-6.1	-5.8	-5.5	-5.3	-5.4
H10	513449	577603	-10.7	-5.1	-6.2	-5.8	-5.4	-5.2	-5.2
H11	513566	577655	-10.6	-5.0	-6.1	-5.7	-5.4	-5.2	-5.2
H12	514700	579510	-12.7	-6.5	-7.7	-7.6	-7.5	-7.5	-7.5
H13	513505	577609	-10.8	-5.2	-6.3	-5.9	-5.6	-5.3	-5.4
H14	513565	577612	-10.9	-5.2	-6.4	-5.9	-5.6	-5.4	-5.4

	ITM	ITM	3m/s	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H15	512009	577691	-9.4	-5.7	-6.5	-5.1	-4.1	-3.6	-3.6
H16	513794	577514	-11.9	-6.4	-7.5	-7.0	-6.7	-6.4	-6.5
H17	511756	577894	-8.8	-5.4	-6.2	-4.6	-3.5	-2.9	-3.0
H18	511689	577885	-8.7	-5.7	-6.4	-4.7	-3.5	-2.8	-2.9
H19	513838	580300	-13.7	-7.5	-8.7	-8.6	-8.5	-8.5	-8.5
H20	513548	577431	-11.8	-6.5	-7.6	-7.0	-6.6	-6.3	-6.3
H21	514950	577873	-15.2	-12.1	-10.3	-10.1	-10.0	-9.9	-9.9
H22	515053	579406	-14.9	-8.7	-9.8	-9.8	-9.7	-9.7	-9.7
H23	513747	577308	-12.9	-7.7	-8.7	-8.0	-7.6	-7.3	-7.3
H24	514759	577513	-15.5	-9.7	-10.8	-10.5	-10.3	-10.1	-10.1
H25	513572	577269	-12.7	-7.6	-8.6	-7.9	-7.3	-7.0	-7.0
H26	513974	577197	-13.8	-8.7	-9.8	-9.0	-8.5	-8.2	-8.2
H27	515322	579275	-16.5	-10.2	-11.4	-11.3	-11.3	-11.3	-11.3
H28	513631	577179	-13.1	-8.2	-9.2	-8.4	-7.8	-7.5	-7.5
H29	515488	579130	-17.4	-11.0	-12.2	-12.2	-12.2	-12.2	-12.2
H30	514568	577209	-15.7	-10.4	-11.5	-10.9	-10.4	-10.2	-10.2
H31	514413	577149	-15.4	-10.2	-11.2	-10.6	-10.1	-9.8	-9.8
H32	511831	577246	-9.5	-7.4	-7.9	-5.6	-4.2	-3.5	-3.6
H33	515603	579094	-18.0	-11.7	-12.9	-12.9	-12.9	-12.9	-12.9
H34	512444	580689	-15.3	-9.8	-10.9	-10.5	-10.2	-9.9	-10.0
H35	515614	578103	-18.6	-12.3	-13.5	-13.5	-13.5	-13.5	-13.5
H36	515672	578122	-18.9	-12.6	-13.8	-13.8	-13.8	-13.8	-13.8
H37	515646	578046	-18.9	-12.6	-13.8	-13.8	-13.8	-13.8	-13.8
H38	515525	579630	-18.4	-12.1	-13.3	-13.3	-13.3	-13.3	-13.3
H39	515332	577403	-19.0	-12.8	-14.0	-13.9	-13.8	-13.7	-13.8

It can be seen from **Table 11.19** and **Table 11.20** that the predicted cumulative impact does not exceed the lower 40dBA L90 limit at wind speeds below 5 m/s or the 43dBA L90 limit at all other wind speeds.

11.17 MITIGATION MEASURES AND RESIDUAL EFFECTS

11.17.1 Construction Noise Mitigation

No significant construction noise effects have been identified. Therefore, no specific mitigation measures are required. General guidance for controlling construction noise through the use of good practice given in BS 5228 will be followed. During construction of the Project activity shall be limited to working times, except where delivery of large transport loads such as the turbines, where it may be necessary to transport outside of daytime hours.

During decommissioning noise levels are likely to be no more than predicted in **Table 11.15** as similar plant will be utilised. Any legislation, guidance or best practice relevant at the time of decommissioning will be complied with. All construction is a temporary day time activity.

11.17.2 Residual Construction and Decommissioning Effects

The residual effects are the same as the construction and decommissioning effects identified in this assessment.

11.17.3 Operational Noise Mitigation

The Project has been designed to comply with best practice, the Wind Energy Development Guidelines 2006 and recent September 2022 ABP noise limits.

All 5 turbines will have as standard STE fitted as best practice to reduce noise levels so no mitigation is required.

A warranty will be provided from the manufacturer of the turbine selected for the Project in order to ensure that the turbine selected does not require a tonal noise correction.

11.17.4 Residual Operational Effects

The residual effects are the same as the operational effects identified in this assessment.

11.17.5 Cumulative Effects

An assessment of the cumulative effects of noise from the Project together with the cumulative turbines in the nine wind farms in the vicinity have been predicted and assessed and found to be in compliance with the noise limits set in the Wind Energy Development Guidelines 2006.

11.18 SUMMARY OF SIGNIFICANT EFFECTS

Table 11.21 below summarises the effects.

Table 11.21: Summary of Effects

	Quality	Significance	Duration
Construction noise	Negative	Not significant	Temporary
Blasting Vibration	Negative	Not Significant	Momentary
Operational Noise	Negative	Not Significant	Long Term

11.19 STATEMENT OF SIGNIFICANCE

This Section has assessed the significance of the potential effects of the Project during operation, construction and decommissioning.

The effects of noise from the operation of the Project have been assessed using the methodology in the 2006 Guidelines, the methodology described in ETSU-R-97 and the IOA Good Practice Guide. Noise levels during operation of the Project have been predicted using the best practice calculation technique and compared with the noise limits in the 2006 Guidelines.

The draft 2019 Wind Energy Development Guidelines are subject to review and are liable to be changed.

It is understood that there are likely revisions to the draft consultation documents, however a mitigation strategy to incorporate a reduction in sound power level outputs with respect to directionality can be put in place to comply with any specific variation in noise limit levels if new guidelines are adopted. All turbines have software control incorporated so that the sound power levels can be reduced by direction and energy output.

Noise and vibration during construction and operation will comply with the guidelines already given. Noise and vibration during decommissioning of the wind farm will be managed to comply with best practice, legislation and guidelines current at that time so that effects are not significant.

12 LANDSCAPE AND VISUAL AMENITY

12.1 INTRODUCTION

This chapter assesses the impacts of the Project on landscape and visual amenity. The Project refers to all elements of the application for the proposed Inchamore Wind Farm (see **Chapter 2: Project Description**). The assessment will consider the potential effects during the following phases of the Development:

- Construction of the Project;
- Operation of the Project, and
- Decommissioning of the Project.

Common acronyms used throughout this EIAR can be found in **Appendix 1.2.** This chapter of the EIAR is supported by Figures provided in Volume III and by the following Appendix documents provided in Volume IV of this EIAR:

- **Appendix 12.1 – Visual Impact Assessments at Selected Viewpoints**
- **Appendix 12.2 – Cumulative Impact Analysis at Selected Viewpoints**

Landscape Impact Assessment (LIA) relates to changes in the physical landscape brought about by the Development, which may alter its character, and how this is experienced. This requires a detailed analysis of the individual elements and characteristics of a landscape that go together to make up the overall landscape character of that area. By understanding the aspects that contribute to landscape character, it is possible to make judgements in relation to its quality (integrity) and to identify key sensitivities. This, in turn, provides a measure of the ability of the landscape in question to accommodate the type and scale of change associated with the Development without causing unacceptable adverse changes to its character.

Visual Impact Assessment (VIA) relates to assessing effects on specific views and on the general visual amenity experienced by people. This deals with how the surroundings of individuals or groups of people may be specifically affected by changes in the content and character of views as a result of the change or loss of existing elements of the landscape and/or introduction of new elements. Visual impacts may occur from: visual obstruction (blocking of a view, be it full, partial or intermittent) or Visual Intrusion (interruption of a view without blocking).

Cumulative landscape and visual impact assessment is concerned with additional changes to the landscape or visual amenity caused by the Development in conjunction with other developments (associated or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future.

This Landscape and Visual Impact Assessment (LVIA) uses methodology as prescribed in the following guidance documents:

- Environmental Protection Agency publication 'Guidelines on the Information to be contained in Environmental Impact Assessment Reports (2022) and the accompanying Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (Draft 2015).
- Landscape Institute and the Institute of Environmental Management and Assessment publication entitled Guidelines for Landscape and Visual Impact Assessment (GLVIA) – Third Edition (2013).
- Scottish Natural Heritage Guidance Note: Cumulative Effect of Wind Farms (2012).
- Department of the Environment, Heritage and Local Government Wind Energy Development Guidelines (2006).
- Scottish Natural Heritage Visual representation of wind farms: Best Practice Guidelines (version 2.2 - 2017).

12.1.1 Statement of Authority

This Landscape and Visual Impact Assessment was prepared Richard Barker, Principal Landscape Architect at Macro Works Ltd, a specialist LVIA company with over 20 years' experience in the appraisal of effects from a variety of energy, infrastructure and commercial developments. Relevant experience includes LVIA work on over 140 on-shore wind farm proposals throughout Ireland, including six Strategic Infrastructure Development (SID) wind farms. Macro Works and its senior staff members are affiliated with the Irish Landscape Institute.

12.1.2 Description of the Project

The full description of the Project assessed hereunder is contained in Chapter 2 of the EIAR Project Description.

12.1.3 Definition of Study Area

The Wind Energy Development Guidelines published by the Department of the Environment, Heritage and Local Government (current 2006 and Draft Revised 2019) specify different radii for examining the Zone of Theoretical Visibility (ZTV) of proposed wind farm projects. The extent of this search area is influenced by turbine height, as follows:

- 15 km radius for blade tips up to 100 m;
- 20 km radius for blade tips greater than 100 m; and
- 25 km radius where landscapes of national and international importance exist.

In the case of this Project, the blade tips will range between 177 m and 185 m high. Thus, the minimum ZTV radius recommended is 20 km from the outermost turbines of the scheme. There are not considered to be any sites of national or international importance between 20 – 25 km and thus, the radius of the study area is considered acceptable at 20 km. Notwithstanding the full 20 km extent of the LVIA study area, there will be a particular focus on receptors and effects within the central study where there is higher potential for significant impacts to occur due to closer proximity to the proposed wind farm. When referenced within this assessment, the 'central study area' is the landscape within 5 km of the Site.

12.1.4 Assessment Structure

In line with the aforementioned Guidelines for Landscape and Visual Assessment, the structure of this chapter will consist of separate considerations of landscape effects and visual effects in the following order:

- Assessment of landscape value and sensitivity;
- Assessment of the magnitude of landscape effects;
- Assessment of the significance of landscape impacts;
- Assessment of visual receptor sensitivity;
- Assessment of visual impact magnitude at representative viewpoint locations (using photomontages);
- Assessment of visual impact significance, and
- Assessment of cumulative landscape and visual impacts.

12.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

Production of this Landscape and Visual Impact Assessment involved baseline work in the form of desktop studies and fieldwork comprising professional evaluation by qualified and experienced Landscape Architects. This entailed the following:

12.2.1 Desktop Study

- Establishing an appropriate Study Area from which to study the landscape and visual impacts of the proposed wind farm;
- Review of a Zone of Theoretical Visibility (ZTV) map, which indicates areas from which the Development is potentially visible in relation to terrain within the Study Area;
- Review of relevant County Development Plans, particularly with regard to sensitive landscape and scenic view/route designations;
- Selection of potential Viewshed Reference Points (VRPs) from key visual receptors to be investigated during fieldwork for actual visibility and sensitivity.

12.2.2 Fieldwork

- Recording of a description of the landscape elements and characteristics within the Study Area.
- Selection of a refined set of viewpoints for assessment based on relevance and the degree of intervening screening. This includes the capture of reference images and grid reference coordinates for each VRP location for the visualisation specialist to prepare photomontages.

12.2.3 Appraisal

- Consideration of the receiving landscape with regard to overall landscape character as well as the salient features of the study area including landform, drainage, vegetation, land use and landscape designations.
- Consideration of the visual environment including receptor locations such as centres of population and houses; transport routes; public amenities and facilities and; designated and recognised views of scenic value.
- Consideration of design guidance and planning policies.
- Consideration of potentially significant effects and the mitigation measures that could be employed to reduce such effects.
- Consideration of the significance of residual landscape impacts.
- Consideration of the significance of residual visual impacts aided by photomontages prepared at the selected viewpoint locations.
- Consideration of cumulative landscape and visual effects in combination with other surrounding developments that are existing, permitted or proposed (in planning awaiting a decision or pre-planning/concept – where information is publicly available).

12.2.4 Assessment Criteria for Landscape Impacts

The classification system used by Macro Works to determine the significance of landscape and visual impacts is based on the IEMA Guidelines for Landscape and Visual Impact Assessment (2013). When assessing the potential impacts on the landscape resulting from a wind farm development, the following criteria are considered:

- Landscape character, value and sensitivity;
- Magnitude of likely impacts; and
- Significance of landscape effects.

The sensitivity of the landscape to change is the degree to which a particular landscape receptor (Landscape Character Area (LCA) or feature) can accommodate changes or new features without unacceptable detrimental effects to its essential characteristics. Landscape

Value and Sensitivity is classified using criteria derived for the Guidelines for Landscape and Visual Impact Assessment in **Table 12.1**.

Table 12.1: Landscape Value and Sensitivity

Sensitivity	Description
Very High	Areas where the landscape character exhibits a very low capacity for change in the form of development. Examples of which are high value landscapes, protected at an international or national level (World Heritage Site/National Park), where the principal management objectives are likely to be protection of the existing character.
High	Areas where the landscape character exhibits a low capacity for change in the form of development. Examples of which are high value landscapes, protected at a national or regional level (Area of Outstanding Natural Beauty), where the principal management objectives are likely to be considered conservation of the existing character.
Medium	Areas where the landscape character exhibits some capacity and scope for development. Examples of which are landscapes, which have a designation of protection at a county level or at non-designated local level where there is evidence of local value and use.
Low	Areas where the landscape character exhibits a higher capacity for change from development. Typically this would include lower value, non-designated landscapes that may also have some elements or features of recognisable quality, where landscape management objectives include, enhancement, repair and restoration.
Negligible	Areas of landscape character that include derelict, mining, industrial land or are part of the urban fringe where there would be a reasonable capacity to embrace change or the capacity to include the development proposals. Management objectives in such areas could be focused on change, creation of landscape improvements and/or restoration to realise a higher landscape value

The magnitude of a predicted landscape impact is a product of the scale, extent or degree of change that is likely to be experienced as a result of the Project. The magnitude takes into account whether there is a direct physical impact resulting from the loss of landscape components and/or a change that extends beyond the proposal Site boundary that may have an effect on the landscape character of the area, as outlined in **Table 12.2** below derived for the Guidelines for Landscape and Visual Impact Assessment.

Table 12.2: Magnitude of Landscape Impacts

Sensitivity	Description
Very High	Change that would be large in extent and scale with the loss of critically important landscape elements and features, that may also involve the introduction of new uncharacteristic elements or features that contribute to an overall change of the landscape in terms of character, value and quality.
High	Change that would be more limited in extent and scale with the loss of important landscape elements and features, that may also involve the introduction of new

Sensitivity	Description
	uncharacteristic elements or features that contribute to an overall change of the landscape in terms of character, value and quality.
Medium	Changes that are modest in extent and scale involving the loss of landscape characteristics or elements that may also involve the introduction of new uncharacteristic elements or features that would lead to changes in landscape character, and quality.
Low	Changes affecting small areas of landscape character and quality, together with the loss of some less characteristic landscape elements or the addition of new features or elements.
Negligible	Changes affecting small or very restricted areas of landscape character. This may include the limited loss of some elements or the addition of some new features or elements that are characteristic of the existing landscape or are hardly perceivable.

The significance of a landscape impact is based on a balance between the sensitivity of the landscape receptor and the magnitude of the impact. The significance of landscape impacts is arrived at using **Table 12.3** below.

Table 12.3: Impact Significance Matrix

	Sensitivity of Receptor				
Magnitude	***Very High***	***High***	***Medium***	***Low***	***Negligible***
Very High	Profound	Profound-substantial	Substantial	Moderate	Slight
High	Profound-substantial	Substantial	Substantial - moderate	Moderate - slight	Slight - imperceptible
Medium	Substantial	Substantial - moderate	Moderate	Slight	Imperceptible
Low	Moderate	Moderate - slight	Slight	Slight - imperceptible	Imperceptible
Negligible	Slight	Slight - imperceptible	Imperceptible	Imperceptible	Imperceptible

Note: Judgements deemed 'substantial' and above are considered to be 'significant impacts' in EIA terms.)

12.2.5 Assessment Criteria for Visual Impact

As with the landscape impact, the visual impact of the proposed wind farm will be assessed as a function of receptor sensitivity versus magnitude. In this instance, the sensitivity of visual receptors, weighed against the magnitude of visual effects.

12.2.5.1 Visual Sensitivity

Unlike landscape sensitivity, visual sensitivity has an anthropocentric basis. Visual sensitivity is a two-sided analysis of <u>receptor susceptibility</u> (people or groups of people) versus the <u>value of the view</u> on offer at a particular location.

To assess the susceptibility of viewers and the amenity value of views, the assessors use a range of criteria and provide a four-point weighting scale ('Strong Association' to 'Negligible Association') to indicate how strongly the viewer/view is associated with each of the criterion. Susceptibility criteria is extracted directly from the IEMA Guidelines for Landscape and Visual Assessment (2013), whilst the value criteria relate to various aspects of a view that might typically be related to high amenity including, but not limited to, scenic designations. These are set out below.

Susceptibility of receptor group to changes in view

This is one of the most important criteria to consider in determining overall visual sensitivity because it is the single category dealing with viewer susceptibility. In accordance with the IEMA Guidelines for Landscape and Visual Assessment (3rd edition 2013) visual receptors most susceptible to changes in views and visual amenity are:

- Residents at home;
- People, whether residents or visitors, who are engaged in outdoor recreation, including use of public rights of way, whose attention or interest is likely to be focussed on the landscape and on particular views;
- Visitors to heritage assets, or to other attractions, where views of the surroundings are an important contributor to the experience;
- Communities where views contribute to the landscape setting enjoyed by residents in the area; and
- Travellers on road rail or other transport routes where such travel involves recognised scenic routes and awareness of views is likely to be heightened.

Visual receptors that are less susceptible to changes in views and visual amenity include:

- People engaged in outdoor sport or recreation, which does not involve or depend upon appreciation of views of the landscape; and
- People at their place of work whose attention may be focussed on their work or activity, not their surroundings and where the setting is not important to the quality of working life.

12.2.5.1.1 Values typically associated with Visual Amenity

Recognised scenic value of the view

These are usually represented by County Development Plan designations, guidebooks, touring maps, postcards. These represent a consensus in terms of which scenic views and routes within an area are strongly valued by the population because in the case of County Development Plans, at least, a public consultation process is required;

Views from within highly sensitive landscape areas. Again, highly sensitive landscape designations are usually part of a county's Landscape Character Assessment, which is then incorporated with the County Development Plan and is therefore subject to the public consultation process. Viewers within such areas are likely to be highly attuned to the landscape around them;

Intensity of use, popularity.
Whilst not reflective of the amenity value of a view, this criterion relates to the number of viewers likely to experience a view on a regular basis and whether this is significant at county or regional scale;

Connection with the landscape.
This considers whether or not receptors are likely to be highly attuned to views of the landscape i.e., commuters hurriedly driving on busy national route versus hill walkers directly engaged with the landscape enjoying changing sequential views over it;

Provision of elevated panoramic views.
This relates to the extent of the view on offer and the tendency for receptors to become more attuned to the surrounding landscape at locations that afford broad vistas;

Sense of remoteness and/or tranquillity.
Remote and tranquil viewing locations are more likely to heighten the amenity value of a view and have a lower intensity of development in comparison to dynamic viewing locations such as a busy street scene, for example;

Degree of perceived naturalness.
Where a view is valued for the sense of naturalness of the surrounding landscape it is likely to be highly sensitive to visual intrusion by obvious human interventions;

Presence of striking or noteworthy features.
A view might be strongly valued because it contains a distinctive and memorable landscape feature such as a promontory headland, lough or castle;

Historical, cultural or spiritual value.
Such attributes may be evident or sensed at certain viewing locations that attract visitors for the purposes of contemplation or reflection heightening the sense of their surroundings;

Rarity or uniqueness of the view.
This might include the noteworthy representativeness of a certain landscape type and considers whether other similar views might be afforded in the local or the national context;

Integrity of the landscape character in view.
This criterion considers the condition and intactness of the landscape in view and whether the landscape pattern is a regular one of few strongly related components or an irregular one containing a variety of disparate components;

Sense of place.
This criterion considers whether there is special sense of wholeness and harmony at the viewing location; and

Sense of awe.
This criterion considers whether the view inspires an overwhelming sense of scale or the power of nature.

Those locations where highly susceptible receptors or receptor groups are present and which are deemed to satisfy many of the view value criteria above are likely to be judged to have a high visual sensitivity and vice versa.

12.2.5.2 Visual Impact Magnitude

The magnitude of visual effects is determined on the basis of two factors: the visual presence of the proposal and its effect on visual amenity.

Visual presence is a somewhat quantitative measure relating to how noticeable or visually dominant the proposal is within a particular view. This is based on a number of aspects beyond simply scale in relation to distance. Some of these include the extent of the view as well as its complexity and the degree of existing contextual movement experienced such as might occur where turbines are viewed as part of / beyond a busy street scene. The backdrop against which the Project is presented and its relationship with other focal points or prominent features within the view is also considered. Visual presence is essentially a measure of the relative visual dominance of the proposal within the available vista and is often expressed as such i.e., minimal, sub-dominant, co-dominant, dominant, highly dominant.

For wind energy developments, a strong visual presence is not necessarily synonymous with adverse impact. Instead, the 2012 Fáilte Ireland survey entitled 'Visitor Attitudes On The Environment – Wind Farms' found that *"Compared with other types of development in the Irish landscape, wind farms elicited a positive response when compared to telecommunication masts and steel electricity pylons"*…. and that *"most* (tourists) *felt that their presence did not detract from the quality of their sightseeing, with the largest proportion (45%) saying that the presence of the wind farm had a positive impact on their enjoyment of sightseeing…*".

The purpose here is not to suggest that turbines are either inherently liked or disliked, but rather to highlight that the assessment of visual impact magnitude for wind turbines is more complex than just the degree to which turbines occupy a view. Furthermore, a clear and comprehensive view of a wind farm might be preferable in many instances to a partial, cluttered view of turbine components that are not so noticeable within a view. On the basis of these reasons, the visual amenity aspect of assessing impact magnitude is qualitative and considers such factors as the spatial arrangement of turbines both within the scheme and in relation to surrounding terrain and land cover. It also examines whether the Project contributes positively to the existing qualities of the vista or results in distracting visual effects and disharmony.

It should be noted that as a result of this two-sided analysis, a high order visual presence can be moderated by a low level of effect on visual amenity and vice versa. Given that wind turbines do not represent significant bulk, visual impacts result almost entirely from visual 'intrusion' rather than visual 'obstruction' (the blocking of a view). The magnitude of visual impacts classified in **Table 12.4** derived from the Guidelines for Landscape and Visual Impact Assessment:

Table 12.4: Magnitude of Visual Impacts

Sensitivity	Description
Very High	The proposal intrudes into a large proportion or critical part of the available vista and is without question the most noticeable element. A high degree of visual clutter or disharmony is also generated, strongly reducing the visual amenity of the scene
High	The proposal intrudes into a significant proportion or important part of the available vista and is one of the most noticeable elements. A considerable degree of visual clutter or disharmony is also likely to be generated, appreciably reducing the visual amenity of the scene
Medium	The proposal represents a moderate intrusion into the available vista, is a readily noticeable element and/or it may generate a degree of visual clutter or disharmony,

Sensitivity	Description
	thereby reducing the visual amenity of the scene. Alternatively, it may represent a balance of higher and lower order estimates in relation to visual presence and visual amenity
Low	The proposal intrudes to a minor extent into the available vista and may not be noticed by a casual observer and/or the proposal would not have a marked effect on the visual amenity of the scene
Negligible	The proposal would be barely discernible within the available vista and/or it would not detract from, and may even enhance, the visual amenity of the scene

12.2.6 Visual Impact Significance

As stated above, the significance of visual impacts is a function of visual receptor sensitivity and visual impact magnitude. This relationship is expressed in the same significance matrix included for Landscape Impact Significance at **Error! Reference source not found.**

12.2.7 Quality and Duration of Effects

In addition to assessing the significance of landscape effects and visual effects, EPA Guidance (2022) requires that the quality of the effects is also determined. This could be negative/adverse, neutral, or positive/beneficial.

- Positive Effects: A change which improves the quality of the environment;
- Neutral and/or balanced Effects: No effects, or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error, and
- Negative/adverse Effects: A change that reduces the quality of the environment.

The same EPA guidelines also set out categories of impact duration:

- Temporary – Lasting for one year or less;
- Short Term – Lasting one to seven years;
- Medium Term – Lasting seven to fifteen years;
- Long Term – Lasting fifteen years to sixty years; and
- Permanent – Lasting over sixty years.

In the case of commercial wind energy developments and the associated introduction of new moving structures within rural and upland areas, the quality of landscape and visual effects will almost always be negative, rather than positive or even neutral. Unless otherwise stated, the quality of landscape and visual effect judgements herein can be taken as negative.

In terms of duration, the proposed turbines will have a Long Term impact as the permission is being sought for a 35 year period after which the turbines will be decommissioned. Some other elements of the Project relating to access tracks and elements of the grid connection will remain in perpetuity and will therefore have Permanent effects.

12.2.8 Assessment Criteria for Cumulative Effects

The Scottish Natural Heritage Guidance relating to 'Assessing the Cumulative Effects of Onshore Wind Farms (2018) identify that cumulative impacts on visual amenity consist of combined visibility and sequential effects. The same categories have also been adopted in the Landscape Institute's 2013 revision of the Landscape and Visual Impact Assessment Guidelines. The principal focus of wind energy cumulative impact assessment guidance relates to other wind farms - as opposed to other forms of development. This will also be the main focus herein, albeit with a subsequent consideration of cumulative impacts with other forms of notable development (existing, permitted or proposed), particularly within the central study area.

'Combined visibility occurs where the observer is able to see two or more developments from one viewpoint. Combined visibility may either be in combination (where several wind farms are within the observer's arc of vision at the same time) or in succession (where the observer has to turn to see the various wind farms).

Sequential effects occur when the observer has to move to another viewpoint to see different developments. The occurrence of sequential effects may range from frequently sequential (the features appear regularly and with short time lapses between, depending on speed of travel and distance between the viewpoints) to occasionally sequential (long time lapses between appearances, because the observer is moving very slowly and / or there are large distances between the viewpoints.)'

Cumulative impacts of wind farms tend to be adverse rather than positive as they relate to the addition of moving manmade structures into a landscape and viewing context that already contains such development. Based on guidance contained within the SNH Guidelines relating to the Cumulative Effects of Wind Farms (2012) and the DoEHLG Wind Energy Guidelines (2006), cumulative impacts can be experienced in a variety of ways.

Table 12.5 provides Macro Works' criteria for assessing the magnitude of cumulative impacts, which are based on the SNH Guidelines (2018).

Table 12.5: Magnitude of Cumulative Impacts

Magnitude of Impact	Description
Very High	• The proposed wind farm will strongly contribute to wind energy development being the defining element of the surrounding landscape. • It will strongly contribute to a sense of wind farm proliferation and being surrounded by wind energy development. • Strongly adverse visual effects will be generated by the proposed turbines in relation to other turbines.
High	• The proposed wind farm will contribute significantly to wind energy development being a defining element of the surrounding landscape. • It will significantly contribute to a sense of wind farm proliferation and being surrounded by wind energy development. • Significant adverse visual effects will be generated by the proposed turbines in relation to other turbines.
Medium	• The proposed wind farm will contribute to wind energy development being a characteristic element of the surrounding landscape. • It will contribute to a sense of wind farm accumulation and dissemination within the surrounding landscape. • Adverse visual effects might be generated by the proposed turbines in relation to other turbines.
Low	• The proposed wind farm will be one of only a few wind farms in the surrounding area and will be viewed in isolation from most receptors. • It might contribute to wind farm development becoming a familiar feature within the surrounding landscape. • The design characteristics of the proposed wind farm accord with other schemes within the surrounding landscape and adverse visual effects are not likely to occur in relation to these.
Negligible	• The proposed wind farm will most often be viewed in isolation or occasionally in conjunction with other distant wind energy developments. • Wind energy development will remain an uncommon landscape feature in the surrounding landscape. • No adverse visual effects will be generated by the proposed turbines in relation to other turbines.

12.3 BASELINE DESCRIPTION

12.3.1 Landscape Baseline

The landscape baseline represents the existing landscape context and is the scenario against which any changes to the landscape brought about by the proposal will be assessed. This also includes reference to any relevant landscape character appraisals and the current landscape policy context (both are generally contained within County Development Plans).

A description of the landscape context of the Project and wider study area is provided below. Additional descriptions of the landscape, as viewed from each of the selected viewpoints, are provided under the detailed assessments later using a similar structure. Although this description forms part of the landscape baseline, many of the landscape elements identified also relate to visual receptors i.e., places and transport routes from which viewers can potentially see the Project. The visual resource will be described in greater detail in **Section 12.4** below.

12.3.1.1 Landform & Drainage

Overall, the study area is characterised by a notable variance of landform, which arises from wide, lowland valleys less than 100 m AOD, to mountain tops over 800 m AOD; ranges mostly angled in a north-east/south-west direction. In terms of drainage, there is an abundance of rivers, streams and, to a lesser extent, loughs and lakes throughout the study area.

<u>The Site</u>

Landform within the Site is notably upland and sloping, with considerable variance in terrain elevation. The Derrynasaggart ridgeline marks the Site's northern/ north-western boundary, peaking at 460 m AOD with the lowest terrain of the Site dropping to approx. 270 m AOD. In the east of the Site, two small streams flow north-south to drain a bowl-like, upland tributary valley, while in the west of the Site are a further three streams. All five of these streams feed into the Inchamore Stream, which in turn flows into the Bardinch and Sullane Rivers flowing east towards Ballyvourney.

Plate 12.1: Bowl-like, upland tributary valley in the east of the Site

Central study area:

The principle landform within the Site and its immediate vicinity, as well as the central study area, is that of the Derrynasaggart Mountains that align a section of the mid Cork-Kerry border, and which reach 694 m AOD at their highest. The central study area is characterised by mountains and hillscapes with relatively narrow, visually enclosed valleys between these elevations. Within approx. 700 m west of the Site is Coomagearlahy Mountain (506 m AOD.) In the north of the central study area is the Owengarve and Clydagh Rivers, north of which are the various foothills that ascend towards the Paps of Anu, approx. 6.5 km north of the Site: a pair of similarly-shaped mountains adjacent to each other, both between 690-694 m AOD. Along or near such ridgelines are multiple corrie lakes and/or small mountain loughs. In the south of the central study area, landform is marginally lower, with it gravitating between 400-500 m AOD at hill tops in the south-western quadrant, before largely dropping between 200-300 m AOD in the south-east and east of the central study area, particularly along the wider, U-shaped valley carved out by the Sullane River.

5-10 km away:

Between 5-10 km from the Site, there are also several notable mountains, aside from the aforementioned Paps. These include Caherbarnagh (681 m AOD) and Mullaghanish (649 m AOD) in the northeast and Crohane (656 m AOD) in the northwest, while in the south, the landform is marginally less dramatic, excepting summits such as Mweelin (487 m AOD) and Carrigalougha (423 m AOD), approx. 7 km south of the Site. To the east and southeast, topography mostly lowers to less than 250 m AOD, with increasingly wider, lower valleys. The Sullane River is dominant in this section, fed by its tributary, the River Douglas. Other rivers of note 5-10 km from the Site include the Toon (southeast), the Roughty (southwest) and the Owenskeagh (north).

10-20 km away:

Between 10-20 km from the Site, there is considerably greater diversity in landform. In terms of scale, the most apparent is Mangerton (843 m AOD), followed by Torc Mountain (535 m AOD), which lie 14-15 km west of the Site. Carran (604 m AOD) and Coomataggart (530 m AOD) are located in the south-west. More than 15 km to the south is Carrigmount (546 m AOD), Douce (476 m AOD) and Doughhill (471 m AOD) mountains, though terrain is considerably lower in the south-eastern quadrant. Beyond 10 km to the north and north-east, terrain is distinctively lower than that of the Paps, rarely lifting above 200 m. However, more than 10 km due east of the Site, land lifts to 497 m AOD at the summit of Musherbeg.

In terms of watercourses, more than 10 km from the Site is the Blackwater, Beheenagh and Awnaskirtaun Rivers in the north and northwest, as well as the Foherish, Garrane and Keel Rivers in the east of the study area. The Bunsheelin, Owengariff and Lee Rivers are found in the south, with the Slaheny River, the Roughty River and its tributary, the Owbeg, in the south-west. In addition, larger lakes can be found within the study area. Lough Allua in the south and Gougane Barra in the south-west are well known, but the largest lakes of the study area reside in the north-west: Lough Guitane, Muckross Lake and Lough Leane.

Plate 12.2: Landform in the south of the Study Area

Plate 12.3: Mountainous profile within the Study Area

12.3.1.2 Vegetation & Land Use

There is considerable variance of vegetation and land use across the study area, ranging from intensive pastoral agriculture upon the lowlands, to more marginal agriculture and commercial forestry in more elevated, yet accessible lands, to unmanaged upland and mountain heath and bog.

The Site:

The Site spans approx. 4 km in a northeast-southwest direction, covering a variety of land uses with an evident anthropocentric imprint. In the east of the Site, within the aforementioned bowl-like valley, commercial conifer plantations at various stages of the maturation/harvesting cycle are prevalent on the upper slopes. Marginal, rush-infested, pastoral agriculture is dominant in the floor of this tributary valley. Although an upland, marginal context, there is considerable evidence of a strong anthropocentric imprint along these upland slopes, in the form of drainage excavations and multiple vehicular tracks, of various ages and conditions.

In the central south of the Site, a large, triangular block of commercial forestry is present, immediately north of which are a derelict building and numerous vehicular tracks ascending up the hillside. Upland heath dominates the upper slopes, as it scales up to the ridgeline of the range, which marks the Site's northern/ north-western boundary as well as the Cork/ Kerry border. Here there is evidence of considerable drainage excavations and multiple vehicular tracks.

The south-western part of the Site is also dominated by commercial conifer plantations at various stages of the maturation/harvesting cycle. However, a wide, private vehicular track passes through this segment of the Site, and appears to be connecting wind turbines on adjacent lands to the Site.

Central study area:

While pastoral agriculture is prevalent in the south-eastern quadrant of the central study area, most other areas of agriculture tend to be marginal pasture in a small, sometimes poorly drained fields. More patent is the uplands/mountains that share a combination of commercial conifer plantations and upland/mountain heath, with evidence of multiple wind farms along or below ridgelines within, or close to, the central study area. Immediately adjoining the western perimeter of the Site, in County Kerry, is the Coomagearlahy Wind farm, with at least one turbine located within 250 m of the Site boundary, and just to the south of that is the Glanlee (Midas) wind farm.

Within the relatively narrow, visually enclosed, lowland valleys between the high hills and mountains, there is some evidence of intensive pastoral practises in medium-sized fields. In addition, there are roads and just one settlement: the village of, located approx. 3 km south-east of the Development.

Plate 12.4: Coolea village within the central Study Area

Plate 12.5: Wind farms across ridgelines within or close to the Study Area

Wider study area (i.e. 5-20 km away):

The variance of vegetation and land use in the wider study area broadly mirrors that of the central study area. However, in the south-east quadrant and more than 10 km north of the Site, intensive, lowland agricultural practises are dominant, in medium-sized fields with often low or mid-height hedgerows serving as field boundaries. Representative of land uses in such elevated terrain across the province and country, the multiple mountains and high hillscapes found throughout the wider study area are mostly a mix of commercial conifer plantations with upland/mountain heath. This includes Killarney National Park in the north-west and Gougane Barra Forest Park in the south-west, as well as mountains such as Mangerton or the Paps.

Plate 12.6: Intensive agricultural practises in the south-eastern quadrant of the Study Area

While wind energy developments are visible across much of the study area, they are not as apparent as within or close to the central study area. There is also some evidence of quarrying and/or extractive land use in the north and northeast. Lastly, there are numerous settlements, residences and roads in the study area, as well as lakes/loughs, particularly in the north-western quadrant.

Plate 12.7: The ridgelines above Killarney National Park, in the north-east of the Study Area

Plate 12.8: Commercial conifer plantations across a hillscape of the Study Area

12.3.2 Planning Policy Context

12.3.2.1 Department of Environment, Heritage and Local Government Wind Energy Development Guidelines (current 2006, Draft Revised 2019)

In December 2019 the Department of Housing, Planning and Local Government issued the Draft Revised Wind Energy Development Guidelines. Following consultation and review, these draft revised guidelines intend to supersede the current 2006 Wind Energy Development Guidelines, once fully adopted. With regards to LVIA, the one difference between the Draft Revised Wind Energy Development Guidelines (2019) and the current 2006 Wind Energy Development Guidelines, is the incorporation of minimum residential 'Setback', which is not contained in the current 2006 Wind Energy Development Guidelines.

'Setback'

Section 6.18 of the 2019 Draft Revised Guidelines refers to "siting in relation to individual properties," which is colloquially known as "setback." This is understood to be the only landscape and visual related change to the 2006 guidelines that is of potential relevance to the Project. The only SPPR (Specific Planning Policy Requirement) that applies to "setback" in the revised Guidelines is:

SPPR 2- "With the exception of applications where reduced setback requirements have been agreed with relevant owner(s) as outlined at 6.18.2 below, planning authorities and An Bord Pleanála (where relevant), shall, in undertaking their development planning and development management functions, ensure that a setback distance for visual amenity purposes of 4 times the tip height of the relevant wind turbine shall apply between each wind turbine and the nearest point of the curtilage of any residential property in the vicinity of the proposed development, subject to a mandatory minimum setback of 500 metres from that residential property. Some discretion applies to planning authorities when agreeing separation distances for small-scale wind energy developments generating energy primarily for onsite usage. The planning authority or An Bord Pleanála (where relevant), shall not apply a setback distance that exceeds these requirements for visual amenity purposes."

There are no inhabited dwellings contained within the specified setback distance of 4 times the tip height of the relevant wind turbine (740 m) as listed in the Draft Revised Wind Energy Development Guidelines (2019) for the tip height of the proposed turbines.

The current 2006 and Draft Revised Wind Energy Development Guidelines (2019) both provide the same guidance on wind farm siting and design criteria for a number of different landscapes types. It is not considered that the Project is contained wholly within one of these particular landscape types. Rather, there are three landscape types that would appear most applicable:

- 'Mountain Moorland';
- 'Transitional Marginal landscape', and
- 'Hilly & flat farmland'.

Mountain Moorland:

Location – *"It may be acceptable to locate wind energy developments on ridges and peaks. They may also be appropriate, in certain instances, in a saddle between two peaks where they will be partially contained or "framed." A third acceptable location is lower down on sweeping mountainside."*

Spatial extent - *"Given the typical extensive areas of continuous unenclosed ground, larger wind energy developments can generally be accommodated because they correspond in terms of scale..."*

Spacing - *"All spacing options are usually acceptable. Where a wind energy development is clearly visible on a crest or ridge there is considerable scope to vary the rhythm, though on simple ridges, regular spacing may be more appropriate."*

Layout - *"All layout options are usually acceptable. However, the best solutions would either be a random layout, and clustered where located on hills and ridges … or a grid layout on sweeping and continuously even areas of moorland or plateaux…"*

Height - *"There would generally be no height restrictions on mountain moorlands as the scale of landscape is so great…"*

Cumulative - *"The open expanse of such landscapes can absorb a number of wind energy developments, depending on their proximity. The cumulative impact will also depend on the actual visual complexity of landform, whether steeply rolling, undulating or gently sweeping. The more varied and undulating an area is topographically, the greater its ability to absorb and screen wind energy developments. The aesthetic effect of wind energy developments in these landscapes is acceptable where each one is discrete, standing in relative isolation."*

Transitional Marginal Landscapes:

Location - *"As wind energy developments, for reasons of commercial viability, will typically be located on ridges and peaks, a clear visual separation will be achieved from the complexity of lower ground. However, wind energy developments might also be located at lower levels in extensive areas of this landscape type, where they will be perceived against a relatively complex backdrop. In these situations it is important to minimise visual confusion such as the crossing by blade sets of skylines, buildings, utility lines and varied landcover."*

Spatial Extent - *"Wind energy developments in these landscapes should be relatively small in terms of spatial extent. It is important that they do not dominate but achieve a balance with their surrounds, especially considering that small fields and houses are prevalent."*

Spacing - *"All options are possible, depending on the actual landscape characteristics. However, irregular spacing is likely to be most appropriate…"*

Layout - *"The likely location of wind energy developments on ridges suggests a linear or staggered linear layout whereas on broader hilltops they could be linear or clustered…"*

Height - *"…where the upper ground is relatively open and visually extensive, taller turbines may be more appropriate. In terms of perceived height, the profile can be even or uneven, depending on the profile and visual complexity of the terrain involved. The more rugged and undulating, the greater the acceptability of an uneven profile provided it does not result in significant visual confusion and conflict."*

Cumulative - *"This would have to be evaluated on a case-by-case basis, but great caution should be exercised. The spatial enclosure often found in transitional marginal landscapes is likely to preclude the possibility of seeing another wind energy development. However, should two or more wind energy developments be visible within a confined setting a critically adverse effect might result, depending on turbine height and wind energy development extent and proximity."*

Hilly and Flat Farmland:

Location *- "Location on ridges and plateaux is preferred … Elevated locations are also more likely to achieve optimum aesthetic effect."*

Spatial extent *- "This can be expected to be quite limited in response to the scale of fields and such topographic features as hills and knolls."*

Spacing *-"The optimum spacing pattern is likely to be regular, responding to the underlying field pattern."*

Layout *- "The optimum layout is linear, and staggered linear on ridges (which are elongated) and hilltops (which are peaked), but a clustered layout would also be appropriate on a hilltop."*

Height - *"Turbines should relate in terms of scale to landscape elements and will therefore tend not to be tall. However, an exception to this would be where they are on a high ridge or hilltop of relatively large scale. The more undulating the topography the greater the acceptability of an uneven profile, provided it does not result in significant visual confusion and conflict."*

Cumulative - *"It is important that wind energy development is never perceived to visually dominate. However, given that these landscapes comprise hedgerows and often hills, and that views across the landscape will likely be intermittent and partially obscured, visibility of two or more wind energy developments is usually acceptable."*

It is considered that there is a fairly mixed combination of guidance outlined above for the various landscape types, which make up the setting of the Project. However, all of it promotes a site-specific design response.

In terms of location, the combined guidance suggests suitability for elevated/hilltop ridges or peaks that are considered sufficiently distant to ensure a distinct separation from villages and towns in the study area.

In terms of spatial extent, the combined guidance leads towards larger wind energy developments that can be accommodated, but which achieve a balance with their surrounds. However, on lower slopes development is expected to be more limited, in relation to topographic features.

The combined guidance in relation to turbine spacing and layout leads towards the summation that all design options are potentially acceptable depending on the nature of the Site and its immediate surrounds.

Various turbine height options may be acceptable according to the combined guidance, though taller turbines may be more appropriate. At an overall height of between 177 m and 185 m inclusive, the proposed turbines are typical of current trends for recent planning applications and permissions.

In terms of cumulative effect, the combined guidance suggests that while some reasonable caution should be expressed, the undulating nature of this landscape can absorb a number of wind energy developments as long as that development is not perceived to visually dominate. Crucially, such a topographically varied and undulating area has a greater ability to absorb and/or screen wind energy developments; a critical reason as to why there are several wind farms contained within, and in the vicinity of, the central study area.

Overall, it is considered that the Project design is in accordance with the guidance for this varied landscape setting and does not conflict with it.

12.3.2.2 Cork County Development Plan 2022-2028

Cork County Council recently adopted a new County Development Plan for the period 2022-2028. It should be noted that the same Landscape Character Assessment prepared for County Cork in 2007 (Appendix F) remains the basis of landscape policy and the same scenic designations have carried over from the 2014-2020 Plan into the 2022-2028 Plan.

The Development Plan includes Chapter 14 'Green Infrastructure and Recreation', within which, sub-section 14.7 relates to landscape. A number of general objectives relating to landscape are noted within this chapter and are included below.

GI 14-9: Landscape:

a) *Protect the visual and scenic amenities of County Cork's built and natural environment.*

b) *Landscape issues will be an important factor in all land-use proposals, ensuring that a pro-active view of development is undertaken while maintaining respect for the environment and heritage generally in line with the principle of sustainability.*

c) *Ensure that new developments meet high standards of siting and design.*

d) *Protect skylines and ridgelines from development.*

e) *Discourage proposals necessitating the removal of extensive amounts of trees, hedgerows and historic walls or other distinctive boundary treatments.*

GI 14-10: Draft Landscape Strategy:

"Ensure that the management of development throughout the County will have regard for the value of the landscape, its character, distinctiveness and sensitivity as recognised in the Cork County Draft Landscape Strategy and its recommendations, in order to minimize the visual and environmental impact of development, particularly in areas designated as High Value Landscapes where higher development standards (layout, design, landscaping, materials used) will be required."

A Landscape Character Assessment was undertaken as part of the Draft Cork Landscape Strategy (2007). This has been incorporated within the current Development Plan and divides the county into 16 No. Landscape Character Types (LCTs). The Site and most of the central study area (within County Cork) is contained in LCT15b 'Ridged and Peaked Upland'. Also within the southeast portion of the central study area is the LCT12a 'Rolling Marginal and Forested Middleground (see **Figure 12.1**).

<u>LCT15b 'Ridged and Peaked Upland':</u>

Within the Draft Cork Landscape Strategy (2007), LCT15b - 'Ridged and Peaked Upland' is described as having:

- Landscape Value: Medium
- Landscape Sensitivity: Medium
- Landscape Importance: County

Its 'Landscape Description' entails:

"Ridged, peaked and forested upland landscape type which is located south of Millstreet town, includes much of the Millstreet to Macroom road (R582) and swings south west towards the county boundary west of Ballyvourney. This landscape type has been glaciated and comprises a fairly rugged and rolling mountainous topography at a relatively high elevation. The area around the Boggeragh Mountains provides a good example of this landscape type … The landscape, with its rapid and steep rising and falling, seems to tumble down along the valleys. The rugged and diverse landcover, involving moorland, heath and scrub, lends a strong sense of the naturalistic."

Its 'Key Characteristics' include:

- *"Comprises a rolling mountainous topography at a relatively high elevation and includes the southern slopes of the Boggeragh Mountains.*
- *Soils are of low fertility and experience relatively high levels of rainfall due to its elevation, resulting in poor growing conditions and limited vegetation including moorland, heath and scrub.*
- *Isolated or clusters of fields, are scattered along lower slopes, giving this landscape type a small scale dimension, to the otherwise open moorland.*
- *Large tracks of coniferous forestry evident particularly in upland areas.*
- *There are patches of fertile land within the landscape*
- *The main agricultural practice in these upland areas is sheep farming.*
- *Field boundaries comprise mainly stonewalls and low hedges.*
- *With forestry over the landscape (not blocks as in other areas). Delineated by tight gorse hedgerows, walls, banks or post and wire fencing and punctuated by a coniferous or broadleaf shelterbelts around small farmsteads."*

Aspects of its 'Built Environment' include:

> *"There is a remote feel to the area with few houses mainly farm buildings."*

Within 'Pressure for change' in this LCT (i.e. Page 117 of the Draft Cork Landscape Strategy 2007):

> *"Windfarms can be seen off in the distance from certain elevated views within this landscape type. While their presence is noted, their visual impact is not major but an accumulation of more windfarms could have a more intolerable visual impact in the future."*

The 'Recommendations' that are of relevance to the Site include:

"Protect the high ridges and mountainous peaks, particularly to the south west of Millstreet town (Claragh Mountain). These upland areas are predominant components of this landscape type."

Four Landscape Character Areas occur within LCT15b 'Ridged and Peaked Upland', with the Site being located within Landscape Character Area 2 'Derrynasaggart Pass', which is described as a 'Composite Moorland Upper Valley.'

In addition, the 'Rolling Marginal and Forested Middleground' (South)' LCT, located more than 2 km from the Site in the east of the central study area, is described as having:

- *Landscape Value: Medium*
- *Landscape Sensitivity: Medium*
- *Landscape Importance: Local*

It should be noted that the Site is not situated in an area recognised as a 'High Value Landscape' (HVL) and the nearest HVL designation relates to the area within and surrounding Gougane Barra, which is located more than 12 km southwest of the Site.

Scenic Designations

According to Section 14.9.1 of the CDP:

"The County contains many vantage points from which views and prospects of great natural beauty may be obtained over both seascape and rural landscape. This scenery and landscape is of enormous amenity value to residents and tourists and constitutes a valuable economic asset. The protection of this asset is therefore of primary importance in developing the potential of the County. Therefore, the plan identifies specific Scenic Routes consisting of important and valued views and prospects within the County."

According to Section 14.9.2 of the CDP:

"It is important to protect the character and quality of those particular stretches of scenic routes that have special views and prospects particularly those associated with High Value Landscapes."

According to GI 14-11[1] of the CDP:

"Whilst advocating the protection of such scenic resources the plan also recognises the fact that all landscapes are living and changing, and therefore in principle it is not proposed that

[1] The following scenic route text appears to have been misplaced from the previous CDP into a landscape related objective (GI 14-11)

this should give rise to the prohibition of development along these routes, but development, where permitted, should not hinder or obstruct these views and prospects and should be designed and located to minimise their impact."

According to Section 14.9.3 of the CDP:
"All proposals should be assessed on their merits taking into account the overall character of the scenic route including the elements listed in Volume 2 Heritage and Amenity Chapter 5 Scenic Routes of the plan and the Landscape Character Type through which the route passes…"

With regards to the "elements listed in Volume 2 Heritage and Amenity Chapter 5 Scenic Routes," please note that the relevant designated scenic routes within the study area will be addressed later in this chapter in **Section 12.4.3.1**, in relation to visual receptors. Within the study area there are 17 No. County Cork designated scenic routes (**see Figure 12.2**).

In the central study area, there are three Co. Cork scenic routes:

- "Scenic Route S23: Road between Macroom and Derrynasaggart Mountains," located approx. 1.1 km northeast of the location of the nearest turbine.
- "Scenic Route S24: Road between Coolea and Coom," located within approx. 2.8 km south of the location of the nearest turbine.
- "Scenic Route S25: Winding road joining Coolea - Coom road to Lissacresig road," located approx. 4.7 km south of the location of the nearest turbine.

5-10 km from the Site, there are a further two additional Co. Cork scenic routes as well as Scenic Route S23, S24 and S25 extending from the central study area:

- "Scenic Route S22: Road from Ballyvourney to Mullaghanish to Caherdowney."
- "Scenic Route S26: Road between Lissacresig and the Mouth of the Glen."

10-20 km from the Site, there are a further eight Co. Cork scenic routes:

- "Scenic Route S20: Roads at Mushera in the boggeragh Mountains and roads from Mushera to Ballynagree, Lackdoha and Rylane Cross"
- "Scenic Route S21: Road at Carriganima"
- "Scenic Route 27: Road between Gougane Barra and the Mouth of the Glen"
- "Scenic Route S28: Scenic road at the Pass of Keimaneig to Gougane Barra"
- "Scenic Route S32: South Lake Road - Inchigeela and Ballingeary to Keimaneigh"
- "Scenic Route S33: Road between Ballingeary - branch off S. Lake Road - and Kealvaugh"
- "Scenic Route S34: Road between Inchigeela and Ballingeary to Keimaneigh"

- "Scenic Route S35: Road Between Dromcarra and Rossmore"
- With Scenic Route S22 and S23 extending from within 10 km of the Site.

Relevant planning objectives relating to the protection of 'Landscape Views and Prospects' within this chapter entail:

GI 14-12: General Views and Prospects:
"Preserve the character of all important views and prospects, particularly sea views, river or lake views, views of unspoilt mountains, upland or coastal landscapes, views of historical or cultural significance (including buildings and townscapes) and views of natural beauty as recognized in the Draft Landscape Strategy."

GI 14-13: Scenic Routes:
"Protect the character of those views and prospects obtainable from scenic routes and in particular stretches of scenic routes that have very special views and prospects identified in this plan."

GI 14-14: Development on Scenic Routes:
"a) Require those seeking to carry out development in the environs of a scenic route and/or an area with important views and prospects, to demonstrate that there will be no adverse obstruction or degradation of the views towards and from vulnerable landscape features. In such areas, the appropriateness of the design, site layout, and landscaping of the proposed development must be demonstrated along with mitigation measures to prevent significant alterations to the appearance or character of the area."

<u>Wind Energy Strategy</u>
In relation to Cork County's Wind Energy Strategy, the Site is within a broad area that is deemed to be 'Open to consideration' (i.e. neither 'Normally discouraged' nor 'Acceptable in principle' nor an 'Urban Area'). According to the strategy:

> *"This area comprises almost 50% of the County area. Within these areas there are locations that may have potential for wind farm developments but there are also some environmental issues to be considered. This area has variable wind speeds and some access to the grid…"*

ET 13-7: Open to Consideration (CDP Objective)
"Commercial wind energy development is open to consideration in these areas where proposals can avoid adverse impacts on:

- *Residential amenity particularly in respect of […] visual impact;*
- *Visual quality of the landscape and the degree to which impacts are highly visible over wider areas."*

12.3.2.3 Kerry County Development Plan 2022-2028

Immediately adjacent to the north of the Site, County Kerry occupies nearly half of the central study area and the wider study area. It is, therefore, important to consider landscape designations in the current Kerry County Development Plan (CDP).

A landscape review has been included as part of the Kerry County Development Plan 2022-2028. Within this, the landscape is classified by landscape types and landscape character areas. The parts of County Kerry located within the study area are predominantly contained within the landscape 'Type A – Mountains', 'Type B – Pasture with Drystone Walls and Hedgebanks' and 'Type D - Coniferous Plantation'. The nearest and most relevant landscape character areas are 'LCA 27 – Clydagh River, The Paps and the Derrynasaggart Mountains' and 'LCA 40 Bonane and Sheen River Valley'. Both of these landscape character areas have been classified with an overall sensitivity of 'medium / high'.

Chapter 11 Environment' of the Kerry CDP contains two relevant objectives under the heading 'Landscape Sensitivity'.

KCDP 11-70: *Protect the landscape of the County as a major economic asset and an invaluable amenity which contributes to the quality of people's lives.*

KCDP 11-71*: Protect the landscapes of the County by ensuring that any new developments do not detrimentally impact on the character, integrity, distinctiveness or scenic value of their area. Any development which could unduly impact upon such landscapes will not be permitted*

The entirety of the landscape within County Kerry that falls within the central study area has been designated as 'Visually Sensitive Area'. This designation, which appears to have collated the Rural Prime and Rural Secondary Amenity Areas from the previous CDP, covers much of the upland and coastal rural landscapes of the County. The remainder of the County is designated 'Rural General'.

<u>Views & Prospects</u>

There are numerous Co. Kerry scenic designations within the study area (see **Figure 12.2**). Section 11.6.5 of the current Kerry CDP pertains to views and prospects. It states:

"County Kerry contains areas of outstanding natural beauty which are recognised internationally. There is a need to protect and conserve views and prospects adjoining public roads throughout the County. These views and prospects are important to the amenity of the County and to its tourist industry...

Relevant objectives relating to views and prospects include:

KCDP 11-72 - *Preserve the views and prospects as defined on Maps contained in Volume 4.*

KCDP 11-74 - *Prohibit developments that have a material effect on views designated in this plan from the public road or greenways towards scenic features and/or public areas.*

The scenic designation maps clearly indicate the presence and exact location of these Co. Kerry designated views and prospects, as well as which ones have designated views in both directions (of the route) and which have designated views in just one direction, as well as the orientation of that view. However, they do not identify the name or code number for these views and prospects, or any further information. Be that as it may, the mapping reveals that:

- In the central study area, there is one Co. Kerry designated view/prospect 1.4 km, at its closest point, north of the location of the nearest turbine.
- 10-20 km from the Site, there are four further Co. Kerry designated views/prospects, ranging from 8-16 km from the location of the nearest turbine.

Kerry Wind Energy Strategy:

The Wind Energy Strategy in the closest portion of County Kerry to the Site was altered twice in the context of the consultation and review process of the recently adopted 2022-2028 CDP. Areas that had previously not been subject to a specific wind deployment zone (and therefore defaulted to 'Unsuitable for Wind Energy Development') were briefly designated as 'Open to Consideration' for wind energy development, but reverted to undesignated (unsuitable) in the final adopted iteration. The area in question lies adjacent to the northeast of existing wind energy areas that have been designated for 'Repowering' (See Figure 12.11).

12.3.2.4 International and National Ecological Designations

European ecological designations such as Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Natural Heritage Areas (NHAs) and proposed Natural Heritage

Areas (pNHAs) are relevant to the landscape and visual assessment as they can identify areas that are likely to exhibit naturalistic character and low levels of built development. They also highlight areas to which landscape conservation values are attached and they are often associated with outdoor amenity facilities where people go to enjoy the landscape setting. Where these occur in the central study area, they have the potential to inform the landscape character of the central study area.

In this instance, there are two overlapping ecological designations within the central study area, listed below, though the scale and size of these are substantial (i.e. stretching over 70 km in a north-east/south-west alignment):

- SAC & pNHA: Killarney National Park, Macgillycuddy's Reeks And Caragh River Catchment – approx. 2.6 km north of the Site, at its nearest point

However, in the wider study area it should be noted that there are multiple, distinct designations, including venerated sites such as the Killarney National Park.

12.3.3 Visual Baseline

Only those parts of the Study Area that potentially afford views of the Development are of interest to this part of the assessment. Therefore, the first part of the visual baseline is establishing a 'Zone of Theoretical Visibility' and subsequently, identifying important visual receptors from which to base the visual impact assessment.

12.3.3.1 Zone of Theoretical Visibility (ZTV)

Computer generated Zone of Theoretical Visibility (ZTV) maps have been prepared to illustrate where the Project is potentially visible from. These are produced for a tip height of 177 m and 185 m in order to cover the range of potential turbines being assessed (the difference is fractional). The ZTV maps are based solely on terrain data (bare ground visibility), and ignore features such as trees, hedges or buildings, which may screen views. Given the complex vegetation patterns within the Study Area, the main value of this form of ZTV mapping is to determine those parts of the landscape from which the Development will definitely not be visible, due to terrain screening within the 20 km Study Area (see **Figure 12.3**).

The following considerations can be derived from the ZTV mapping:

- Approximately 50% of the overall study area is afforded potential views of the Project and much of that indicates partial visibility of 1-2 turbines or 3-4 turbines Given the undulating nature of the study area and the 'concentric - tidal' ZTV pattern, Much of the visibility also appears to relate to partial blade sets and blade tips rather than full visibility of the proposed turbines.

- The south facing slopes of the Mangerton range show fairly comprehensive visibility, which contrasts with the northern slopes where views are fully screened. There are two splays of visibility that occur within County Kerry beyond the Mangerton range and these indicate partial views through two of the more deeply incised valleys. The splay to the northwest takes in the eastern outskirts of Killarney.
- Whilst there is fairly comprehensive theoretical visibility within the central study area this dissipates throughout the southern quarters due to screening from undulating hills. The sand ripple pattern indicates visibility from only upper slopes and ridge, whereas most receptors (roads and settlements) are contained within lower ground.
- The important heritage site of Gougane Barra is not contained within the ZTV pattern and indicated no potential for visibility other than for some of the peaks that surround the iconic glaciated valley.

12.3.3.2 Scenic Designations

Views of recognised scenic value are primarily indicated within County Development Plans in the context of scenic views/routes designations, but they might also be indicated on touring maps, guidebooks, roadside rest stops or on post cards that represent the area. Those contained within the relevant County Development Plans are detailed in **Section 12.3.2 –** Planning Context and have been combined into a single map of scenic routes for the study area (see **Figure 12.2**)

All of the scenic routes where the ZTV indicates potential visibility were investigated during fieldwork to determine whether actual views of the Project might be afforded. Where visibility may occur, at least one viewpoint has been selected for use in the visual impact appraisal later in this chapter (see **Figure 12.9**).

12.3.3.3 Centres of Population and houses

This is not a heavily populated study area and there are few settlements within close proximity to the Site. The nearest include the village of Coolea approximately 3 km to the southeast and the more substantial sized settlement of Ballyvourney, which hugs the N22 approximately 5.5 km to the east. The elevated village of Kilnamartyra is approximately 12 km to the east of the Site and has potential for visibility of the Project. The settlements of Inchigeelagh and Ballingeary lie on the R584 to the south of the Site (9 km and 5 km away respectively) but have no potential for visibility of proposed turbines as they lie in the base of a valley.

Macroom is a relatively large settlement on the N22 near the south-eastern edge of the study area. Kilgarvan and part of Killarney are in the outer western and north-western portions of the study area respectively, albeit the ZTV pattern only indicates potential for visibility of the Project from the outskirts of the latter.

12.3.3.4 Transport Routes

The main transport route in relation to the Project is the N22 national road that runs between Cork and Killarney. Much of it is designated as a scenic route and is at its nearest to the Development as it approaches the Kerry border approximately 1 km to the northeast. There is a national secondary route within the study area and this is the N72 that heads east from Kilarney. It is approximately 12 km northwest of the Site at its nearest point.

The R569 regional road links between the N22 and Kilgarvan and is approximately 4.5 km to the northwest of the Site at its nearest point. The R584 regional road runs through the southern portion of the study area and is approximately 11 km from the Site at its nearest point.

Within and around the central study area, the road network consists of narrow local roads, private driveways and forest tracks.

12.3.3.5 Tourism Amenity and Heritage Features

Whilst not as synonymous with tourism heritage and recreation as the area around Killarney Lakes and the MacGillycuddy Reeks (to the west / north-west) or along the coastline of west Cork (to the south), there are some notable draws for tourists and recreationalists contained within the study area. Chief among these is the enclosed setting of Gougane Barra, which hosts St Finbarr's Oratory in the middle of Gougane Barra Lake in a strikingly scenic setting. The head of the Gougane Barra valley has also been extensively developed for forest / hill walking by Coillte. The 'Slí Gaeltacht Mhúscraí (Beara Breifne Way) is a long distance way marked trail that also passes through the Gougane Barra valley on its winding south-west to north-east route through the study area. It passes approximately 5 km to the southeast of the Site at its nearest point. The Beara Gougane Barra Cycling route from Cork City to Gougane Barra also passes through the southern study area and the Sheeps Head Way and Beara Way both flirt close to the southwestern perimeter of the study area without entering it.

The Kerry Way – another long distance waymarked trail runs along the northern slopes of the Derrynasaggart Mountains in an east-west orientation, where views are obscured by the mountains, as can be seen in the ZTV. Other shorter trails and loop walks include, Rossacroo Wood - Millennium Park Trail, which is a short Coillte Recreational Trail situated just over 7 km west of the Site. Danú Mountain Trail is a route to the summit of Danu Mountain / The Paps. Only the upper part of the route, close to the summit, lies within the ZTV pattern. The 'Paps of Anu' are twin peaks with Iron Age cairns at their summits.

Killarney Lakes National Park lies within the outer north-western portion of the study area and surrounds the popular tourist centre of Killarney. Aside from being just outside of the study area, these features are also screened from the Project by the Mangerton mountain range. The Mangerton Range itself has several notable peaks such as Mangerton Mountain and Crohane and is a popular destination for hill walkers. The most renowned walking route, the Devil's Punchbowl Loop, begins on the Killarney side and circumnavigates a corrie lough taking in Mangerton Mountain.

The Gearagh Meadowlands and associated walking loop are located within the 'LCT 8- Hilly River and Reservoir Valleys' and its associated High Value Landscape zoning. However, this is near the south-eastern outskirts of the study area where the ZTV maps indicate no potential for turbine visibility. Likewise, Lough Guitane is a highly scenic setting in the north-western extremities of the study area, but it too is shown not to have any potential for turbine visibility by the ZTV maps.

12.3.4 Route Screening Analysis (RSA)

Whilst the standard ZTV map outlines baseline theoretical visibility within the study area, it can considerably overestimate the actual degree of visibility as it does not take existing hedgerows, woodland and large areas of forestry into account, which, in this case will offer a notable degree of screening in the direction of the Project.

Route Screening Analysis, as its name suggests, considers actual visibility of the proposed wind farm from surrounding roads using recently captured, highly accurate Digital Surface Model (DSM) data that includes for all existing forms of land cover including vegetation. Route Screening Analysis bridges the gap between the bare-ground theoretical visibility modelling (e.g., ZTV maps) and the actual nature of visibility in a given area. In order to get a clearer understanding of visibility within the central study area, Route Screening Analysis (RSA) was undertaken for every public road within a 5 km radius of the proposed turbines using a Digital Surface Model (DSM) and sample points every 25 m along each public road/waymarked route.

The RSA consists of three visibility scenarios: open visibility; partial visibility; and fully screened. In this instance, 'open visibility' is very conservatively judged to occur if the view of a full blade rotation of any one single turbine is afforded. 'Partial visibility' occurs when there is view of less than a full blade rotation of any particular turbine/s occurs. For analysis purposes, the RSA data is broken down into concentric 1 km distance bands i.e., 0 to 1 km, 1 km to 2 km and so on out to 5 km. See Standard RSA Map (**Figure 12.4**)

12.3.4.1 RSA Results

The RSA map (**Figure 12.4**) and associated analysis graph illustrates a notable degree of wind farm screening from the surrounding local road network. 'Open Views' (needs clear visibility of only one blade set) predominate within the nearest 1 km, but as can be seen from the map, this relates a to a single sparsely populated local road that runs directly up the valley towards the wind farm. By the 1-2 km band Partial Views prevail (58%) and much of these come from the local road that runs along the upland valley to the southwest of the Site where views of less than full blade sets are likely above an intervening spur ridge. Beyond 1-2 km fully screened views dominate by a considerable margin and by the 4-5 km band approximately 84% of road sections are screened.

In terms of the RSA map, it is clear that nearly all of the open visibility of the proposed wind farm comes from roads to the southeast of the Site that are contained in the same drainage and visual catchment of Coolea Village. There is also very few roads at all within the elevated western quarters of the RSA study area. Outside of the upland catchment that contains the Site, very limited visibility exists from the road network, and by default most of the roadside dwellings.

What is very clear from the RSA graph is that screened views have a consistent and rapid increase across the distance bands from less than 9% in the nearest 1 km to over 80% by the 4-5 km band. Whilst this is typical of other RSA studies, Open Views usually have a distinct and opposite pattern reducing at a similar rate across the distance band and with all three categories at similar levels in the 2-3 km range. This usually indicates the threshold at which intervening terrain and vegetation screening becomes an effective screen for the progressively more distant turbines. However, it is a simple pattern that has become familiar in flat midland sites. In this instance Open Views drop away sharply to less than 20% by the 1-2 km range and remain there, albeit fluctuating all the way to the 4-5 km band. This highlights the complexity of the terrain and vegetation patterns in this knotty landscape and the effective screening provided within relatively short distances.

In terms of receptors, there is a relatively high proportion of Open and Partial visibility of turbines from within and around the village of Coolea and scenic route S24 that leads west from the village.

12.3.4.2 Additional 'Open View' analysis

As the methodology used for the RSA requires only a view of the full blade set of one turbine to record an 'open view' of the Project, it is useful to analyse the 'open view' set in more detail to establish how many turbines are actually visible in each instance (see the 'Open View' Refinement map - **Figure 12.5**)

The results for the finer grained analysis of the 'Open View' RSA class are intriguing as it appears that the closer the viewer is to the wind farm the fewer turbines, they are likely to see. In the nearest 1 km to the Site, where there is a view of turbines, for more than 90% of the road sections, less than 10% of this relates to a view of all 5 turbines. Views of all5 of the turbines is still the least common scenario in the 1-2 km and 2-3 km distance bands (7-8%) where views of only 1-2 turbines is the prevailing scenario (52% to 68%). However in 3-4 km band views of 5 turbines is more likely (18%), but remains subordinate to views of on 1-2 turbines at approximately 55%. By the 4-5 km distance band views of just 1-2 turbines occurs for nearly 80% of the road section that have some open visibility of the Project.

The finer grained analysis of the Open Visibility class further reinforces that there is not a clear and concentric (relating simply to viewing distance) pattern when it comes to the nature of visual exposure of the proposed turbines from the road network within 5 km of the Site. Instead, it highlights a generally high degree of screening where even if turbines are visible, it is least likely to be all of them visible at once and most likely just 1 or 2 of the five.

12.3.5 Identification of Viewshed Reference Points as a Basis for Assessment

The results of the ZTV analysis provide a basis for the selection of Viewshed Reference Points (more commonly abbreviated to viewpoints or VPs), which are the locations used to study the landscape and visual impact of the proposed wind farm in detail. It is not warranted to include each and every location that provides a view of this Project as this would result in an unwieldy report and make it extremely difficult to draw out the key impacts arising from the Project. Instead, a variety of receptor locations was selected that are likely to provide views of the proposed wind farm from different distances, different angles and different contexts.

The visual impact of a proposed development is assessed using up to 6 categories of receptor type as listed below:

- Key Views (from features of national or international importance);
- Designated Scenic Routes and Views;
- Local Community views;
- Centres of Population;
- Major Routes; and
- Amenity and heritage features.

Where a viewpoint might have been initially selected for more than one reason it will be assessed according to the primary criterion for which it was chosen. The characteristics of each receptor type vary as does the way in which the view is experienced. These are described below.

Key Views

These viewpoints are at features or locations that are significant at the national or even international level, typically in terms of heritage, recreation or tourism. They are locations that attract a significant number of viewers who are likely to be in a reflective or recreational frame of mind, possibly increasing their appreciation of the landscape around them. The location of this receptor type is usually quite specific. In this instance the Paps of Anu could be considered a key receptor under this category, but do not attract a high number of visitors. They have been included as a 'heritage and amenity' feature in the visual impact conclusions and the assigned category of assessment has no bearing on the assessment itself.

Designated Scenic Routes and Designated Views

Due to their identification in the County Development Plan this type of viewpoint location represents a general policy consensus on locations of high scenic value within the Study Area. These are commonly elevated, long distance, panoramic views and may or may not be mapped from precise locations. They are more likely to be experienced by static viewers who seek out or stop to take in such vistas.

Local Community Views

This type of viewpoint represents those people who live and/or work in the locality of the proposed Development, usually within a 5 km radius of the Site. Although the viewpoints are generally located on local level roads, they also represent similar views that may be available from adjacent houses. The precise location of this viewpoint type is not critical, however, clear elevated views are preferred, particularly when closely associated with a cluster of houses and representing their primary views. Coverage of a range of viewing angles using several viewpoints is necessary in order to sample the spectrum of views that would be available from surrounding dwellings.

Centres of Population

Viewpoints are selected at centres of population primarily due to the number of viewers that are likely to experience that view. The relevance of the settlement is based on the significance of its size in terms of the Study Area or its proximity to the Site. The viewpoint may be selected from any location within the public domain that provides a clear view either within the settlement or in close proximity to it.

Major Routes

These include national and regional level roads and rail lines and are relevant viewpoint locations due to the number of viewers potentially impacted by the Development. The precise location of this category of viewpoint is not critical and might be chosen anywhere along the route that provides clear views towards the proposal Site, but with a preference towards close and/or elevated views. Major routes typically provide views experienced whilst in motion and these may be fleeting and intermittent depending on screening by intervening vegetation or buildings.

Amenity and Heritage Features

These views are often one and the same given that heritage locations can be important tourist and visitor destinations and amenity areas or walking routes are commonly designed to incorporate heritage features. Such locations or routes tend to be sensitive to development within the landscape as viewers are likely to be in a receptive frame of mind with respect to the landscape around them. The sensitivity of this type of visual receptor is strongly related to the number of visitors they might attract and, in the case of heritage features, whether these are discerning experts or lay tourists. Sensitivity is also heavily influenced by the experience of the viewer at a heritage site as distinct from simply the view of it. This is a complex phenomenon that is likely to be different for every site. Experiential considerations might relate to the sequential approach to a castle from the car park or the view from a hilltop monument reached after a demanding climb. It might also relate to the influence of contemporary features within a key view and whether these detract from a sense of past times. It must also be noted that the sensitivity rating attributed to a heritage feature for the purposes of a landscape and visual assessment is not synonymous with its importance to the Archaeological or Architectural Heritage record.

The Viewshed Reference Points selected in this instance are set out in **Table 12.6** and shown on the VP selection Map at **Figure 12.6**.

Table 12.6: Viewpoint Selection

VP No.	Location	Receptor	Direction of View
VP1	Local Road at Gortnagross	• Local Community Views	SW
VP2	Local Road at Coolea Village	• Local Community Views	NW
VP3	Local road west of Coolea	• Designated Scenic Route • Local Community Views	NW
VP4	Local road at Lumnagh	• Designated Scenic Route • Local Community Views	N
VP5	Local road at Inchamore	• Local Community Views	NE
VP6*	Local road at Laharan East	• Designated Scenic Route • Local Community Views	N
VP7	Local road at Caraghnacaha	• Designated Scenic Route • Local Community Views	N
VP8	Local road at Milleeny	• Local Community Views	N
VP9	Local road at Bardinch	• Local Community Views	N
VP10	Summit of Crohane Mountain	• An Amenity Feature	SE
VP11	N22 at Derrynasaggart	• Designated Scenic Route • Major route	SW
VP12	Local road at Coomnagire	• Designated Scenic Route	W
VP13	Western Summit of 'the Paps of Anu'	• An Amenity and Heritage Feature	S
VP14	Summit of Mangerton Mountain	• An Amenity Feature	SE

VP No.	Location	Receptor	Direction of View
VP15	N72	• Major Route	NE
VP16	Local road at Coumaclovane	• Local Community Views	NE
VP17	Local road at Gortnahoughtee	• Designated Scenic Route	NW
VP18	Local road at Kilbarry	• Designated Scenic Route	NW
VP19	N22 at Ballymakeery	• Designated Scenic Route • Centre of Population	NW
VP20	N22 at Inchinlinane	• Designated Scenic Route • Major route	NW
VP21	Local road near Kilnamartyra	• Centre of population	NW
VP22	R582 at Gortavranner	• Designated Scenic Route • Major route	SW
VP23	Local road at Dangansallagh	• Designated Scenic Route • Centre of population	NW
VP24	Local road at Reananerree	• Local Community Views	SW

12.4 ASSESSMENT OF POTENTIAL EFFECTS

12.4.1 Do Nothing Effects

In this instance, the existing forestry plantations contained within the Site would continue to be planted and felled in rotation in the do-nothing scenario. As this aligns with the current scenario, no additional landscape or visual impacts are likely to occur.

12.4.2 Landscape Effects

Landscape impacts are assessed on the basis of landscape sensitivity weighed against the magnitude of physical landscape effects within the Site and effects on landscape character within the wider landscape setting. This wider setting is considered in respect of the immediately surrounding landscape (central study area <5 km) as well as the broader scale of the Wider Study Area (5-20 km).

12.4.2.1 Landscape Character, Value and Sensitivity

Central Study Area (<5 km from the Development)

The Site and central study area are contained within a rugged and marginal landscape that serves as something of a threshold of transition between a gently rolling and settled farming landscape to the south-east and the taller moorland covered peaks and ridges of the Derrynasaggart range immediately to the north and the more dramatic Mangerton range to the north-west. Indeed, the Site is contained on the southern slopes of the Derrynasaggart range which define the border between County Cork and County Kerry. The central study area is sparsely populated with farmsteads and rural dwellings and small and dispersed villages such as Coolea, Ballingeary and Reananerree. The landcover is a consistent combination of improved and marginal grazing in the valley floors and lower slopes, with scrub and scrubby woodland emerging on steeper slopes along with broad tracts of coniferous plantation forestry. The nearest turbines of the Coomagearlahy and Kilgarvan Wind Farm occur 3 km to the southwest of the Site just over the Kerry border. The Derragh and Cleanrath Wind Farms are also recent additions to the south and visible from the central study area. This is a productive rural landscape but characterised by extensive and low intensity land uses and despite consisting of tall moving structures, wind energy development is included in this characterisation.

There is some scenic amenity within the central study area, which is reinforced by a number of scenic route designations. Some of these clearly relate to broad elevated vistas, whereas others are more tranquil and enclosed or were designated at a time when forestry plantations were at the beginning of a rotation. In terms of landscape designations, the Site and most of the central study area (within County Cork) is contained in LCT15b 'Ridged and Peaked Upland' which is considered to be of 'Medium' landscape value, 'Medium' landscape sensitivity and a 'County' level of importance (the median category). Notably, this Landscape Character Type and those that surround it are not considered to achieve the separate and distinct status of a High Value Landscape (HVL).

It is considered that the central study area has landscape values that are relatively evenly balanced between productivity and sustaining the rural lifestyle in this area as well as a sense of remoteness and tranquillity and a rugged sense of scenic amenity. On balance and for these reasons, the Site and central study area (within 5 km) is deemed to have a landscape sensitivity of **Medium-low**.

Wider Study Area (5 km – 20 km from the Development)

For the wider study area there is a broader diversity of landscape character types and equally broad set of landscape values associated with them. The upland area to the south-west becomes more rugged and remote than the central study area and contains the highly sensitive landscape setting of Gougane Barra with its associated sense of heritage and wealth of recreational amenity. This area includes the High Value Landscape designations associated with both LCT '16a – Glaciated Cradle Valleys' and a small inland portion of LCT '4 – Rugged Ridge Peninsulas'.

To the south-east is a lower and more gently rolling landscape that is contained in productive farming. However, it also contains the elongated and naturalistic Lough Allua and the associated corridor of the River Lee. The High Value Landscape designation associated with LCT 8 – Hilly River and Reservoir Valleys' is also contained in this portion of the outer study area.

The northern portion of the wider study area is dominated in the first instance by the mountainous spine of the Mangerton range. This forms a northern backdrop to the central study area as well as physically, visually and perceptually dividing it from the lower lying landscape around the important tourist centre of Killarney and the Killarney Lakes National Park.

To the northeast is an extension of the Derrynasagart range, which has some of its extent contained within the north-central study area, whilst to the west of the central study area in the direction of Kilgarvan are similar landscape types to the central study area. This transitional east to west band across the study area is characterised by the same combination of marginal upland farming, forestry and wind energy developments and is considered to be generally robust.

Overall, it is considered that the wider study area is more diverse than the central study area and has areas and features that are of high or even very high landscape sensitivity, but also areas that are of a similar nature and sensitivity. Thus, it is also considered to have a general **Medium-low** sensitivity but with the acknowledgment that the Mangerton range to the north has a **High** sensitivity and Gougane Barra to the south-west has a **Very High** sensitivity, particularly within the heart of the valley in the vicinity of St Finbarr's Oratory.

12.4.2.2 Magnitude of Landscape Effect

The physical landscape as well as the character of the Project and its central study area (<5 km) is affected by the proposed wind turbines as well as ancillary development such as access and circulation roads, areas of hard standing for the turbines, borrow pits, grid connection and the substation compounds. By contrast, for the wider landscape of the study area, landscape impacts relate exclusively to the influence of the proposed turbines on landscape character. The aspects of the Project that are likely to have an impact on the physical landscape and landscape character are described in **Chapter 2: Project Description** with construction processes described in the Construction and Environmental Management Plan (CEMP) at **Appendix 2.1**.

Construction Stage

It is considered that the Project will have a modest physical impact on the landscape within the Site as none of the Project features have a large 'footprint' and land disturbance/vegetation clearing will be relatively limited and dispersed across a wide area. These effects are similar in nature and scale to forest harvesting activities with hardstand areas being akin to forestry skid/landing sites i.e. where the logs are hauled to for processing and collection. The topography and land cover of the Site will remain largely unaltered with construction being limited to tracks, areas of hard standing for the turbines, the on-site substation compound, temporary site construction compound, proposed met masts, drainage works and an on-site borrow pit. Excavations will tie into existing ground levels and will be the minimum required for efficient working. Any temporary excavations or stockpiles of material will be re-graded to marry into existing site levels and reseeded appropriately in conjunction with advice from the Project ecologist as detailed in **Section 5.9.1 of Chapter 5: Terrestrial Ecology**.

The finalised internal road layout has been designed to avoid environmental constraints, and every effort has been made to minimise the length of necessary roadway by utilising and upgrading existing forestry tracks. Furthermore, the road layout has been designed to follow the natural contours of the land wherever possible reducing potential for areas of excessive 'cut and fill'. There will be an intensity of construction stage activity associated with the access tracks and turbine hardstands consisting of the movement of heavy machinery and materials, but this will be temporary in duration and transient in location. The construction stage effects on landscape character from these dispersed activities will be minor.

There will be one 38 kV Onsite Substation with an associated Control Building constructed to collect the generated power from the Project before distributing it to the existing network substation at Ballyvouskill. The 38 kV on-site substation will be located in an area of farmland within the heart of the Site and will have a footprint of 1,314 m^2. The proposed sub-station compound will comprise of a single storey building with a pitched roof and will have a concrete render finish. The proposed substation compound, which will be enclosed by a 2.65-metre-high steel palisade fence, will be well contained by the surrounding terrain and is of a modest scale. The most notable construction stage landscape impacts resulting from the proposed on-site substation relate to the levelling of the Site using a balance of cut and fill to form a level platform. There will also be construction of concrete foundations to facilitate the substation building. Overall, these construction stage effects are relatively minor and compare to the construction of an industrial farm shed and yard, albeit on sloping ground requiring cut and fill earthworks.

All internal site cabling will be underground and will follow Site Access Roads without the need for trenching through open ground. Indeed, the land cover of the Site will only be interrupted as necessary to build the structures of the proposed wind farm and to provide access. Impacts from land disturbance and vegetation loss at the Site are considered to be modest in the context of this landscape setting. Some forest felling will be necessary to accommodate the construction of some turbines (T2, T4, and T5), hardstands, crane pads, access tracks and the proposed onsite substation. All forestry that is permanently removed will be subject to forest replanting provisions.

A permanent meteorological (Met) mast will be erected on site and will comprise of a 110 m high lattice steel mast and 4 m lightening rod (114 m overall height) with a shallow concrete foundation. The most notable construction stage effects will relate to the minor amount of ground excavation required to facilitate the shallow foundations for the steel mast structure. The Project also includes the upgrade of 3.4 km of existing forest tracks and construction of 3.8 km of new tracks that shall be used for construction and ongoing operational and maintenance activities.

The 38 kV grid connection cabling will run from the onsite substation across a combination of private lands and public roads generating land disturbance and associated movement of machinery and stockpiling of materials. The proposed grid connection route will include three watercourse crossings. No overhead lines are required for this connection. Connection works will involve the installation of ducting, joint bays, drainage and ancillary infrastructure and the subsequent running of cables along the existing road network. This will require delivery of plant and construction materials, followed by ground excavation laying of cables and subsequent reinstatement of trenches, and will result in minor and very localised construction stage landscape effects.

Site activity will be at its greatest during the construction phase due to the operation of machinery on site and movement of heavy vehicles to and from the Site. This phase will have a more significant impact on the character of the Site than the operational phase, but it is a 'short-term' impact that will cease as soon as the Project is constructed and becomes operational (approximately 21 months from the commencement of construction).

There will be some long term/permanent construction stage effects on the physical landscape in the form of turbine foundations and hardstands, access tracks and borrow pit. At decommissioning it is proposed to remove wind farm structures including, turbines, cabling and monitoring mast, but to leave roads and associated drainage works in place. Hardstanding areas will be allowed to regenerate naturally, as will turbine foundations once the plinths have been removed. Thus, the construction stage landscape effects of the Project are largely reversible.

There will be some construction stage effects on landscape character generated by the intensity of construction activities (workers and heavy machinery) as well as areas of bare-ground and stockpiling of materials as identified in the Construction and Environmental Management Plan (CEMP in **Appendix 2.2**). Such effects will be temporary/short term in duration and are, therefore, not considered to be significant. Overall, construction stage landscape effects are considered to be of a High-medium magnitude within the Site and its immediate surrounds and reducing with distance from the Site.

Operation and Decommissioning Stage Effects on Landscape Character

For most commercial wind energy developments, the greatest potential for landscape impacts to occur is as a result of the change in character of the immediate area due to the introduction of tall structures with moving components. Thus, wind turbines that may not have been a characteristic feature of the area become a new defining element of that landscape character. In this instance, wind turbines are a characteristic feature of the central and wider study area, most notably to the west and south of the Site where several existing commercial-scale wind energy developments occur (Coomagearlahy Kilgarvan, Derragh and Cleanrath - see locations on **Figure 12.7**). Considerable existing wind energy development is also located to further southwest of the Site at distances between 5 and 10 km, where there is in the order of 100 turbines spread between eight developments. The effect, therefore, is one of intensification and extension of an established land use in this landscape and not the introduction of a new and unfamiliar feature.

In terms of scale and function, the proposed wind farm is well assimilated within the context of the central study area. This is due to the broad scale of the landform, landscape elements and land use patterns. These attributes prevent the height and extent of the proposed wind farm causing the type of scale conflict that can occur in more intricate landscape areas. The rugged hills and ridges in the immediate surrounds of the Site have a notable utilitarian character due to the presence of the existing wind energy developments, in addition to extensive tracts of commercial conifer plantation. Although the Project represents a stronger human presence and level of built development than currently exists on the Site, it will not detract significantly from its productive upland rural character, which wind turbines are already a key component of.

It is important to note that in terms of duration, this Project proposal represents a long term, but not permanent impact on the landscape and is reversible. The lifespan of the Project is 35 years, after which time the turbines will be dismantled and the landscape reinstated / allowed to regenerate to prevailing conditions. Within 2-3 years of decommissioning there will be little evidence that a wind farm ever existed on the Site, albeit the proposed on-site substation will remain in perpetuity as part of the national grid infrastructure, in addition to access tracks.

The decommissioning phase will have similar temporary impacts as the construction phase with the movement of large turbine components away from the Site. There may be a minor loss of roadside and trackside vegetation that has grown during the operation phase of the Project. It is expected that the decommissioning phase would be completed within a period of 3-6 months. During this temporary period, landscape impacts are deemed to be High-medium within the Site and its immediate surrounds but reducing with distance from the Site.

In summary, there will be physical impacts on the land cover of the Site as result of the Project during the operational phase, but these will be relatively minor in the context of this productive rural landscape that comprises of existing wind energy developments and extensive areas of commercial conifer forest. The scale of the Project will be well assimilated within its landscape context without undue conflicts of scale with underlying land form and land use patterns. For these reasons the magnitude of the landscape impact is deemed to be **High-medium** within the Site and its immediate environs (c.1 km) reducing to **Medium** and then **Medium-low** for the remainder of the central study area. Beyond 5 km from the Site, the magnitude of landscape impact is deemed to reduce to **Low** and **Negligible** at increasing distances as the wind farm becomes a proportionately smaller and integrated component of the overall landscape fabric.

12.4.2.3 Significance of Landscape Effects

The significance of landscape impacts is a function of landscape sensitivity weighed against the magnitude of the landscape impact. This is derived from the significance matrix (**Table12.3**) used in combination with professional judgement. Based on the assessment in **Section 12.3**, the significance of landscape impact is considered to be **Substantial-moderate** within the Site and its immediate environs reducing to **Moderate** and **Moderate-slight** throughout the remainder of the Central Study Area. This is deemed to be the same for the construction stage, operational stage and decommissioning.

For the wider study area (beyond 5 km from the Site), landscape impact significance is not considered to exceed **Slight** at any of the stages of the Project and will reduce to Slight and Imperceptible at increasing distances as the Project becomes a progressively smaller component of the wider landscape fabric even in the context of higher sensitivity landscape units / features.

12.4.3 Visual Effects

In the interests of brevity and so that this chapter remains focussed on the outcome of the visual assessment (rather than a full documentation of it), the visual impact assessment at each of the 30 selected representative viewpoint locations has been placed into **Appendix 12.1**. This section should be read in conjunction with both **Appendix 12.1** and the associated photomontage set contained in **Volume III**. A summary table is provided below, which collates the assessment of visual impacts (**Table 12.7**). A discussion of the results is provided thereafter.

Table 12.7: Summary of Visual Impact Assessment at Representative Viewpoint Locations (Appendix 12.1)

VP no.	Distance to nearest turbine (km)	Visual Receptor Sensitivity	Visual Impact Magnitude	Significance of effect
VP1	5.4	Medium	Medium-low	**Moderate-slight/ Negative/ Long-term**
VP2	3.2	Medium	Medium	**Moderate/ Negative/ Long-term**
VP3	3.0	High-medium	Medium-low	**Moderate/ Negative/ Long-term**
VP4	3.4	High-medium	Medium-low	**Moderate/ Negative/ Long-term**

VP no.	Distance to nearest turbine (km)	Visual Receptor Sensitivity	Visual Impact Magnitude	Significance of effect
VP5	1.2	Medium-low	Medium	**Moderate/ Negative/ Long-term**
VP6	N/A	Medium-low	Negligible	**Imperceptible/ Neutral**
VP7	6.8	High-medium	Low-negligible	**Slight-imperceptible/ Negative/ Long-term**
VP8	0.8	Medium-low	High-medium	**Moderate/ Negative/ Long-term**
VP9	0.8	Medium-low	Medium	**Moderate-slight/ Negative/ Long-term**
VP10	2.3	Very High	Low-negligible	**Moderate-slight/ Negative/ Long-term**
VP11	8.4	High-medium	High-medium	**Substantial-moderate/ Negative/ Long-term**
VP12	1.2	High	Low	**Moderate-slight/ Negative/ Long-term**
VP13	6.2	Very high	Low	**Moderate/ Negative/ Long-term**
VP14	6.5	Very High	Low-negligible	**Moderate-slight/ Negative/ Long-term**
VP15	14.5	Medium	Low	**Slight/ Negative/ Long-term**
VP16	13.9	Medium-low	Medium	**Moderate-slight/ Negative/ Long-term**
VP17	3.1	High	Low-negligible	**Slight/ Negative/ Long-term**
VP18	16.4	High	Low-negligible	**Slight/ Negative/ Long-term**
VP19	16.6	Medium-low	Low	**Slight/ Negative/ Long-term**
VP20	7.9	Medium	Negligible	**Imperceptible/ Neutral**

VP no.	Distance to nearest turbine (km)	Visual Receptor Sensitivity	Visual Impact Magnitude	Significance of effect
VP21	N/A	Medium	Low	**Slight/ Negative/ Long-term**
VP22	13.1	High-medium	Negligible	**Imperceptible/ Neutral**
VP23	15.9	Medium-low	Low-negligible	**Slight-imperceptible/ Negative/ Long-term**
VP24	11.9	Medium	Negligible	**Imperceptible/ Neutral**

12.4.3.1 Impacts on Designated View

There is a series of designated scenic routes in relatively close proximity to the Development. The nearest is S23 from the Cork County Development Plan, which runs along the N22 to the northeast of the Site also becoming a scenic route on the Kerry side of the county border. There are three scenic routes to the south and southeast of the Site (S24, S25 and S26) and also more distant ones to the east (S21 and S22). These have been well covered by representative viewpoints in the visual impact assessment including 'illustrative views' where the absence of effect is what is being illustrated.

Scenic Route S24 is covered by VP2, VP3 and VP4 and this receptor affords some of the clearest views of the Project within its upland rural setting from relatively close distances. The proposed turbines improve in their legibility as the viewer moves west between VP2 at the outskirts of Coolea village, first passing VP3 and then VP4. At the peri-urban VP2 the turbine layout is uneven and result in some visual clutter from overlapping. The turbines become more evenly spread and are seen in an open and simple rural context by VP3 and by VP4 the layout is exemplary for this setting. However, the Development also increases in visual prominence from VP2 to VP4 and so does visual receptor sensitivity resulting in the same 'Moderate' significance at all three of these viewpoints which also represent the Local Community Views viewpoint category.

Scenic Route S23 is covered by VP11, VP19 and VP20 as it traces the N22 between Macroom and the Kerry border within the Derrynasaggart range. The nearest of these to the Site is VP11 where there is a partial view of turbine blade sets rotating above the near forested ridge to the southwest. However, it is the broad down-valley views to the southeast that appear to be the reason for this scenic route designation and the turbines will be only a peripheral component of that vista. Views from lower down the valley that is traversed by the N22 scenic route are much more restricted by enclosing terrain and vegetation.

Consequently, the significance of impact at VP19 and VP20 is deemed to be Slight and Imperceptible respectively.

Scenic route S22 from within the Derrynasaggart range to the east of the N22 road is represented by VP12 where the turbines are openly visible as a tight cluster rising above a middle distance ridge to the west. However, as with VP11, the turbines will be peripheral features of broad downhill views to the south, which also contain wind turbines. Thus, the significance of effect is deemed to be Modern-slight.

Scenic route S25 is covered by VP6 and VP7 but as it is currently shrouded in forestry and previously appears to have been designated for easterly and southerly vistas, rather than north towards the Site, the Project will not be readily visible from this designation. Significance was deemed to be Imperceptible and Slight-imperceptible from VP6 and VP7 respectively. Likewise, VP24 which represents scenic route S26 to the southeast of the Site affords no visibility of the Project. A potential long distance glimpse of turbine blades is afforded from VP22, which represents scenic route S21, but this is of no consequence to visual amenity.

12.4.3.2 Impacts on Local Community Views

This is a relatively sparsely populated area with small dispersed rural villages and a scattering of farmsteads and rural dwellings that tend to be well contained and sheltered within the upland valleys. There are also some more elevated road sections (often designated scenic views) with the local dwellings that align them enjoying more extensive views. Local community views are generally considered to be those which represent the people who live, work and move around the area within 5 km of the Site. In this instance there were nine such views used for the visual impact assessment (VP1, VP2, VP3, VP4, VP5, VP8, VP9, VP11 and VP16). Eight of these are contained on scenic routes and have already been discussed in **Section 12.4.3.1** above. The remainder will be summarised below.

Of the local community views that are not also within the scenic designation set, VP1 is the most elevated and extensive view. It has many of the attributes of the other scenic views (more than some) and has duly been accorded a Medium receptor sensitivity rating, whereas most of the other more enclosed local community views are attributed Medium-low sensitivity. From VP1, all of the proposed turbines are clearly visible at a reasonable scale, but in an exemplary and highly legible manner that assimilates well with the scale and nature of the underlying terrain and land use pattern. Consequently, the significance of effect is Moderate-slight despite clear and relatively close visibility. It should be noted that there are no dwellings afforded this particular view as the nearest houses are located on more sheltered lower slopes below the viewpoint.

For VP5, VP8, and VP16 the viewing scenario is more typical of the settled valley context of the central study area. From VP5 and VP16 the proposed turbines tend to be visible as only blade sets and partial blade sets rising above the enclosing forested (VP5) and rugged moorland (VP16) ridgelines. In both cases the visible components are seen at a prominent scale, but in a less than ideal aesthetic scenario with turbine blades cutting against the intervening ridgeline. However, they are not out of keeping with the productive upland setting and do not appear over-scaled relative to the underlying landform and land cover patterns. VP8 is a much clearer view of the scheme where the turbines are prominent and broadly dispersed across the view, but they are substantially visible in a legible manner. The significance of effect ranges between Moderate and Moderate-slight for these three local community views with the nearer VP5 and VP8 registering Moderate for differing reasons relating to the balance between the reduced degree of visual exposure at the former and the better visual legibility at the latter. The slightly greater viewing distance for VP16 was responsible for it only registering a Moderate-slight significance. The nature of visibility from within the local area is well represented in the Route Screening Assessment particularly **Figure 12.4**. This indicates that most of the open visibility within the central study area occurs within the same valley as the turbines to the southeast in the vicinity of the village of Coolea. Beyond this physical and visual catchment, the visibility from roads within the local area (5 km) become sporadic with 'Screened views' being a much more likely scenario beyond the 2-3 km distance band.

12.4.3.3 Impacts on Centres of Population

There are few substantial centres of population within the study area and even fewer that will be notably impacted by views of the proposed wind farm. Coolea is the most impacted and this is represented by VP2, which is discussed in relation to scenic routes as the S24 scenic route starts here and travels west. The selected viewpoint also represents something of a worst-case-scenario in terms of views from the village as clear visibility towards the Project is not readily available from within the core of the village.

The settlements of Ballyvourney to the east and Ballingeary to the south are not affected to any material degree by the Project as they are enclosed by other nearer ridges than that containing the Site. The small settlement of Reanree to the southeast of the Site is also not materially affected by the Project. Scenic Route S26 is represented by VP24 close to the settlement, but there will be no visibility of turbines.

Further afield to the south east, the elevated village Kilnamartyra affords clear, but distant views of the Project, where it appears in a legible manner (VP21). The significance of effect is deemed to be Slight at this settlement.

12.4.3.4 Impacts on Major Routes

The only major route within the study area with any reasonable potential for visual impacts is the N22 national road from Macroom to Killarney. This is a designated scenic for the entire portion of the study area where effects could be experienced and hence it has been discussed in the context of scenic designations (**Section 12.4.3.1** above) specifically in respect of VP11, VP19 and VP20.

Of particular note is that the N22 Ballyvourney Bypass was completed in December 2022 and runs upslope to north of the settlement. In early-stage consultation with Cork County Council it was recommended that potential views from the new road alignment should also be considered. VP25 was selected for this purpose and illustrates that the Project will be clearly visible above a middle distance ridge, but at a modest scale and in a clear and unambiguous manner (Slight significance of impact).

12.4.3.5 Impacts on Tourism, Heritage and Amenity Features

There is one particular viewing context of relevance to this category of receptor, which tend to be attributed High or Very High Sensitivity. These include summit views from the Derrynasaggart / Mangerton mountain ranges. The 'Beara to Breifne Way', a long distance way-marked walking route, also passes though the Gougane Barra glaciated valley and just to the south of the central study area on its northward journey.

From the Derrynasaggart / Mangerton mountain ranges, three summit viewpoints were selected; VP13 – The Paps of Anu; VP10 Crohane Mountain; and VP14 Mangerton Mountain. The nature of the view is very similar from all of these highly elevated vantage points, which are generally obtained by only fit and experienced hill walkers as opposed to attracting high numbers of visitors and tourists. The vast 360° views take in a range of dramatic and naturalist mountain areas and lakes, including the Derrynasaggart and Mangerton ranges themselves, the McGillycuddy Reeks, Lough Guitane and the Killarney Lakes. They also take in views of more settled and productive landscapes. In the direction of the Site, the landscape is a consistent mix of upland farming, conifer plantations, scrubby woodland and moorland with a generous scattering of wind turbines in concentrated, but contiguous groups. The main body of these are contained between 5 km and 10 km southwest of the Site and also further distant to the east in the direction of Millstreet.

The proposed turbines will be clearly and legibly visible from all of these locations in clear viewing conditions, albeit as small scale distant features of vast 360 views. However, it is not the view of the proposed turbines in their own right that is the key issue here. It is the cumulative effect and whether the proposed turbines cause the absorptive capacity threshold of this landscape for wind turbines, to be crossed. i.e., does this go from a rural upland area where wind turbines are one of a balanced few characteristic features to becoming a landscape that is principally defined by wind energy development. It is these elevated contextual views from which the cumulative effect is most noticeable, as it is far less noticeable from in and around the enclosed setting of the central study area. It is considered that the proposed wind farm makes a modest contribution to the quantum and extent of wind energy development in this area, but its main contribution is to serve as a perceptual link development between the Kilgarvan Cluster of wind farms and the Millstreet cluster of wind farms. Nonetheless, it maintains a generous buffer to each of these concentrations of wind farm developments and the link effect is only noticeable within the broad southerly views in question. It is therefore not considered to push the threshold of significant cumulative effects from these mountain top views and the significance is considered to range between Moderate (VP13) and Moderate-slight (VP10, VP14) and this is principally a factor of the high and Very High sensitivity of these receptors rather than the magnitude of impact.

The Beara to Breifne Way is represented by VP1 which is discussed in the context of Local Community views in **Section 12.4.3.2**. It is also closely represented by VP12 which is slightly uphill from it but with a similar viewing context. VP12 has been discussed in the context of Designated Scenic Route S22 in **Section 12.4.3.1**. Like all national way-marked routes, it passes through a diverse range of landscapes and includes road sections, forest tracks and trails. Such routes are designed to be accessible to a broad spectrum of the population and seldom entail difficult or dangerous upland sections. They represent an explorative journey through the landscape of a region showcasing not only naturalistic and scenic areas, but productive working landscapes and even townscapes. Whilst the proposed wind farm might be occasionally openly visible from the Beara to Breifne Way, it is just one feature amongst a vast array of other natural and man-made features that walkers will encounter along the way and it is a familiar form of development in this area without being a relentless one for this walking route.

12.4.3.6 Consideration of turbine dimension range

The Turbine parameters as described in Table 2.2 of this EIAR and all scenarios within the parameters have been fully considered in this chapter. For the landscape and visual assessment, the pertinent aspect of the design envelope relates to the turbine dimensions used to prepare the photomontages, upon which, the visual impact assessment is based.

There is some conjecture as to whether turbines with the same tip height, but varying hub height to rotor diameter ratios have a comparable visual impact. In the case of a higher hub and smaller rotor diameter, there is greater potential to see the hub, being the key component and figurative centre of the turbine, above surrounding ridgelines than for a lower hub / larger rotor scenario. However, the latter scenario represents a greater 'swept area' for the blades and potentially a stronger visual presence. In this instance, a balanced approach was taken where the specimen turbine used for the photomontages that informed the main visual impact assessment employed the maximum tip height dimension of 185 m with a median hub height of 107.5 m and maximum rotor diameter of 155 m. The reason for this approach is that any variation from this specimen turbine, in the form of an adjusted rotor diameter / hub height ratio, will see a minimal departure from the specimen turbine dimensions and consequently, less variation from the results of the visual impact assessment.

In order to examine the full range of potential turbine dimensions and to illustrate the potential variation in impact, Macro Works prepared comparative photomontages at three of the previously selected viewpoints (VP2, VP3 and VP4) to represent short and mid-distance views of the Project in differing contexts. It was not considered necessary to use long distance views (10 km+) for this comparative exercise as any variation in turbine dimensions are even less likely to be read at longer distances. The comparative scenarios used include:

- Specimen Turbine – 107.5 m hub, 155 m rotor diameter, 185 m tip height (as used for the visual impact assessment herein)
- Alternative Scenario 1 – 102.5 m hub, 149 m rotor diameter, 177 m tip height (lowest hub height)
- Alternative Scenario 2 – 110.5 m hub, 149 m rotor diameter, 185 m tip height (highest hub height, shortest rotor diameter)

As can be seen from the comparative photomontages (contained at the end of the Photomontage Volume) the variation in turbine dimensions is very difficult to discern across the three scenarios even with considerable scrutiny. This is unsurprising as the variation in hub height is 6 m from the specimen turbine position. There is also a potential 8 m departure from the specimen turbine in terms of tip height, but this would result a reduction in overall height (i.e. the visual impact would not increase). Whilst the variation in rotor dimeter is 6 m between the specimen turbine and Alternative scenario 2, this only translates as a variation of 3 m in blade length.

Regardless of whether the difference between the alternative turbine dimensions presented in the comparative photomontages can be discerned or not, it is clear that there is not a material difference in the level of visual impact between them and certainly not a higher impact than the base-case used for the submitted LVIA. Thus, the submitted LVIA is deemed to comfortably cover the range of potential turbine dimension options proposed and it is not considered necessary to prepare separate photomontages / assessments at all viewpoints for all possible turbine dimensions within the range.

12.4.3.7 Summary of Visual Effects

The proposed wind farm will give rise to a range of effects when considered in relation to different receptor types. There are very few notable impacts at centres of population and along major routes, which are the receptor types that usually harbour the greatest numbers of receptors (people). Compared to many other wind energy developments, the effects on local community views, one of the more susceptible receptor types and closest to the Project, are generally in the mid-range (Moderate and Moderate-slight) rather than higher end of the spectrum. This is less to do with the low population density and more to do with the enclosed nature of the rugged landscape in the central study area. Also, when broad elevated views are presented (VP11, VP12) they tend to be oriented away from high ground towards lower lying areas with the wind farm peripheral or even behind the viewer.

The most impacted receptor types were designated scenic routes as there is a high density of them within the central and wider study area and they often represented Local Community views as well (those within 5 km). On the basis that the scheme is of a modest overall scale and extent and is viewed within designated scenes that include broad scale forestry farming and wind energy developments, it appears well assimilated in terms of both scale and function in such views.

There are occasions where the five turbines appear somewhat cluttered with several instances of turbine overlap. However, these are at least matched by occasions when the layout is exemplary in terms of the relevant siting and design guidance from the Wind Energy Development Guidelines with an even spacing and gently undulating ridgetop profile that matches the underlying terrain. Such instances tend to occur to the south of the array and include VP1, VP4 and VP6.

For the reasons summarised above and detailed through this chapter, it is considered that the proposed Inchamore Wind Farm will give not give rise to any significant impacts.

12.5 CUMULATIVE EFFECTS

There are 24 separate wind farm developments within the wider study area that are either existing or permitted along with one in-planning development (Gortyrahilly Wind Farm) and one planned development (Cummeenabuddoge Wind Farm) (see **Figure 12.7** and the **Appendix 12.3**). It is important to note that because many of the other developments are existing, they have already been integral to the landscape and visual impact assessment contained within the preceding sections of this chapter.

Whilst the **Figure 12.7** map view of cumulative wind farms within the study area implies a dense accumulation of turbines in some portions of the landscape, the rugged nature of this landscape generally has the ability to absorb developments within discrete visual catchments. The exception to this is when the landscape is viewed from elevated locations within the Derrynasaggart and Mangerton mountain ranges to the north.

The nature of cumulative visibility is indicated on the Cumulative ZTV map (**Figure 12.7**). This indicates the following key points:

- There is only a very small proportion of the study area (2.1%) that will have a theoretical 'bare-ground' view of the proposed Inchamore turbines in isolation. These areas occur immediately to the north of the Site and also as two splays through saddles in the Mangerton range to the north.
- The main areas of combined visibility of the Project in conjunction with other developments contained within the study area (purple ZTV pattern) are within the central study area and then extending eastwards to approximately 10 km from the Site where cumulative visibility becomes more sporadic corresponding with higher ground only. There is also a sporadic band of combined visibility that runs along the peaks of the Mangerton and Derrynasaggart ranges to the north and north-west. It is notable that these areas generally have the lowest stocking of wind energy developments within the study area. In terms of the areas that will not have combined visibility with the Project, these tend to be large areas in the outer northeast, south and southwest of the study area (contained in green ZTV pattern).

There is one permitted wind farm (permitted Gortahilla) within the central study area as well as the edge of a large cluster of other existing wind farms stretching from just inside the Kerry border westwards into the Derrynasaggart range to the south of Kilgarvan. For the purposes of the cumulative impact assessment, that cluster of developments is going to be collectively referred to as the 'Kilgarvan cluster' and addressed in the context of the broader study area.

12.5.1 Cumulative Landscape Effects

From a landscape fabric / landscape character perspective, the proposed turbines will introduce wind energy development into a section of the landscape where wind turbines feature as partially revealed background features above and beyond containing ridgelines to the southwest (Kilgarvan cluster) and the south (Derragh and Cleanrath). Consequently, it is not a local landscape that is notably characterised by wind energy development, but the permitted Gortahilla Wind Farm (4 turbines) c. 2.5 km to the west will make wind turbines a more familiar feature. The proposed turbines will contribute to wind energy development becoming a more characteristic feature of the central study area, but far from the defining one.

Within the context of the wider study area, the proposed turbines will make less of a proportional contribution to the volume of turbines that already exist there or are currently permitted or in-planning. Wind farms are already a characteristic, but not a defining component of this upland rural and moorland landscape context and they will not become the defining feature with the addition of the Project. Instead, the contribution of the Project in that wider context is the infilling of a small pocket of landscape that heretofore had not been a focus for wind energy development in the same manner that the north-easterly and south-westerly extents of the Derrynasaggart range have been.

12.5.2 Cumulative Visual Effects

From a cumulative visual perspective, the proposed turbines are most commonly seen with other existing permitted or in-planning turbines in three main scenarios. The first of these is with the turbines from the permitted Gortahilla and predominantly existing Kilgarvan cluster featuring as small and partially exposed background features relative to the proposed turbines when seen from local views to the southeast of the Site. These include VP1, VP2, VP3 and VP4 from Coolea and the S24 scenic route running westwards out of Coolea village, but less so from close views to the Site where intervening ridges serve as a stronger screen.

The second scenario relates to elevated views from the south and southeast where the proposed turbines will be visible as a smaller scale development beyond and to the north of the existing Derragh and Cleanrath turbines as well as the in-planning Gortyrahilly turbines, should they be consented. Such views include VP17, VP18 and VP21 and notably the Kilgarvan cluster of turbines tends not to be visible from these locations due to screening by the primary ridge that forms the Cork / Kerry border.

The other notable cumulative visibility scenario relates to the views from the peaks within the Mangerton range including, VP12, VP13 and VP14 where the proposed turbines are seen in the context of a large number of cumulative wind farms dispersed in groups across the study area. In this context the large Kilgarvan cluster of turbines can be seen to the south and the similarly broad Millstreet Cluster can be seen further to the east. The proposed Inchamore turbines will site discretely between these larger areas of wind energy development avoiding detracting aesthetic effects with other turbines such as visual stacking or scale confusion / conflict with smaller earlier generation turbines. However, the proposed turbines serve as something of a visual link that could be perceived to link between the larger concentrations of turbines to the northeast and southwest of the Site. However, there is a limit to the degree that a five turbine wind farm could do that and maintaining a buffer to particularly the nearer Kilgarvan cluster of turbines was part of early stage design refinement from a substantially larger initial scheme. It is considered that element of mitigation has been successful in avoiding significant cumulative impacts.

On the basis of the reasons outlined above, the contribution of the Project to cumulative impact is deemed to be Low in accordance with the criteria contained in **Table 12.5**.

12.6 MITIGATION MEASURES AND RESIDUAL EFFECTS

Macro Works have been involved with this Project since undertaking a feasibility study in 2018, wherein potential constraints were refined and design optimisation measures were recommended. At that initial feasibility stage, the Project consisted of 15 turbines which stretched further to the west in the direction of the Kerry border. There were also outlying turbines surrounding the same upland basin that contains the current Site. It was considered preferable to reduce the overall extent and scale of the Project to reduce localised impacts and also to maximise the buffer to the nearest large cluster of Kilgarvan wind farms. This was done in the interests of reducing cumulative impacts and the benefits of this are apparent in the photomontage set. The result is that a much more consolidated and discrete turbine array has been brought to planning application stage than was originally considered at feasibility stage (see **Figure 12.8**).

Aside from these design iterations, which are embedded in the assessed Project, other specific landscape and visual mitigation measures are not considered necessary / likely to be effective. Thus, the impacts assessed in **Section 12.4 and 12.5** are the equivalent of residual impacts in this instance.

12.6.1 Decommissioning Phase

The decommissioning phase will see a similar nature of effects to the construction stage due to the movement of heavy machinery within the Site and to and from the Site removing turbine components. However, such effects will be temporary in duration and decreasing in scale as turbines are removed from view and the landscape is substantially reinstated to former uses (with the likely exception of the Substation infrastructure). Structures and cabling will be removed and hardstands and turbine foundations will be allowed to regenerate naturally. Roads and associated drainage will remain in place. As with construction stage landscape and visual impacts, decommissioning stage effects are not considered to be significant.

12.7 SUMMARY OF SIGNIFICANT EFFECTS

It is not considered that there will be any significant effects arising from the proposed Inchamore Wind Farm.

12.8 STATEMENT OF SIGNIFICANCE

Based on the landscape, visual and cumulative assessment contained herein, it is considered that there will not be any significant effects arising from the proposed Inchamore Wind Farm.

13 MATERIAL ASSETS AND OTHER ISSUES

13.1 INTRODUCTION

This chapter assesses the impacts of the Project on material assets. The Project refers to all elements of the application for Inchamore Wind Farm (**Chapter 2: Project Description**). The assessment will consider the potential effects during the following phases of the Project:

- Construction of the Project
- Operation of the Project
- Decommissioning of the Project

Common acronyms used throughout this EIAR can be found in **Appendix 1.2.** This chapter of the EIAR is supported by Figures provided in Volume III and by the following Appendix documents provided in Volume IV of this EIAR:

- **Appendix 13.1 Ai Bridges Telecommunications Impact Study**
- **Appendix 13.2 PUNCH Civil & Structural Due Diligence Report**
- **Appendix 13.3 Ai Bridges Aviation Review Statement**

13.2 STATEMENT OF AUTHORITY

This chapter has been prepared by Ms. Sarah Moore of Jennings O'Donovan & Partners Limited. The with the assistance of Ms. Shirley Bradley of Jennings O'Donovan & Partners Limited. The Telecommunications Impact Survey (**Appendix 13.1**) and the Aviation Review Statement (**Appendix 13.3**) were carried out by Kevin Hayes, David McGrath, Patrick Tinney and Karla Chagas in Ai Bridges Ltd.

Ms. Sarah Moore is a Senior Environmental Consultant and holds a Bachelor (Hons.) Degree in Environmental Science from University of Limerick and a MSc (Dist) in Environmental Engineering from Queen's University, Belfast. She has worked in environmental consultancy for over fourteen years and has prepared AA Screenings, Environmental Reports and EIARs.

Ms. Shirley Bradley is a Graduate Environmental Scientist with a First-Class Honours Degree (BSc Hons) in Environmental Science from the Institute of Technology, Sligo. She was also awarded with the Governing Body award for a BSc in Environmental Protection. Shirley's key capabilities are in report writing, assisting Senior Consultants and GIS.

Kevin Hayes is the Founding Director and Engineering Contracts Manager in Ai Bridges Ltd. Kevin has over 20 years' experience in Telecommunications Network Design and

Project Management. Kevin has a B.Eng Hons in Electronic Engineering – Communications & Industrial Automation and M.Eng Hons in Electronic Engineering- Communications & Communications Engineering. He also managed and designed the software prediction model for the TVI & Broadband EMI Interference Studies for Wind Farms.

David McGrath is a Radio Planning Engineer in Ai Bridges Ltd. David has a Bachelor of Science degree in Computing and has received a Bachelor of Engineering in Electronic Engineering. David has experience in analysing Radio Frequency issues, research and development in varying wireless network projects and supervision of Dublin Institute of Technology Master's degree students.

Patrick Tinney is a Communications Engineer in Ai Bridges Ltd. with a B.Eng. in Electronics, Occupational First Aid and 3 years' experience as a Health and Safety representative. He has received a B.Eng. in Computer and IT Systems. Patrick has experience in conducting site surveys and RF. He provides on-site support for the roll-out of fixed wireless access in Ireland.

Karla Chagas is a Software Engineer in Ai Bridges Ltd. with over 14 years' experience working in radar, telecommunications and radio related interference and telecommunications modelling projects. Karla has over 4 years' experience working with aviation, telecommunications and EMI interference and remediation projects. She has received a M.Sc. in Electrical Engineering and is currently undertaking a Ph.D. in Computer Engineering.

Further details and biographies/CVs of those involved in the development of each chapter have been included in **Chapter 1: Introduction** (**Section 1.9**).

13.3 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

Following preliminary consultations with key consultees during the scoping process, desk-based assessments, site visits and field surveys were undertaken. In line with the EIA Directive 2011/92/EU as amended by EIA Directive 2014/52/EU and current EPA Guidelines, this chapter of the EIAR focuses the assessment solely on those elements likely to have a significant effect on the environment. Economic assets of natural heritage include non-renewable resources such as minerals or soils, and renewable resources such as wind and water. These assets are addressed in **Chapter 8: Soils and Geology, Chapter 9: Hydrology and Hydrogeology,** and **Chapter 10: Air and Climate**. Peat and spoil are assessed in **Chapter 8: Soils and Geology**. Amenity resources and tourism are addressed in **Chapter 4: Population and Human Health**. The cultural assets of Archaeology and Cultural Heritage are addressed in **Chapter 14: Cultural Heritage** and traffic is addressed in **Chapter 15: Traffic and Transportation**. Utilities such as water, wastewater and waste services are addressed in this chapter and in **Chapter 2: Project Description.**

The material assets considered in this chapter include:

- Land Use – Agriculture;
- Land Use – Forestry;
- Telecommunications;
- Air Navigation;
- Quarries, and
- Utilities (gas, water, waste)

13.4 LAND USE - AGRICULTURE

13.4.1 Baseline Environment

The Site, located 5.9 km west of Ballyvourney, is characterised as being generally commercial forestry and rural, agricultural land. There are also a number of residential properties and established wind farms in the region. The Site as a whole is characterised by elevations of between 350 m and 460 m AOD and a spatial area of 170.1 hectares.

The agricultural land is predominantly utilised for sheep and cattle grazing. The commercial forestry is mainly made up of Sitka Spruce and is further detailed in **Section 13.5**.

13.4.2 Assessment of Potential Effects

The total land-take of the Development, including the Site Access Roads, Turbine Hardstands, Turbine Foundations, Grid Connection Route, Turbine Delivery Route nodes, borrow pit, met mast and sub-station is 19.6 hectares. There are 170.1 hectares within the Red Line Boundary therefore the total land take is 12% of the Site. The proposed Site Access Roads and upgrade to existing roads will improve access for surrounding agricultural use.

The construction, operational and decommissioning phase of the Project will result in a change of 4.32 hectares of agricultural land use in areas where new Site Access Roads, wind turbine bases, hardstanding areas, Met Mast, the Onsite Substation and Control Building and associated drainage infrastructure will be located.

The construction of the Grid Connection Route and Turbine Delivery Route will only require relatively localised excavation works within and adjoining the public roads, with some works in private lands and the Site Boundary and will be reinstated upon installation of cables.

There will be two turbines located on or partly on agricultural lands. This will result in the change of use from agricultural pastureland to wind farm use. This will have a long-term slight, negative impact on agricultural land use due to the removal of grazing lands for the duration of the construction and operation phases.

The approach proposed for decommissioning is one of minimal intervention:

- Decommissioning works will be limited to action necessary to remove the wind farm structures, i.e., removal of turbines and monitoring mast, extraction of cables but leaving ducting *in-situ*.
- Roads and associated drainage systems will remain in place to serve ongoing forestry and agriculture activity.
- Hardstanding areas will be allowed to revegetate naturally.
- Turbine plinths will be removed, and the hardcore covering turbine foundations will be allowed to revegetate naturally.
- Soil disturbance will be avoided as much as possible.

Therefore, the effects of the decommissioning phase on agriculture will be less than those during the construction phase and not significant.

13.4.3 Mitigation Measures

A process of "Mitigation by Avoidance" to avoid or minimise impacts on agricultural land use has been incorporated into the design stage. The construction and operational footprint of the Project has been kept to the minimum necessary to avoid impact on existing land uses and existing tracks have been used where possible.

These mitigation measures will allow for the prevention of unnecessary or inappropriate ground works or land use alterations to occur and will avoid unnecessary soil compaction.

13.4.4 Residual Effects

Implementation of the mitigation measures, outlined in **Section 13.4.3**, at the design stage will ensure that residual impacts will be slight negative for the duration of the construction and negligible for the operational lifespan of the Project.

All existing access points (i.e., to domestic premises, business, farms) will be accessible during construction, operation and decommissioning stages. This is to maintain local access and avoid impacts on other various land uses. **Chapter 15: Traffic and Transportation** details all of the proposed works and deliveries along the turbine delivery route. The works have been designed to avoid undue impact to adjacent land uses. The traffic impact to adjacent land users was also considered during the design of the Project for the decommissioning phase for which traffic will be required along the Construction Haul Route. The Turbine Delivery Route will no longer be needed post construction. This is further detailed in **Chapter 2: Project Description**. Thus, the residual impact on surrounding agricultural land uses is negligible during construction, operation and decommissioning.

13.4.5 Cumulative Effects

Due to the localised nature of the proposed construction/decommissioning works, there is no potential for significant cumulative effects in-combination with other local developments on the agricultural land use apart from some small sections of the Turbine Delivery Route, all effects are directly within the Red Line Boundary.

Other projects outside the Development do not have the potential to reduce or increase the magnitude of effects on land use within the Site. Therefore, this will not contribute to any significant cumulative effects during the construction/decommissioning or operational phases.

Land management practices in the wider area which are considered to have potential for cumulative effects with the Project are agriculture and forestry. All existing and approved projects in **Appendix 2.4** were considered. There are no applications for large-scale commercial or industrial activities near the Site. Minor domestic and agricultural development will not introduce potential for cumulative effects during the construction, operational or decommissioning phases as the impacts will be localised and not significant.

The nearest operational wind farm is located 2.7 km to the south-west of the Development (Coomagearlahy Kilgarvan Wind Farm). Surrounding agricultural activities can and will continue during the construction, operational and decommissioning phases of the Development when fencing has been fully established.

13.4.6 Statement of Significance

No significant impacts are predicted on agricultural land use.

13.5 LAND USE - FORESTRY

13.5.1 Baseline Environment and Description of Development

Permission is being sought by the Developer for the construction of five (5 No.) Wind Turbines, a meteorological mast, an on-site substation, all ancillary works and upgrade works along the site access road from the N22. A full description of the Project can be found in **Chapter 2: Project Description**.

The Site contains 145.4 hectares of forestry which is classified as commercial forestry. The proposed windfarm infrastructure layout (i.e., roads, Turbine Hardstands, etc.) affects forestry with four (4 No.) turbines located within forestry. A summary of the forestry affected is provided in **Table 13.1** with Site Access Roads and the site compound also cutting through some of these plots**.**

Table 13.1: Summary of Removal of Forestry to facilitate the Project

Infrastructure	Area of forestry lost (Ha)	Species present
Turbines 2-5	12.77	Sitka spruce
Substation	0.64	Sitka spruce
Borrow Pit	3.53	Sitka spruce
Access Roads	7.25	Sitka spruce
Met Mast and Turning Head	1.11	Sitka spruce
Compound	0.58	Sitka spruce
T5 Turning Head	0.56	Sitka spruce
Total	**26.43**	

Detailed consideration of the approach to afforestation requirements associated with the Development is included in **Appendix 2.5**. It should be noted that the clearfelling of trees in the State requires a felling licence. The associated afforestation of alternative lands equivalent in area to those lands being permanently clearfelled is also subject to licensing ('afforestation licensing'). The Forest Service of the Department of Agriculture, Food & the Marine is Ireland's national forest authority and is responsible for all forest licensing. In light of the foregoing and for the purposes of this Project, the Developer commits that the location of any replanting (alternative afforestation) associated with the Project will be greater than 10 km from the wind farm site and also outside any potential hydrological pathways of connectivity i.e., outside the catchment within which the Development is located. On this basis, it is reasonable to conclude that there will be no more than imperceptible, indirect or in-combination effects associated with the replanting. In addition, the developer commits to not commencing the Project until both felling and afforestation licences are in place and this ensures the afforested lands are identified, assessed and licenced appropriately by the relevant consenting authority.

13.5.2 Assessment of Potential Effects

The lands affected by the Project are currently in use for commercial forestry and agriculture.

Arc GIS Pro was used to calculate areas of forestry within the surrounds of the Development. Inchamore was calculated to have 174 ha and Milleeny was calculated to have 271 ha. The majority of the forestry within the surrounds of the Development was classed as 'Coniferous forest' according to CORINE Land Cover (Copernicus)[1].

The removal of 26.43 ha (18.2%) of 145.4 ha commercial forestry lands within the Site will have a permanent slight, negative impact on the existing forestry land use during the construction, operation and decommissioning of the Project.

13.5.3 The 'Do-Nothing' Impact

If the Project does not proceed, lands in the vicinity of the Site will continue to be used for forestry and agricultural purposes. This would have a neutral effect.

13.5.4 Mitigation Measures

Existing forestry tracks have been incorporated into the design to minimise the construction of new Site Access Roads and minimise the removal of forested areas. New Site Access Roads have been sensitively designed to minimise impact on forestry. Electricity cables will be installed underground in or alongside Site Access Roads to avoid and minimise negative impact. The construction and decommissioning works will be planned and managed by a Construction and Environmental Management Plan (CEMP) (**Appendix 2.1**). This provides details on day to day works and methodologies. As part of these works, the public and other stakeholders will be provided with updates on construction activities which will affect access to surrounding lands. This will be communicated to members of the public through a community liaison officer employed for the duration of the construction period.

[1] Environmental Protection Agency Maps https://gis.epa.ie/EPAMaps/ [Accessed Online_22/06/2022]

13.5.5 Residual Effects

The impact on land take during construction/decommissioning is likely to have a permanent slight, negative impact on the forestry, in that it alters the character of the environment, albeit in a manner consistent with existing and emerging wind farm trends in the surrounding area. Implementation of the measures outlined in **Section 13.5.4** will ensure that any residual impacts will be slight negative and short term in duration.

During the operational phase, the impact on forestry land take is likely to have a moderate negative permanent impact on the environment of the area (in that it alters the character of the environment); however, this change is consistent with existing and emerging trends. There are no predicted residual impacts, with respect to forestry land use, arising from the operational phase.

13.5.6 Cumulative Effects

Due to the localised nature of the proposed construction/decommissioning works which will be kept within the Site Boundary, there is no potential for significant cumulative effects in-combination with other local developments on commercial forestry as all effects are directly within the Site.

The surrounding commercial forested area of the Development will continue its ongoing commercial maintenance, felling and replanting schedule throughout the operational life of the Project.

As forestry activity is expected to continue on surrounding lands throughout the lifespan of this Project, no potential significant cumulative effects are considered likely.

13.5.7 Statement of Significance

No significant impacts are predicted on commercial forestry.

13.6 TELECOMMUNICATIONS

Microwave links need an unobstructed line of sight from end to end as blocked links will perform inadequately. It is therefore necessary to ensure tall wind turbines will not interrupt links. Impacts can include reflection, diffraction, blocking and radio frequency interference.

During operation, wind turbines have the potential to interfere with electromagnetic signals passing above the ground due to the nature and size of the wind farm.

Ireland saw the roll out of Digital Terrestrial Television, locally known as Saorview TV, in October 2010, incorporating the switchover from analogue to digital television. According to Ofcom (a regulatory UK body) (2009), *digital television signals are much better at coping with signal reflections, and digital television pictures do not suffer from ghosting*[2]. Ghosting is the replica of a transmitted image which is offset in position and is superimposed on top of the main image.

Since digital switchover, there have been very few reported cases of wind turbine interference with domestic analogue reception. Modern turbine blades are also typically made of synthetic materials which have a minimal impact on the transmission of electromagnetic radiation. Therefore, potential effects on television and radio signals from the Project will be negligible and are not considered further, given the advancements in technology.

13.6.1 Guidance

Potential telecommunication effects generated by the Project have been assessed with reference to the following documents.

- Cork County Development Plan, 2022 - 2028
- 'Best Practice Guidelines for the Irish Wind Energy Industry', published by the Irish Wind Energy Association (2012).
- Information about Electric & Magnetic Fields and the Electricity Transmission System in Ireland, EirGrid[3]
- Wind Energy Development Guidelines: Planning Guidelines, Department of Environment, Heritage and Local Government (DHPLG) 2006[4]

13.6.2 Scoping and Consultation

Telecommunications providers were consulted about the Project. A summary of responses is outlined in **Table 13.2** and **Appendix 1.1** outlines full consultation responses.

[2] Ofcom (2009) *Tall Structures and Their Impact on Broadcast and Other Wireless Services*, OFCOM, United Kingdom. Available online at: https://www.ofcom.org.uk/__data/assets/pdf_file/0026/63494/tall_structures.pdf [Accessed 14/11/2019]
[3] Eirgrid (2014) *Information on Electric and Magnetic Fields*. Available online at : http://www.eirgridgroup.com/site-files/library/EirGrid/Information%20on%20Electric%20and%20Magnetic%20Fields.pdf [Accessed on 18/11/2019]
[4] Department of Housing, Planning, Community and Local Government (2006) Planning Guidelines. Available online at: https://www.gov.ie/en/publication/f449e-wind-energy-development-guidelines-2006/ [Accessed 25/02/2021]

Table 13.2: Summary of Consultations

Consultee	Response Date	Response
RTÉ Donnybrook Dublin 4 (*2RN is the trading name of RTÉ Transmission Network DAC*)	17/11/2020	*"The site will not affect 2RN's fixed linking, the nearest link is 750 m to the south if T6. There is however a risk that the site could cause interference to Digital Terrestrial Television (DTT) viewers receiving from our site at Mullaghanish. We would therefore ask that a protocol be signed between 2RN and the Developers should the site go ahead."*
Virgin Media Television Westgate Business Park Ballymount Dublin 24	Na	No response received
Vodafone Netshare Ireland Iveagh Buildings Carrickmines Dublin 18	15/02/2021	Highlighted links that will be affected, namely KYIHE-CKMGH.
Tetra Ireland	09/12/2020	*"We anticipate no impact from the development as proposed."*
ENET	19/02/2021	Highlighted links close to turbines

13.6.3 Assessment Methodology

Following scoping, AI Bridges were commissioned to undertake a telecommunications impact assessment of the operational phase of the Development, which is attached as **Appendix 13.1**.

There are four primary stages in preparing and compiling a communication impact study:

- Telecom Operator Consultations;
- Field Surveys;
- Desktop Survey Network Modelling and Analysis, and
- Report Generation.

AI Bridges assessed the impact of the Development on two Vodafone communication links, using 3D network modelling which were highlighted in the scoping responses from Vodafone and Enet as listed in Table 13.2.

13.6.4 Assessment of Potential Effects

All potential effects, which are associated with the operational phase of the Project, are classified as long-term effects. It is predicted there will be no impact to the two Vodafone links and that highlighted by ENET as the links are sufficiently far from the nearest turbine that the operation of the link will not be impacted. There is potential that RTE DTT viewers receiving from Mullaghanish could experience interference. A detailed assessment of the effects of the Project on telecommunications can be found in **Appendix 13.1: Telecommunications Impact Study**.

13.6.4.1 The 'Do-nothing Impact'

If the Project does not proceed, there will be neutral impacts on telecommunications. This 'do-nothing' scenario would result in no interference in electromagnetic signals subject to the continuation of current activities and practices which are expected to continue.

13.6.4.2 Construction Phase

During the construction phase, there are likely to be several sources of temporary electromagnetic emissions. Chief among these will be the brief use of electrical power tools and the use of electrical generators which may be brought onsite before mains electricity is provided. These devices are required by Irish and European law to comply with the EMC Directive 2014/30/EU. Compliance with this Directive will mean that the electromagnetic emissions from these devices will not cause interference to other equipment.

Other potential effects during the construction phase are likely to be as a result of tall cranes used for constructing the turbines. These cranes will be beside the proposed turbines. Any interference effects are likely to be similar to those arising during the operational phase of the Project. This is further detailed in **Appendix 2.1**.

13.6.4.3 Operational Phase

There is potential RTÉ DTT viewers receiving from Mullaghanish could experience interference.

13.6.4.4 Final Decommissioning Phase

When decommissioning of the Project takes place, effects associated with this phase on telecommunications will be similar to those at the construction phase.

13.6.5 Mitigation Measures

All electrical elements of the Development are designed to ensure compliance with electro-magnetic fields (EMF) standards for human safety.

Mitigation measures were undertaken in the design phase through mitigation by avoidance i.e., the known routes of the telecommunication links were plotted and a buffer was applied to them, outside of which the proposed turbines were located. Compliance with the EMC Directive 2014/30/EU will mean that the electromagnetic emissions from devices used will not cause interference to other equipment.

In the event the Project is granted planning permission a protocol will be signed between 2RN and the Developer, in which the Developer will accept total financial responsibility for remedial measures which could be required as a result of potential negative impact of the wind farm on 2RN's network specifically RTÉ DTT viewers.

13.6.6 Cumulative Effects

All existing, approved and proposed projects in **Appendix 2.4** have been considered for potential cumulative effects. There are a number of proposed, permitted or operational wind farms within 20 km of the Development (**Appendix 2.2**). Each developer is responsible for engaging with all relevant telecommunications operators to ensure their proposals will not interfere with television or radio signals by acting as a physical barrier. Therefore, as each project is designed and built to avoid impacts arising, a cumulative impact cannot arise. There will be no cumulative impacts relating to the Project and surrounding projects in relation to telecommunications.

13.6.7 Statement of Significance

The implementation of mitigation measures will ensure no interference with communication links. Therefore, no significant effects are predicted on telecommunications or radio reception as a result of the Project.

13.7 ELECTRICITY NETWORKS

13.7.1 Introduction

This section describes the transmission network and the anticipated connection option. It is not proposed to utilise any elements of the distribution network.

The nationwide electricity transmission system allows for the transport of large volumes of electricity from generation stations, including wind farms, to bulk supply points near the main population centres where it interconnects with the distribution system.

The Grid Connection will be 19.9 km in length and will be along public roads, private roads and forestry roads.

Connection will be sought from the grid system operator by application to EirGrid. The substation will connect via underground 38kV cables. At the existing Ballyvouskill 220kV substation, the cable will connect into existing infrastructure within the confines of the substation and its compound. The Grid Connection will be constructed to the requirements and specifications (CDS-GFS-00-001-R1) of EirGrid.

13.7.2 Assessment Methodology

Punch Consulting Engineers prepared a Civil and Structural Due Diligence Report which assesses utilities along the Grid Connection Route and can be found in **Appendix 13.2**. The report assesses the impacts based on desktop study, consultation and site visit.

EirGrid was consulted about the Development and the connection to Ballyvouskill 220 kV substation via an online webinar. EirGrid confirmed that it cannot determine any proposed connection methods until the formal connection application process is completed. ESB responded to consultation with relevant information of their network installations, which are adjacent to and cross the cable route (**Appendix 13.2**).

13.7.3 Assessment of Potential Effects

Due to the fact that all on-site internal cabling will be underground as will the grid connection from the onsite substation to Ballyvouskill, there will be no impact on the overhead electricity network.

The Development will contribute directly and in the long term to the electricity network by strengthening it through additional renewable energy generation.

At the existing Ballyvouskill 220kV substation, the cable will connect into existing infrastructure within the confines of the substation and its compound and thus will have a slight, short term effect.

13.7.4 The 'Do-nothing' Impact

If the Project does not proceed, there will be no offset to fossil fuel usage, and no provision of additional electricity generation in the local area.

13.7.5 Mitigation Measures

Mitigation by design and avoidance will minimise impacts on existing electricity networks.

- Prior to construction confirmatory drawings for all existing services will be sought from ESB Networks.
- Immediately prior to construction taking place, the area where excavation is planned will be surveyed by CAT scan (sub-surface survey technique to locate any below-ground utilities) and all existing services will be verified. Temporary warning signs will be erected.
- The as-built location of the installed ducts will be surveyed and recorded using a total station/GPS before the trench is backfilled to record the exact location of the ducts. The co-ordinates will be plotted on as-built record drawings for the grid connection cable operational phase.
- Clear and visible temporary safety signage will be erected all around the perimeter of the live work area to visibly warn members of the public of the hazards of ongoing construction works.

13.7.6 Cumulative Effects

All existing, approved and proposed projects in **Appendix 2.4** have been considered. There are a number of proposed, permitted or operational wind farms within 20 km of the Development. There will be no cumulative impacts relating to the Project and surrounding projects in relation to electricity networks during the construction phase.

Potential negative cumulative effects on electricity networks are unlikely during the operational and decommissioning phases.

13.7.7 Statement of Significance

No significant negative impacts on the grid connection or grid network are anticipated. There will be a long-term slight positive residual impact on transmission infrastructure in the area (due to the installation of new infrastructure) and no impact on distribution. It is not proposed to utilise any elements of the distribution network.

13.8 AIR NAVIGATION

13.8.1 Introduction

Operating wind farms have the potential to cause a variety of adverse effects on aviation. Rotating wind turbine blades may have an impact on certain aviation operations, particularly those involving radar. The physical height of turbines can cause obstruction to aviation and the overall performance of communications, navigation and surveillance equipment. All structures over 150 m in height are required by the Irish Aviation Authority to have lighting to warn aviation traffic. The Development's ground to blade tip height of the wind turbines will range from 177 m to 185 m during operation. The tallest tip height (185 m) represents the largest obstacle of any turbine within the Turbine Range to air traffic (irrespective of the turbine selected and constructed within the Turbine Range, a turbine with an equal or lesser tip height will still be within that space).

Enniskeane Airstrip is 35 km to the south-east. Bantry Aerodrome is 33 km to the south-west of the Development. The closest regional airport is Kerry Airport, 31 km to the north-west. The closest international airport is Cork, 51 km to the south-east.

13.8.2 Consultation

Consultation with the relevant aviation organisations was initiated during the scoping process, to identify any potential aviation issues that could be affected by the Development. The findings are summarised in **Table 13.3**.

Table 13.3: Summary of Consultation Response

Consultee	Scoping Date	Response Date	Response
Irish Aviation Authority The Times Building 11-12 D'Olier Street Dublin 2	16/11/2020	17/12/2020	*"Turbine No. 1 is approximately 30 kms South East of Kerry Airport. The aerodrome operator should be contacted and requested to assess whether a preliminary screening assessment is required in relation to the potential impact on instrument flight procedures or any communication, navigation and surveillance equipment at Kerry Airport.* *Subject to that being completed and no likely significant impact being noted, the Aerodromes division would likely issue the following general observation during the formal planning process….* *1. Agree an aeronautical obstacle warning light scheme for the wind farm development.* *2. Provide as-constructed coordinates in WGS84 format together with ground and tip height elevations at each wind turbine location.* *3. Notify the Authority of intention to commence crane operations with at least 30 days prior notification of their erection.*
Kerry Airport Farranfore Killarney Co. Kerry V93 KHF7	21/12/2020 22/11/2022 13/02/2023 31/03/2023	08/03/2023	"*From an initial review the development would appear to be outside Kerry Airports 15 km OLS area. However as you have highlighted in your scoping document section 4.2, the development has potential to impact on aviation coverage, and as such I would recommend that this be investigated further to confirm the development will not impact on the safe operation of aircraft and maintain current aviation associated coverage such as radio, radar, navigational aids etc. The requirements for lighting and inclusion of the structures on associated maps etc will I am sure be addressed by the IAA."*

Consultee	Scoping Date	Response Date	Response
		18/04/2023	For the assessment report (Appendix 13.3) 1. Section 2.2 as the proposed development penetrates the Annex 15 Aerodrome surfaces, the developer must ensure the development does not impact or increase current published operating minima associated with Kerry Airport. 2. Section 2.3 MSA's- any development must ensure that there is no impact on the current published MSA's associated with Kerry Airport. 3. Section 2.8- Obstacle warning lights- the developer should liaise with the Aviation Authority to ensure that the development is included on maps and lighted in the interest of aviation safeguarding. 4. The assessment and planning should include the assessment of the construction phase as part of planning to ensure cranes or other equipment involved in the development do not impact on Aviation safety during the construction phase.
Cork Airport Kinsale Road Cork T12P5NF	16/11/2020	No Response	None

13.8.3 Assessment Methodology

Following scoping with Irish Aviation Authority (IAA), Kerry Airport and Cork Airport, Ai Bridges a communication specialist was commissioned to undertake an aviation impact assessment of the operational phase of the Development, which is attached as **Appendix 13.3**.

The aviation assessment which included a desk-top study and modelling reviewed the possible impacts of the proposed wind farm on aviation systems in the vicinity of the Development. As part of the review, the following subjects were considered:

- Annex 14 - Obstacle Limitation Surfaces (OLS)
- Annex 15 – Aerodrome Surfaces
- Minimum Sector Altitudes (MSA)
- Instrument Flight Procedures
- Permitted Wind Farms in vicinity of Proposed Wind Farm
- Communications, Navigation and Radar Surveillance Systems Safeguarding
- Flight Inspection and Calibration
- Aeronautical Obstacle Warning Light Scheme

- Irish Air Corps / Department of Defence (DoD) Safeguarding

13.8.4 Assessment of Potential Effects

The aviation impact assessment found the proposed turbines would penetrate the ICAO Annex 15 Aerodrome Surface for Kerry Airport. As a result, all obstacles, if more than 100 meters above terrain for a distance of 45 km from centre point of Kerry Airport, need to be registered in the IAA Air Navigation Obstacle Data Set.

The impact assessment concluded that no significant effects are predicted on air navigation as a result of the Development.

13.8.5 The 'Do-Nothing Impact'

If the Development were not to proceed, there would be no impact on aviation operations in the area.

13.8.6 Mitigation Measures

Although no potential effects were identified, the following mitigation measures proposed by the Irish Aviation Authority (IAA) and Kerry Airport will be implemented:

- An aeronautical lighting scheme for the Development will be agreed with the IAA and will be installed.
- As-constructed coordinates in WGS84 format together with ground and tip height elevations at each wind turbine location will be provided to the IAA.
- The IAA will be notified of intention to commence crane operations with at least 30 days prior notification of their erection.

13.8.7 Cumulative Effects

All existing, approved and proposed projects in **Appendix 2.4** have been considered. There are a number of proposed, permitted or operational wind farms within 20 km of the Development. Each Developer is responsible for engaging with the aviation authority to ensure the proposals will not interfere with aviation radio signals by acting as a physical barrier. Therefore, as each project is designed and built to avoid impacts arising, a cumulative impact cannot arise. There will be no cumulative impacts relating to the Development and surrounding projects in relation to aviation during the construction phase.

Potential negative cumulative effects on aviation are unlikely during the operational and decommissioning phases.

13.8.8 Statement of Significance

No significant impacts are predicted in terms of air navigation. In adherence to IAA Safety Regulations and ICAO Annex 15, aeronautical obstacle warning light schemes will be installed as requested by IAA. Co-ordinates of ground and tip height elevations at each wind turbine location as constructed will be provided to the IAA. IAA will be notified of the provision of the intention to commence crane operations within a minimum of 30 days prior to erection.

13.9 QUARRIES

13.9.1 Introduction

While sub-base and base course materials for the Access Track and Turbine Hardstand construction will be sourced on site from the borrow pit, crushed stone will be imported for the final running layer. The crushed stone (5,470 m^3) for construction of the Development will come from licenced quarries in the locality such as:

- McGroup Keim Quarry;
- Coppeen Concrete, Enniskeane;
- Mid-Cork Quarries, Gortnadiha;
- McSweeney Bros, Kilmichael;
- Keohane Readymix, Ballygurteen, and
- Murray Bros Tarmacadam Ltd, Ardcahan.

These quarries will also be the source of crushed stone and concrete for turbine foundations and grid connection works. The locations of these quarries in relation to the Development can be seen in **Figure 15.3**.

13.9.2 Assessment of Potential Effects

The construction of the Development will impact on natural resources such as aggregates which will be sourced from the quarries in proximity to the Site (section 13.9.1).

It is likely that a small amount of granular material may be required to maintain access tracks during operation which could impact the source quarry. However, the decommissioning phase will have no impact on the source quarry.

The use of imported materiel will have a slight, permanent negative impact on non-renewable resources of the area. This impact is considered to be imperceptible in the long-term.

13.9.3 The 'Do-Nothing Impact'

If the Project were not to proceed, there would be no impact on quarry operations in the area and quarrying activities would continue.

13.9.4 Mitigation Measures

- Existing tracks have been used where possible and the layout was designed to minimise the length of new track required in order to reduce the requirement for such stone material.
- The on-site borrow pit will provide a total volume of 50,276 m^3. The quarry will only be used where the material won onsite is not suitable.
- Local quarries have been identified to reduce impact on transportation (Please see **Chapter 15: Traffic and Transportation)**.
- The source quarry will be chosen based on stone which is chemically similar to that occurring at the Development. This will reduce hydrogeochemical impacts. (Please see **Chapter 8: Soils and Geology**)

13.9.5 Cumulative Effects

All existing, approved and proposed projects in **Appendix 2.4** have been considered.

The very nature of a quarry is that it will be subjected to cumulative effects as it is the source of stone for almost all developments in the area.

Therefore, there will be cumulative impacts relating to the Project and surrounding projects in relation to quarries during the construction phase.

Potential negative cumulative effects on quarries are imperceptible/unlikely during the operational and decommissioning phases.

13.9.6 Statement of Significance

No significant negative impacts on local quarries are anticipated. There will be a slight, permanent negative residual impact on natural resources in the area.

This impact is considered to be imperceptible in the long-term.

13.10 UTILITIES

13.10.1 Introduction

In order to assess the potential for significant effects on built services gas, water and waste in the vicinity of the Development, scoping requests were made to Irish Water and Cork County Council including Water Services and the Environment departments. Refer to **Chapter 1: Introduction** of this EIAR for details in relation to the EIA scoping exercise. In addition to this, Punch Consulting Engineers prepared a Civil and Structural Due Diligence Report (**Appendix 13.2**) which assesses utilities along the Grid Connection Route.

13.10.2 Assessment Methodology

In order to assess the potential for impacts to electricity and water infrastructure and waste services, a scoping exercise was carried out with a number of key consultees, including ESB, Irish Water and Local Authorities. Full details of the scoping exercise that was carried out is provided in **Chapter 1: Introduction**.

A desk study of available information from the EPA did not identify any waste facilities, illegal waste activities, chemical monitoring points or industrial EPA licensed facilities within a 2 km radius of the wind farm site. The nearest waste facility to the Development is Macroom Civic Amenity Site (W0142-01).

13.10.3 Assessment of Potential Effects - Gas, Water Utilities

There are no gas mains located within the Site Boundary. There is therefore no potential for impact. Gas Networks Ireland responded to a consultation request confirming no existing services along the Grid Connection Route or Turbine Delivery Route and there does not appear to be any visible gas infrastructure along the route (**Appendix 13.2**).

Given that no detailed information has been provided by Irish Water or Cork County Council in relation to water services within the Site Boundary, it has been assumed that there is the potential to encounter local water services within the Development.

During Punch Consulting Engineers survey of the Grid Connection Route, the locations of watermains, fire hydrants, metres and sluice valves were recorded and can be found in **Appendix 13.2**.

Potential impacts arising from the Development relating to existing water services have been assessed and are detailed in **Chapter 9: Hydrology and Hydrogeology** and referred to in **Chapter 4: Population and Human Health** with accompanying mitigation measures.

13.10.4 Assessment of Potential Effects - Waste

Staff Facilities

During the construction, operational and decommissioning phases of the Development, there will be the typical waste generated in an office such as left-over food and sandwich wrappers. This is a non-hazardous waste. All such waste will be stored appropriately and safely from wind, rain and wild animals that often tear apart rubbish bags. The effects of this waste will be not significant.

Waste generated on site is estimated to range between 0.005 kg and 0.189kg per person per day.[5]

Sewage

The self-contained port-a-loo units at the construction/decommissioning phase will be managed and serviced regularly (by removal of the contents by tanker to a designated sewage treatment plant such as Ballyvourney/Ballymakeera Wastewater Treatment Plant) and removed off site on completion of construction. Toilet waste is a non-hazardous waste and effects will be slightly significant.

The maximum wastewater production during construction is estimated to be the same as the maximum water consumption (1,000 litres per day)[6].

All wastewater will be tankered off-site by a licensed waste collector to the nearest wastewater treatment plant, (Ballyvourney/Ballymakeera). There will be no on-site treatment of wastewater and effects will be not significant.

Concrete

The use of concrete (construction of Turbine Foundations, Substations etc.) onsite will have slight and permanent effects. It is expected that 20 L – 30 L of concrete washout will be produced during the construction phase which will be collected in designated skip(s) in a bunded area located in the designated concrete washout facility at the contractor's compound located to the north-east of T3.

[5] Based on 1 hour a day within communal facilities. Worldwide, waste generated per person per day averages 0.74 kilogram but ranges widely, from 0.11 to 4.54 kilograms. (World Bank) Available Online: https://datatopics.worldbank.org/what-a-waste/trends_in_solid_waste_management.html [Accessed 24/08/2022]

[6]Table 3 of the EPA WW treatment Manual (Treatment systems for Small Communities, Business, Leisure Centres and Hotels), Environmental Protection Agency, 1999. Quarry (Excluding Canteen) best reflects a construction site. [Available online: https://www.epa.ie/publications/compliance--enforcement/wastewater/EPA_water_treatment_manual_-small-comm_business.pdf]

Concrete structures will be left in place during decommissioning and allowed to naturally revegetate over time. This is the least impactful process of decommissioning. As the Site will have already been altered, the impacts are imperceptible and permanent.

Chemicals, Fuels and Oils

Oil waste and diesel are classified as hazardous waste/dangerous substance. There is no expected chemical/fuel/oil waste other than from rags and residual amounts in containers. Without mitigation, the effects would be slight and medium-term in duration. However, through the implementation of the mitigation measures set out in section 13.10.7 of this chapter, the residual effects will be not significant in the construction/decommissioning phase. The storage/use of such liquids is not seen necessary on site during the operational phase; thus, the effects are imperceptible.

Refuelling

As this has been mitigated by design, the residual effects are not significant.

There will be no need for refuelling onsite during the operational phase and effects are imperceptible.

The quantity of waste produced from refuelling is imperceptible.

Packaging

Packaging will be brought on site during the construction, operational and decommissioning phases and can include cardboard, wood and plastics used to package turbine components. Packaging waste will be dealt with in accordance with the European Union (Packaging) Regulations 2014 (S.I. No. 282 of 2014).

'A producer who supplies to another producer packaging material, packaging or packaged products shall comply with any reasonable request from the latter producer for data on the weight of the material or packaging concerned sufficient to enable the latter producer to comply with these Regulations.'

The occurrence of 10 kg of plastic per turbine blade, between 40 and 50 pallets and 50 to 60 cable drums are expected. This will be removed from site for re-use by an authorised person(s).

This waste is non-hazardous, and the effects of this waste are not significant.

Metals

During decommissioning, it is expected that 3,575 tonnes of steel from decommissioned turbines will be removed. This waste is non-hazardous, and effects will be not significant.

Excavated Materials

Excavated materials will be required for habitat and ecological restoration, reprofiling and backfilling in accordance with the **Appendix 2.1**. As such, excavated materials will not be classified as waste except along the Grid Connection Route.

An estimated 6,557 m^3 of material will be excavated along the Grid Connection Route and will be transported by an authorised waste permit holder to a licensed facility.

The effect of this will be not significant.

13.10.5 The 'Do-Nothing Impact'

If the Project were not to proceed, there would be no impact on the utilities or waste in the area.

13.10.6 Mitigation Measures - Utilities

Mitigation measures relating to existing water services have been assessed and are detailed in **Chapter 9: Hydrology and Hydrogeology** and referred to in **Chapter 4: Population and Human Health**.

13.10.7 Mitigation Measures - Waste

Staff Facilities

Provision for separation of waste streams will be provided so that e.g., paper, and cardboard waste and bottles may be recycled.

Sewage

It is proposed to install a rainwater harvesting system as the source of water for toilet facilities for the operational phase. Wastewater from the staff welfare facilities in the control building will be collected in a sealed storage tank, fitted with a high-level alarm. This is a device installed in a fuel storage tank that is capable of sounding an alarm, during a filling operation, when the liquid level nears the top of the tank.

Concrete

During the construction phase:

- Precast concrete will be used wherever possible i.e., formed offsite. Elements of the Development where precast concrete will be used have been identified and are indicated in the CEMP. Elements of the Development where the use of precast concrete will be used include structural elements of watercourse crossings (single span / closed culverts) as well as Cable Joint Bays. Elements of the Development where the use of precast concrete is not possible include turbine foundations and joint bay pit excavations. Where the use of precast concrete is not possible the following mitigation measures will apply.
- The acquisition, transport and use of any cement or concrete on site will be planned fully in advance and supervised at all times.
- Vehicles transporting such material will be relatively clean upon arrival on site, that is; vehicles will be washed/rinsed removing cementitious material leaving the source location of the material. There will be no excess cementitious material on vehicles which could be deposited on trackways or anywhere else on site. To this end, vehicles will undergo a visual inspection prior to being permitted to drive onto the proposed site or progress beyond the contractor's yard. Vehicles will also be in good working order.
- Any shuttering installed to contain the concrete during pouring will be installed to a high standard with minimal potential for leaks. Additional measures will be taken to ensure this, for example the use of plastic sheeting or other sealing products at joints.
- Concrete will be poured during metrological dry periods/seasons. This will reduce the potential for surface water run off being significantly affected by freshly poured concrete. This will require limiting these works to dry meteorological conditions i.e. avoid foreseen sustained rainfall (any foreseen rainfall event longer than 4 hour duration) and/or any foreseen intense rainfall event (>3 mm/hour, yellow on Met Eireann rain forecast maps), and do not proceed during any yellow (or worse) rainfall warning issued by Met Eireann. This also will avoid such conditions while concrete is curing, in so far as practical.
- Ground crew will have a spill kit readily available, and any spillages or deposits will be cleaned/removed as soon as possible and disposed of appropriately.
- Pouring of concrete into standing water within excavations will be avoided. Excavations will be prepared before pouring of concrete by pumping standing water out of excavations to the buffered surface water discharge systems in place.
- Temporary storage of cement bound sand (if required) will be on hardstand areas only where there is no direct drainage to surface waters and where the area has been bunded e.g., using sand-bags and geotextile sheeting or silt fencing to contain any solids in run-off.
- No surplus concrete will be stored or deposited anywhere on site. Such material will be returned to the source location or disposed of off-site appropriately. A concrete washings area can be seen on Drawing No. 6226-PL-803.

Upon implementation of the above mitigation measures, the effects of the construction of the Development are considered to be not significant.

Chemicals, Fuels and Oils

All storage containers of over 200 litres will have a secondary containment of 110% capacity to ensure that any leaking oil is contained and does not enter the aquatic environment.

A Chemical and Waste Inventory will be kept. This inventory will include:

- List of all substances stored on-site (volume and description)
- Procedures and location details for storage of all materials listed
- Waste disposal records, including copies of all Waste Transfer Notes detailing disposal routes and waste carriers used
- Any tap or valve permanently fixed to the mobile unit through which oil can be discharged to the open or when delivered through a flexible pipe which is fitted permanently to the mobile unit, will be fitted with a lock and locked shut when not in use
- Sight gauges will be fitted with a valve or tap, which will be shut when not in use Sight gauge tubes, if used will be well supported and fitted with a valve
- Mobile units must have secondary containment when in use/out on site

All dangerous substances will be conveyed in a container that compiles with the ADR. As such the manufacturer of each bowser will provide certification to contractors of the following:

- A leak-proof test certificate
- A copy of the IBC approval certificate
- An identification plate attached to the container

Where mobile bowsers are used on site, guidelines will be followed so that:

- Any flexible pipe, tap or valve will be fitted with a lock where it leaves the container and be locked shut when not in use;
- Flexible delivery pipes will be fitted with manually operated pumps or a valve at the delivery end that closes automatically when not in use. Where possible, a nozzle designed to dispense oil will be used;
- The pump or valve will have a lock and be locked shut when not in use.

For loads in excess of 1000 litres (220 gallons), the bowser vehicle driver will have undergone training and hold a special license.

Refuelling

During construction/decommissioning, where possible all refuelling on site will be within the temporary compound within the re-fuelling area (see Drawing No. 6226-PL-803). Only essential refuelling (e.g., cranes) will be carried out, outside of this area, but not within 65 m of any watercourse. In such cases a non-permeable High-density Polyethylene (HDPE) membrane will be provided beneath connection points to catch any residual oil during filling and disconnection. This membrane will be inspected and if there is any sign of oil contamination, it will be removed from site by a specialist licensed waste contractor. All vehicles will be well maintained and free from oil or hydraulic fuel leaks.

Packaging

In accordance with the waste hierarchy, packaging will be returned to the originator ahead of re-use or recycling. Where this is not possible, waste will be separated as appropriate and safely stored on site appropriately in anticipation of recycling.

Metals

Waste metals from concrete reinforcing during construction and removal of metals during decommissioning etc. will have commercial value and will be re-used or recycled with the appropriate licensed waste contractor.

13.10.8 Statement of Significance

There are no gas mains located within the Site Boundary. There is therefore no potential for impact.

It has been assumed that there is the potential to encounter local water services within the Development. Potential impacts arising from the Development relating to existing water services have been assessed and are considered not significant.

There are no EPA-licensed or local authority-authorised waste facilities or activities located within the Site. The closest, authorised municipal waste facility is located approximately 18.3 km south-east of the Development in the townland of Codrum, Macroom, Co. Cork. A list of waste facilities within the vicinity of the Development has been included in **Appendix 2.1: CEMP; Management Plan 5: Waste Management Plan**. Please see **Figure 15.5** for mapped facilities.

The residual effects of waste produced as a result of the construction, operational and decommissioning phases of the Development are considered to be not significant.

14 CULTURAL HERITAGE

14.1 INTRODUCTION

This chapter assesses the impacts of the Project (**Figure 2.2**) on Cultural Heritage. The term 'Project' is used within the chapter to refer to all elements of the application for the construction of Inchamore Wind Farm (**Chapter 2: Project Description**), including the Grid Connection Route and Turbine Delivery Route. The term 'Site' is used to refer to all land that falls within the Inchamore Wind Farm Site Boundary. The term 'Development' is used to describe the wind turbines, all site infrastructure and all works required along the Turbine Delivery Route within the Redline Boundary.

The assessment considers the potential effects during the following phases:

- Construction phase;
- Operation phase, and
- Decommissioning phase.

Where negative effects are predicted, the chapter identifies appropriate mitigation strategies therein.

The term 'Cultural Heritage' encompasses heritage assets relevant to both the tangible resource (archaeology, architecture heritage); and non-tangible resources (history, folklore, tradition, place names etc.). The recorded and potential cultural heritage resource within lands encompassing the proposed wind farm site (the Site) and the surrounding landscape was reviewed in order to compile a comprehensive cultural heritage baseline for the assessment. The proposed Grid Connection Route and the route for the delivery of turbines to the Site were also assessed. The extent of the study area assessed is defined in **Section 14.2.1**.

Common acronyms used throughout this EIAR can be found in **Appendix 1.2.** This chapter of the EIAR is supported by Figures provided in Volume III and by the following Appendix document provided in Volume IV of this EIAR:

- **Appendix 14.1 Plates**

A Construction and Environmental Management Plan (CEMP) is appended to the EIAR in **Appendix 2.1**. In the event planning consent is granted for the Development, the CEMP will be updated prior to commencement of development to address the requirements of any relevant planning conditions, including any additional mitigation measures, which are conditioned and will be submitted to the planning authority for written approval. For the purpose of this application, a summary of the mitigation measures is included in **Appendix 17.1**.

14.1.1 Statement of Authority

The chapter was prepared by Tony Cummins, a Senior Archaeologist with John Cronin and Associates. Mr Cummins holds B.A. and M.A. degrees in archaeology (University College Cork, 1992/1994) and has accumulated twenty-eight years' continuous industry experience. He was confirmed as a licence eligible archaeologist by the National Monuments Service in 1998 and has extensive experience in the preparation of cultural heritage assessments.

14.1.2 Assessment Structure

The results of the desktop study and field surveys, which are provided in **Section 14.3** of this chapter, together with the other assessments are considered to allow the Board to carry out an assessment of the Project from a Cultural Heritage perspective. In line with the revised EIA Directive and current EPA guidelines (as detailed in **Section 14.2.2** below) the chapter provides considerations of effects based on the following:

- Assessment of cultural heritage value and sensitivity;
- Assessment of the magnitude of cultural heritage effects within the Study Area;
- Assessment of the significance of cultural heritage impacts; and
- Assessment of cumulative cultural heritage impacts.

14.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

14.2.1 Definition of Study Area

The study area reviewed for the assessment comprised the area within the Development and the surrounding lands extending for 1 km in all directions beyond its Redline Boundary as well as a 100 m wide area centred on the Grid Connection Route and works required to facilitate the Turbine Delivery Route. The extent of the Development study area was chosen in order to compile a baseline context for the known cultural heritage resource within the Site and its environs as well as to assess potential direct and indirect impacts on the locations and settings of known cultural heritage assets within this area. The extent of the 100 m study area centred on the Grid Connection Route and Turbine Delivery Route work areas was chosen in order to appraise if there are any known elements of the cultural resource within their localised footprints or close environs, including potential sub-surface elements which may be susceptible to direct or indirect impacts.

In addition, the wider landscape extending for 10 km in all directions from the Site was reviewed to determine the presence of any nationally significant cultural heritage assets with heightened visual sensitivities, i.e., National Monuments in State Care and World Heritage sites (including tentative sites). This also included a review of other cultural heritage assets with visual attributes that extend beyond their immediate settings within this area, such as archaeological monuments with ritual visual alignments across the wider landscape that may be potentially subject to intrusions by turbines (e.g., stone circles, stone rows and megalithic tombs). The extent of the 10 km area was chosen in order to appraise if the wider landscape contains individual or groupings of such visually sensitive assets that may be susceptible to potential medium-to-high magnitudes of indirect impacts on their wider settings or alignments.

A review of the assessment of the significance of visual impacts on publicly accessible cultural heritage receptors within 20 km of the Development presented in the Landscape and Amenity Assessment chapter was also carried out (see **Chapter 12**). An archaeological review of this 20 km area did not identify other monuments or cultural heritage locations within publicly accessible lands that likely required visual impact assessment.

14.2.2 Assessment Methodology

The methodology used for this assessment follows guidelines presented in the *Guidelines for Information to be Contained in EIAR* (2022). The chapter complies with the requirements of Directive 2011/92/EU as amended by Directive 2014/52/EU, and the Planning and Development Act, 2000 (as amended) and Planning and Development Regulations, 2001 (as amended).

14.2.3 Relevant Legislation and Guidance

The tangible elements of the cultural heritage resource can be broadly divided into the archaeological resource comprising sites and monuments dating from the prehistoric period to the post-medieval period and the architectural heritage resource, encompassing standing structures and sites of cultural importance often dating to the post-medieval and modern periods. In addition, assets such as local placenames, folklore and traditions are considered part of the intangible cultural heritage resource. The management and protection of the cultural heritage resource in Ireland is achieved through a framework of international conventions and national laws and policies. This framework was established in accordance with the provisions of the 'European Convention on the Protection of the Archaeological Heritage' (the Valletta Convention) and the 'European Convention on the Protection of Architectural Heritage' (Grenada Convention). Both of these conventions were ratified by Ireland in 1997. While there is no current national legislation providing legal protection for the Irish intangible heritage resource it is noted that the UNESCO *Convention for the Safeguarding of the Intangible Cultural Heritage,* 2003, which seeks to safeguard and promote awareness of this element of cultural heritage, was ratified by Ireland in 2015.

The legislation and guidelines that are relevant to this assessment comprise the following:

- National Monuments Act 1930 (and amendments);
- Heritage Act (1995);
- National Cultural Institutions Act (1997);
- Architectural Heritage (National Inventory) and Historic Monuments (Misc) Provisions Act (1999);
- Planning and Development Act (2000) as amended;
- Department of Arts, Heritage and Gaeltacht (2011) *Architectural Heritage Protection: Guidelines for Planning Authorities*[1] , and
- Department of Arts, Heritage, Gaeltacht and the Islands (1999) *Framework and Principles for the Protection of Archaeological Heritage*[2]

14.2.4 Archaeological Heritage

The National Monuments Service is currently based in the Department of Housing, Local Government and Heritage and is responsible for the preservation, protection and promotion of Ireland's archaeological heritage. The National Monuments Acts 1930 (and amendments), the Heritage Act 1995 and relevant provisions of the National Cultural Institutions Act 1997 are the primary means of ensuring the satisfactory protection of archaeological remains. There are a number of mechanisms under the National Monuments Acts that are applied to secure the protection of archaeological monuments. These include the designation of National Monument status, the Register of Historic Monuments, the Record of Monuments and Places and the Sites and Monuments Record as well as the placing of Preservation Orders and Temporary Preservation Orders on endangered sites.

A National Monument is described as 'a monument or the remains of a monument, the preservation of which is a matter of national importance by reason of the historical, architectural, traditional, artistic or archaeological interest attaching thereto' (Section 2, National Monument Act, 1930). The Record of Monuments and Places was established under Section 12(1) of the National Monuments (Amendment) Act, 1994 and was based on the Sites and Monuments Record and Register of Historic Monuments. These records comprise lists and maps of all known archaeological monuments and places for each county in the State. The National Monuments Service maintains an online Historic Environment Viewer[3] which comprises an interactive map/search facility that provide access to records stored on its national database of sites and monuments. The Viewer includes designated areas around recorded monuments known as 'zones of notification' which do not comprise

[1] 1 https://www.gov.ie/en/publication/0937a-architectural-heritage-protection-guidelines-for-planning-authorities/
[2] https://www.archaeology.ie/sites/default/files/media/publications/framework-and-principles-for-protection-of-archaeological-heritage.pdf
[3] https://maps.archaeology.ie/HistoricEnvironment/

buffer zones but are intended to indicate areas of archaeological potential within their environs[4]. All archaeological sites listed in the Record of Monuments and Places receive statutory protection under the National Monuments Act 1994 and no works can be undertaken at their locations, including their surrounding zones of notification, without providing two months advance notice to the National Monuments Service.

The Sites and Monuments Record and the Record of Monuments and Places list two archaeological sites within the Redline Boundary as well as a further 15 examples within the surrounding 1 km area and these are detailed in **Section 14.3**. The potential for the presence of hitherto unrecorded, sub-surface archaeological features within Project areas is also considered.

14.2.4.1 Architectural Heritage

The protection of the architectural heritage resource is provided for through a range of legal instruments that include the Heritage Act 1995, the Architectural Heritage (National Inventory) and National Monuments (Misc. Provisions) Act 1999, and the Planning and Development Act 2000 Section (2.1) of the Heritage Act 1995, describes architectural heritage as follows:

> *All structures, buildings, traditional and designed, and groups of buildings including streetscapes and urban vistas, which are of historical, archaeological, artistic, engineering, scientific, social or technical interest, together with their setting, attendant grounds, fixtures, fittings and contents, and, without prejudice to the generality of the foregoing, includes railways and related buildings and structures and any place comprising the remains or traces of any such railway, building or structure.*

The Planning and Development Act 2000 requires Planning Authorities to maintain a 'Record of Protected Structures' of buildings and other structures that are of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest. All structures listed for protection in current development plans, are designated protected structures and planning permission is required for any works to such structures that would affect their character. A protected structure also includes the lands and other structures within its curtilage. While the notion of curtilage is not defined by legislation, the *Architectural Heritage Protection Guidelines for Local Authorities*[5] (Department of Arts, Heritage and the Gaeltacht 2011), describes it as the parcel of land immediately associated with a structure and which is (or was) in use for the purposes of the structure. The Project, and surrounding study area, extends into Counties Cork and Kerry and the current Record of Protected Structures for these administrative areas are published in the County Cork

[4] https://www.archaeology.ie/sites/default/files/media/publications/archaeology-planning-process-pl13.pdf
[5] https://www.gov.ie/en/publication/0937a-architectural-heritage-protection-guidelines-for-planning-authorities/

Development Plan 2022-2028 and the County Kerry Development Plan 2022-2028. The Planning and Development Act 2000 also provides for the inclusion of objectives for preserving the character of places, areas, groups of structures or townscapes of special interest designated as Architectural Conservation Areas.

The Architectural Heritage Act 1999 established the National Inventory of Architectural Heritage and the National Inventory of Architectural Heritage Historic Gardens and Designed Landscapes to create a record of built heritage structures and associated lands within the State. While inclusion in the National Inventory of Architectural Heritage does not provide statutory protection to a structure, it does provide an indication of architectural heritage value and the inventory is intended to advise local authorities on compilation of their Records of Protected Structures.

14.2.4.2 Cork County Development Plan 2022-2028

The County Cork Development Plan 2022-2028[6] includes a number of policies and objectives in relation to the protection of the cultural heritage resource within the county and these include objectives in relation to the protection of the archaeological resource (HE 16-9b: Management of Monuments within development sites, HE 16-10c: Undiscovered Archaeological Sites, HE 16-7 Battlefield, Ambush and Siege Sites and Defensive Archaeology, HE 16-9: Archaeology and Infrastructure Schemes, HE 16-6 Industrial and Post Medieval Archaeology and HE 16-9c Archaeological Landscapes). The Development Plan also includes a number of policies and objectives in relation to the protection of the architectural heritage resource within the county including the protection of designated structures and Architectural Conservation Areas (HE 16-14: Record of Protected Structures, HE 16-15: Protection of Structures on the NIAH and E 16-18: Architectural Conservation Areas) as well as non-designated features such as vernacular buildings, historic gardens and landscapes, masonry walls, railings, follies, gates, bridges and street furniture that are of built heritage significance (HE 16-16: Protection of Non-Structural Elements of Built Heritage, HE 16-19:Vernacular Heritage and HE 16-20: Historic Landscapes). The Development Plan also includes a number of policies and objectives in relation to the protection of the cultural heritage resource within the county, including aspects such as the cultural heritage of the county (HE 16-23: Cultural Heritage), linguistic heritage (HE 16-22: Gaeltacht Areas), placenames (HE 16-24: Naming of New Developments) and the arts (HE 16-26: The Arts). The *Múscraí Heritage Plan: conservation, management and interpretation plan 2018-2032*[7] was also reviewed as part of the assessment.

[6] https://www.corkcoco.ie/en/resident/planning-and-development/cork-county-development-plan-2022-2028
[7] https://www.corkcoco.ie/sites/default/files/2019-01/M%C3%BAscra%C3%AD%20Gaeltacht%20CMIP%20Final%20Draft%20Jan%202019.pdf

14.2.4.3 Kerry County Development Plan 2022-2028

While the Site is contained within County Cork, the surrounding 1 km study area around its Redline Boundary, as well as sections of the Site Access Road and Grid Connection Route, extend into County Kerry. The County Kerry Development Plan 2022-2028[8] was therefore also reviewed as part of the assessment. Section 8.3 of the Development Plan includes the Council's objectives for the protection of the archaeological resource which includes sections in relation to recorded archaeological monuments as well as the underwater archaeological resource (Development Plan Sections 8.3.1 and 8.3.3). The Development Plan also identifies 19 archaeological landscapes within the County and contains objectives that protect the monuments and their landscape settings within these areas as well as their visual aspect and monument inter-visibility (Development Plan Section 8.3.2). The Project does not extend into the boundaries of any of these designated archaeological landscapes. The Site is located c.2 km outside the boundary of The Paps Archaeological Landscape (Development Plan Archaeological Landscape ref. 13[9]) while a section of the Grid Connection Route follows an existing forestry road that extends outside the southern end of the boundary of this designated landscape. The closest section of this existing forestry road is located c.30 m outside the landscape boundary (**Figure 14.11**). The Development Plan also presents objectives for the protection of the architectural heritage resource, including Protected Structures, Architectural Conservation Areas, vernacular architecture, historic landscapes and arts/culture (Development Plan Sections 8.4.2, 8.4.3, 8.4.4, 8.4.5 and 8.2.1).

14.2.5 Desktop Study

The assessment presents the results of a desktop study of relevant published sources and datasets undertaken in order to identify all recorded and potential archaeological, architectural and other cultural heritage sites/features/areas within the study areas of the Site, Grid Connection Route and Turbine Delivery Route. The principal sources reviewed for the assessment of the recorded archaeological resource were the Sites and Monuments Record and the Record of Monuments and Places. The current Record of Protected Structures for Counties Cork and Kerry as well as the National Inventory of Architectural Heritage were consulted for assessing the designated architectural heritage resource.

Other sources consulted as part of the assessment included the following:

[8] http://docstore.kerrycoco.ie/KCCWebsite/planning/devplan/vol1updated.pdf
[9] https://consult.kerrycoco.ie/sites/default/files/4%20Archaeological%20Landscapes.pdf

Archaeological Inventory of County Cork Vols. 3 and 5:

These publications present summary descriptions of the recorded archaeological sites within this area of the county and relevant entries are included within the chapter. In addition, the current national online database resources pertaining to same were reviewed on the National Monuments Service's Historic Environment Viewer (www.archaeology.ie) in March 2023. A section of the 1 km study area around the Site as well as sections of the Site Access Road, Turbine Delivery Route and Grid Connection Route extend into an area of County Kerry that does not have a published archaeological inventory. The review of the Historic Environment Viewer included an appraisal of the known archaeological monuments within the relevant lands in County Kerry.

Heritage Council of Ireland Map Viewer:

This online mapping source (www.heritagemaps.ie) collates various cultural heritage datasets provided by, among others, the National Monuments Service, the National Museum of Ireland, local authorities, the Royal Academy of Ireland and the Office of Public Works and was reviewed in March 2023.

Topographical Files of the National Museum of Ireland:

These files, which are archived in the museum premises in Kildare Street, Dublin, were reviewed as part of the assessment and contain no entries for any of the townlands within the study area.

Database of Irish Excavation Reports:

This database contains summary accounts of all archaeological excavations carried out in Ireland (North and South) from 1970 to present. Current data was accessed via www.excavations.ie in March 2023.

Literary Sources:

Various published sources were consulted in order to assess the archaeological, historical, architectural heritage and folklore record of the study area.

Cartographic Sources:

A review of available historic cartographic sources was undertaken, and these included the 17th-century Down Survey and various map editions published by the Ordnance Survey from the mid-19th century onward. These sources can indicate the presence of past settlement patterns, including features of archaeological and architectural heritage significance that no longer have any surface expression. Relevant extracts from the reviewed cartographic sources are presented in **EIAR Volume III** (**Figures 14.4 and 14.5**).

Aerial, Satellite and LiDAR imagery:

A review of available imagery of the study area was undertaken in order to review the extent of modern interventions and to ascertain if any traces of unrecorded archaeological sites were visible within the Site.

Irish National Folklore Collection:

A review was undertaken of transcribed material from the National Folklore Collection archive which has been digitised and published online at www.duchas.ie.

UNESCO designated World Heritage Sites and Tentative List:

There are two designated World Heritage sites in Ireland and a number of other significant examples have been included in a Tentative List (2022) that has been put forward by Ireland for inclusion. None of these designated or tentative sites are located within 20 km of the Project.

14.2.6 Field Survey

Proposed development areas were surveyed on 22nd June 2020, 19th May 2021, 26th July 2021 and 3rd November 2021 and this included inspections of the Site, which includes the Site Access Road extending to the Site from the N22 road to the north and the Grid Connection Route. A windshield survey of the Turbine Delivery Route was also carried out. The surveyed lands were assessed in terms of historic landscape, existing land use, tree cover and the potential for the presence and survival of unrecorded archaeological and undesignated architectural heritage sites/features. The results of the field surveys are described within **Section 14.3.14** while annotated extracts from the photographic record are provided in **Appendix 14.1**.

14.2.7 Consultation

During the scoping stage the Development Applications Unit provided a response on 19th April 2021 to the request for comment on the scoping report provided to it. This response did not include any content in relation to the Cultural Heritage resource.'

14.2.8 Predicted Impacts on Archaeological, Architectural and Cultural Heritage

The following provides a summary of the criteria used to assess impacts in order to concisely outline the methodology specifically applied to the cultural heritage resource which has been informed by relevant EPA and ICOMOS guidelines (see **Section 14.2**).

Duration of Effect

The duration of effects is assessed based on the following criteria:

- Momentary (seconds to minutes)
- Brief < 1 day
- Temporary <1 year
- Short-term 1-7 years
- Medium Term 7-15 years
- Long Term 15-60 years
- Permanent > 60 years
- Reversible: Effects that can be undone, for example through remediation or restoration

Quality of Effect

The quality of an effect on the cultural heritage resource can be positive, neutral or negative:

- Positive Effect – a change which improves the quality of the cultural heritage environment, (e.g., increasing amenity value of a site in terms of managed access, signage, presentation or high-quality conservation/restoration and re-use of an otherwise vulnerable derelict structure)
- Neutral Effect – no change or effects that are imperceptible, within the normal bounds of variation for the cultural heritage environment
- Negative Effect – a change which reduces the quality of the cultural heritage resource, (e.g., visual intrusion on the setting of an asset, physical intrusion on features/setting of a site)

Type of Effect

The type of effect on the cultural heritage resource can be direct, indirect or no predicted impact.

- Direct Impact – where a cultural heritage site is physically located within the footprint of the EIA Development, which will result in its complete or partial removal.
- Indirect Impact – where a cultural heritage site or its setting in the landscape is located within the environs of the EIA Development.
- No predicted impact – where the EIA Development will not adversely or positively affect a cultural heritage site.

Magnitude of Effect

This is based on the degree of change, incorporating any mitigation measures, on a cultural heritage asset and can be negative or positive. The magnitude is ranked without regard to the value of the asset according to the following scale: High; Medium; Low and Negligible and has been informed by criteria published in the International Council on Monuments and Sites *Guidance on Heritage Impact Assessments for Cultural World Heritage Properties* (ICOMOS 2011) (**Table 14.1**).

Value assessment criteria

The evaluation of the values of cultural heritage assets used for the purposes of assessment is not intended as definitive, but rather an indicator which contributes to a wider judgment based the individual circumstances of each asset. The value of all known or potential assets that may be affected by development are ranked according to the following scale: Very High; High; Medium; Low; Negligible and Unknown. The factors for assessing the value of cultural heritage assets provided in **Table 14.2** have regard to the ICOMOS *Guidance on Heritage Impact Assessments for Cultural World Heritage Properties*[10] (ICOMOS 2011, 14.17). This guidance is intended as indicative and is used in combination with a consideration of the condition/preservation; documentary/historical significance, group value, rarity, visibility in the landscape, fragility/vulnerability and amenity value of the cultural heritage assets on a case-by-case basis. The values assigned to identified assets within the study areas were determined following the completion of the desktop research combined with subsequent site inspections and are presented in **Section 14.4** of this chapter.

Significance of Effects

The significance of effect can be described as Profound, Very Significant, Significant, Moderate, Slight, Not Significant or Imperceptible (**Table 14.3**) and is assigned based on the combined evaluation of effect magnitude and asset significance (**Table 14.4**).

Table 14.1: Magnitude of Impact Assessment Indicators for Cultural Heritage Assets

Indicative factors for assessing the Magnitude of Impact on the Cultural Heritage Asset *(after ICOMOS Guidelines 2011)*	
High	Most or all key archaeological or architectural materials affected such that the resource is totally altered Comprehensive changes to setting Changes to most or all key historic landscape elements, parcels or components; extreme visual effects; fundamental changes to use or access; resulting in total change to historic landscape character Major changes to area that affect Intangible Cultural Heritage activities or associations or visual links and cultural appreciation
Medium	Changes to many key archaeological or historic building materials/elements such that the resource is clearly/significantly modified Considerable changes to setting that affect the character of a cultural heritage asset. Changes to the setting of a historic building, such that it is significantly modified

[10] https://www.iccrom.org/sites/default/files/2018-07/icomos_guidance_on_heritage_impact_assessments_for_cultural_world_heritage_properties.pdf

Indicative factors for assessing the Magnitude of Impact on the Cultural Heritage Asset *(after ICOMOS Guidelines 2011)*	
	Change to many key historic landscape elements, parcels or components, visual change to many key aspects of the historic landscape, considerable changes to use or access, resulting in moderate changes to historic landscape character Considerable changes to area that affect the Intangible Cultural Heritage activities or associations or visual links and cultural appreciation.
Low	Changes to key archaeological materials/historic building elements, such that the resource is slightly altered/slightly different Slight changes to setting of an archaeological monument Change to setting of a historic building, such that it is noticeably changed Change to few key historic landscape elements, parcels or components; slight visual changes to few key aspects of historic landscape; slight changes to use or access; resulting in limited change to historic landscape character Changes to area that affect the Intangible Cultural Heritage activities or associations or visual links and cultural appreciation
Negligible	Very minor changes to key archaeological materials or setting Slight changes to historic building elements or setting that hardly affect it Very minor changes to key historic landscape elements, parcels or components; virtually unchanged visual effects; very slight changes to use or access; resulting in very small change to historic landscape character Very minor changes to area that affect the Intangible Cultural Heritage activities or associations or visual links and cultural appreciation

Table 14.2: Value Indicators for Cultural Heritage Assets

Indicative factors for assessing Value of Cultural Heritage Assets *(after ICOMOS Guidelines 2011)*	
Very High	*Potential for International Significance which may include* World Heritage Sites (including Tentative List properties) Assets of acknowledged international importance Assets that can contribute significantly to international research objectives Intangible associations with individuals or innovations of international significance
High	*Potential for National Significance which may include* Nationally designated sites, buildings and landscapes of significant quality, rarity, preservation and importance Undesignated assets of the quality and importance to be designated Assets that can contribute significantly to acknowledged national research objectives Archaeological Landscapes with significant group value Intangible associations with individuals or innovations of national significance
Medium	*Potential for Regional Significance which may include* Designated or undesignated assets that can contribute significantly to regional research objectives, including buildings that can be shown to have exceptional qualities in their fabric or historical associations Conservation Areas and historic townscapes containing buildings that contribute significantly to its historic character Intangible associations with individuals or innovations of regional significance
Low	*Potential for Local Significance which may include* Assets compromised by poor preservation and/or poor survival of contextual associations Assets of limited value, but with potential to contribute to local research objectives Historic Townscape or built-up areas of limited historic integrity in their buildings and settings Intangible associations with individuals or innovations of local significance
Negligible	Assets with very little or no surviving archaeological interest Landscapes with little or no significant historical interest

Indicative factors for assessing Value of Cultural Heritage Assets *(after ICOMOS Guidelines 2011)*	
	Buildings or urban areas of no architectural or historical note; buildings of an intrusive character
Unknown	Assets whose importance has not been ascertained Buildings with some hidden (i.e., inaccessible) potential for historic significance

Table 14.3: Significance of Effects (per EPA EIAR Guidelines 2022)

Significance	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 but without affecting its sensitivities
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline 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 14.4: Significance of Effects (per EPA EIAR Guidelines 2022)

Magnitude of Impact	**High**	Not Significant/ Slight	Moderate/ Significant	Significant/ Very Significant	Very Significant/ Profound
	Medium	Not Significant	Slight	Moderate/ Significant	Significant/ Very significant
	Low	Not Significant/ Imperceptible	Slight/ Not Significant	Slight	Moderate
	Negligible	Imperceptible	Not Significant/ Imperceptible	Not Significant/ Slight	Slight
		Negligible	**Low**	**Medium**	**High**
		Value/Sensitivity of the Asset			

14.3 BASELINE DESCRIPTION

14.3.1 Introduction

The following sections presents summary details of the main periods within the Irish archaeological record with references to identified cultural heritage assets located within the study area around the wind farm site, turbine delivery and the Grid Connection Route Datasets have been interrogated and retrieved from current state and local authority sources and are considered accurate at the time of writing in March 2023. **Section 14.3.2** provides a chronological overview of the Site study area since prehistoric times and includes references to known archaeological monuments within the area. The published Archaeological Survey of Ireland inventory descriptions of these monuments are then presented in **Section 14.3.3**. Other baseline information relating to the Site are presented in Sections **14.3.4** to **14.3.11** (inclusive) and baseline information on the Grid Connection Route and Turbine Delivery Routes have been collated in **Sections 14.3.12** and **14.3.13**.

14.3.2 The Wind Farm Site: Archaeological and Historical Background

Prehistoric Periods

Until the recent identification of Palaeolithic human butchery marks on a bear bone recovered from a cave site in County Clare, the earliest recorded evidence for human activity in Ireland dated to the Mesolithic period (7000–4000 BC) when groups of hunter-gatherers lived on the heavily wooded island. The archaeological record indicates that these mobile groups tended to favour coastal, lake and river shores locations which provided a transport resource and also provided elements of their varied diet. They did not construct any settlements or monuments that have left any above ground traces although their presence in an area can often be identified by scatters of worked flints in ploughed fields or sub-surface traces of their settlements revealed during earth-moving undertaken as part of development works. The Neolithic period (4000-2400 BC) began with the arrival of agriculture and its establishment as the principal form of economic subsistence, which resulted in more permanent settlement patterns. As a consequence of the more settled nature of agrarian life, new site-types, such as substantial rectangular timber houses, field systems and various types of megalithic tombs, begin to appear in the archaeological record. There are no known archaeological sites dating to the Mesolithic or Neolithic periods located within 1 km of the Site.

Metalworking arrived in Ireland with the advent of the Bronze Age period (c. 2400–500 BC). This new technology introduced a new artefactual assemblage into the Irish archaeological record and this period was also associated with the construction of new monument types such as standing stones, stone rows, stone circles and fulachta fiadh. The development of new burial practices meant that the construction of funerary monuments such as cairns, barrows, boulder burials and tumuli or cists was a common practice during this period. The arrival of iron-working technology in Ireland saw the advent of the Iron Age (600 BC – 400 AD). Relatively little has been known about settlement patterns during this period until recent decades when the corpus of evidence has been greatly increased by the discovery of Iron Age sites during archaeological investigations undertaken as part of various development projects.

The Site contains one field boundary feature (CO057-006----) and an enclosure site (CO057-007----) both of which are located within Inchamore townland in the area between

Turbines 1 and 2 **(Figures 14.1 and 14.2)**. These site types may potentially date to any period from prehistory onward and typically require archaeological excavation to determine their origin. The classification of 'field boundary' as an archaeological monument refers to field enclosures of potential antiquity and is often applied to remnant traces of walling sealed by bog growth. Isolated sections of such walling can be revealed by turf cutting works and may be an indication of the presence of wider field systems which may remain undetected below existing ground surfaces. They are often found associated with the remains of stone hut sites particularly within unimproved upland areas in western counties. The term 'enclosure' is applied to monuments with observable enclosing elements but have little or no other surviving diagnostic features that allow further classification. The field surveys carried out as part of this assessment included inspections of the locations of these two monuments within the Site and further details are provided in **Section 14.3.14**.

The surrounding 1 km study area also contains two sites of potential or likely Bronze Age date, and these comprise an unclassified megalithic structure (KE086-007----), located within a section of a forestry plantation *c.*460 m outside the north end of the Site and a *fulacht fia* (CO057-008007-) located *c.*550 m outside the south end of the Site (**Figure 14.1)** The megalithic structure and standing stone monuments are associated with funerary or other ritual activities while fulacht fia comprise burnt mounds or spreads that are typically interpreted as the remains of cooking sites. The presence of these monuments within the environs of the Site indicates the potential presence of an established Bronze Age population in the general area who were undertaking both ritual and domestic activities. The settlement sites during this period comprised one or more timber structures and the remains of their foundations and habitation deposits can survive beneath modern ground surfaces. There is also a cluster of recorded archaeological sites located within an area of Inchamore townland at distances of *c.*350 m-480 m outside the southern end of the Site and these comprise a field boundary (CO057-008001-), two enclosures (CO057-008004- and CO057-008005-) and four hut sites (CO057-008002-, CO057-008003-, CO057-008006- and CO057-008008-) (**Figure 14.1**). These sites may conceivably date to any period from prehistory onward and it is not possible to determine their origin without recourse to archaeological excavation.

A review of the landscape extending for 10 km from the Wind farm Site revealed the presence of various extant prehistoric monuments of probable Bronze Age origin which have likely ritual alignments across the wider landscape, and these comprise five stone circles, thirteen wedge tombs, two unclassified megalithic structures and one stone row (**Table 14.5 and Figure 14.7**). The methodology used to assess whether any examples have direct alignments towards turbines within the Site, which may intrude on these alignments, entailed reviews of their archaeological inventory descriptions to determine their recorded alignments, and these were then analysed by cross-referencing each of the monuments' locations in relation to the Site. This review revealed that only one example, a wedge tomb (CO058-060----) located 2.25 m to the northeast of the nearest turbine (T4), has a recorded alignment facing towards the Site (**Figure 14.7**). The Archaeological Survey of Ireland record that this monument is in a ruinous condition within an area of cut away bog and appears to have been exposed by turf cutting. A review of aerial and satellite imagery of its general location revealed that it is located within private lands on the northwest side of a modern forestry plantation and that turf-cutting has continued within its close environs during recent decades. Wedge tombs consist of a long burial gallery formed by large stone slabs, sometimes with an antechamber or small closed end-chamber. They are generally broader and higher at the front, which tends to face towards the west and southwest directions. O' Brien[11] has noted that monuments such as wedge tombs were aligned towards the general direction of the setting sun in the general southwest quadrant during the darker months of the year.

Table 14.5: Review of monuments with potential visual alignments within 10 km of Site

Monument no.	Class	Condition (ASI)	Approx. distance from nearest turbine	Recorded Alignment (ASI)	Aligned towards Site?
CO058-060----	Megalithic tomb - wedge tomb	In ruins	2.25 km to NE	NE-SW	Yes
CO058-075----	Megalithic tomb - wedge tomb	Collapsed	1.8 km to NW	n/a	n/a
CO058-076----	Megalithic tomb - wedge tomb	Partially exposed in cutaway bog face	2.9 km to NE	E-W	No
CO068-005----	Megalithic tomb - wedge tomb	Extant but capstone displaced	7.9 km to S	NE-SW	No
CO069-003----	Megalithic tomb - wedge tomb	In ruins	5.1 km to S	ENE-WSW	No
CO069-014----	Megalithic tomb - wedge tomb	Extant but capstone displaced	6.9 km to SE	E-W	No
CO069-029----	Megalithic tomb - wedge tomb	Extant	8.7 km to SE	ENE-WSW	No
CO069-069----	Megalithic tomb - wedge tomb	Partial remains	3.8 km to SE	N-S	No
CO069-093----	Megalithic tomb - wedge tomb	Extant but capstone displaced	7.2 km to S	E-W	No
KE076-038----	Megalithic tomb - wedge tomb	Extant but partially sealed with field clearance material	3.7 km to NW	ENE-WSW	No

[11] O'Brien, W. (2012) *Iverni: A prehistory of Cork*. The Collins Press. pg 192-3

Monument no.	Class	Condition (ASI)	Approx. distance from nearest turbine	Recorded Alignment (ASI)	Aligned towards Site?
KE076-056----	Megalithic tomb - wedge tomb	Extant but capstone displaced	3.4 km to NW	E-W.	No
KE085-001----	Megalithic tomb - wedge tomb	Extant but partially buried in bog and in forestry	8 km to WNW	E-W	No
KE085-053001-	Megalithic tomb - unclassified	Possible megalith in ruinous condition	5.8 km to SW	n/a	n/a
KE086-007----	Megalithic structure	Irregular-shaped stone structure in forestry, possible megalith	0.67 km to N	E-W	No
KE094-095----	Megalithic tomb - wedge tomb	Extant but capstone displaced	10 km to SW	E-W	No
CO058-029----	Stone circle - five-stone	Extant but one stone missing	5.5 km to SE	E-W	No
CO069-013----	Stone circle - multiple-stone	Extant	7.7 km to SE	NNE-SSW	No
CO069-015----	Stone circle - multiple-stone	Partially collapsed	6.7 km to SE	NNE-SSW	No
CO069-026----	Stone circle - five-stone	Extant	8 km to SE	NE-SW	No
CO069-076----	Stone circle - five-stone	Extant	2.9 km to S	ENE-WSW	No
CO069-027----	Stone row	Extant	8.1 km to SE	NE-SW	No
KE086-009----	Stone pair	Extant	2.5 km to SW	NW-SE	No
CO058-007----	Stone pair	Extant	3.8 km to NW	ENE-WSW	No

Early Medieval to Post-Medieval Periods

The early medieval period began with the introduction of Christianity to Ireland and continued until the arrival of the Anglo-Normans in the late 12th century (c. 400–1169 AD). While this period saw the emergence of the first phases of urbanisation around the larger monasteries and the Hiberno-Norse ports, the dominant settlement pattern continued to be rural-based and founded on an agricultural economy centred on enclosed farmsteads known as ringforts, with stone-built equivalents known as cashels. The early medieval church sites were often morphologically similar to ringforts but are often differentiated by the presence of features such as church buildings, graves, stone crosses and shrines. While there are notable early medieval ecclesiastic sites located within the Baile Bhúire and Gougane Barra areas in the wider landscape, there are no recorded examples within the study area.

There is one potential early medieval site located within the study area and this comprises a holy well (CO057-009----) in Inchamore townland at a distance of 670 m to the south of the Redline Boundary. Holy wells are common features within the Irish landscape and are typically sited at natural springs with some examples simply formed by natural depressions that fill with water while others have stone-built surrounds which often date to recent centuries. The traditions and veneration associated with these sites may date to the earliest phase of Irish Christianity with the potential that they likely form a continuation of pre-Christian ritual activity. Many wells have associations with a saint's name and were the site of annual visitations, known as patrons or patterns, which were held on the named saint's day, a practice which still continues at some examples. The holy well waters are also typically associated with traditions ascribing them various curative properties.

The arrival of the Anglo-Normans in the late 12th century broadly marks the advent of the Irish high medieval period which continued to c.1400 and was followed by the late medieval period which extended to c.1550. These periods saw the continuing expansion of Irish urbanisation as many of the port cities developed into international trading centres and numerous villages and towns began to develop throughout the country, often within the environs of Anglo-Norman manorial centres which were defended by masonry castles. By the 15th century, the native Irish chieftains and lords began to construct tower-house castles within their own landholdings as centres of territorial control. In 1207, King John granted Richard de Cogan rights to an area taking in all or part of Muskerry much of which was still under Gaelic control at that time. The initial land grant for what was to become the barony of Múscraí dates to 1352 when lands on the Cork-Kerry border were the subject of grant from the English crown to Cormac McCarthy. It has been noted that much of the subsequently conquered lands within the region were concentrated along the Lee Valley and that many remote mountainous areas remained in Gaelic control[12]. There are no recorded late or high medieval monuments located within the study area.

The centuries following 1550 comprise the post-medieval period which continued into the middle of the 19th century and the period thereafter is often described as early modern. The early phase of the post-medieval period was a turbulent time in Ireland and included the mid-17th century Cromwellian Wars which resulted in extensive dispossession of forfeited Gaelic lands. The 17th century Down Survey records compiled following the latter period of conflict provide very little information on the two townlands that extend into the Redline Boundary (Inchamore and Milleeny). The annotated maps indicate that land use within the general area was dominated by rough mountain lands, pasture and woodlands. These maps typically only depict larger settlements as well as other significant features such as castles, churches, roads and bridges, none of which are shown within the general area around Inchamore and Milleeny. The Survey records that the lands within the Redline

[12] Butler, W. A. (1910) 'The Barony of Muskerry'. *Journal of the Cork Historical and Archaeological Society*, Vol. **16**, No. 86, p. 81-8.

Boundary were controlled by Catholic landowners in 1641, with David McTeigue Herlihy possessing Inchamore and William Oge Herlihy possessing Milleeny. The lands around Baile Mhic Íre, Baile Bhúirne and Cúil Aodha were subsequently granted to Sir John Colthurst who is named as the owner of Inchamore and Milleeny in the 1670 Survey records.

An agricultural boom in the late 18th and early 19th centuries saw a rise in prices for both Irish tillage and dairy produce which resulted in landlords investing in extensive land improvement works within their holdings to increase productivity. This included widespread land drainage works and enclosure of open lands into field systems that survive to the present-day. The post-medieval period saw the development of high and low status stone houses throughout the Irish countryside and rural settlement clusters at this time typically consisted of single-storey thatched cottages with associated farm buildings while two-storey farmhouses became more common during the 19th century. The settlement pattern throughout much of the rural landscape was greatly affected by the Famine period and its aftermath in the middle of the 19th century which saw the depopulation of many areas. The population records in the wider area region note a 32.7% drop in population in Baile Bhúirne and 35.1% drop in Cill na Martra between 1841 and 1851[13].

The Topographical Dictionary of Ireland[14] provides descriptions of Irish parishes during the early decades of the 19th century and often provides information on contemporary land use patterns, historical events and the presence of archaeological sites and features of architectural heritage interest such as large country houses. The Site is located within the civil parish of Ballyvourney and Lewis's description of this area concentrates on the settlement of the same name but, while it contains no references to the townlands of Inchamore and Milleeny, it does note that other areas of the parish contained about 16,000 acres of rough pasture and moorland, which might be drained and brought into a state of profitable cultivation. Further details on the character of the Site and its environs during the 19th century are presented in the review of historical Ordnance Survey (OS) maps (**Section 14.4.10**).

The recorded archaeological monuments within 1 km of the Site include seven lime kilns which are a common feature in the Irish rural landscape with many dating to recent centuries although the potential exists that some examples may pre-date the post-medieval period. The recorded location of a trackway (KE086-002----) of potential antiquity is c.760 m outside the north end of the Site (**Figure 14.1**). The Archaeological Survey of Ireland inventory

[13] https://www.corkcoco.ie/sites/default/files/2019-01/M%C3%BAscra%C3%AD%20Gaeltacht%20CMIP%20Final%20Draft%20Jan%202019.pdf
[14] Lewis, S. (1837) *Topographical Dictionary of Ireland*. 2 Volumes, Lewis & Company, London

description for this monument notes that its recorded location is covered in forestry and is not visible at ground level, but the Record of Monuments and Places map[15] (Sheet KE086) indicates that it was aligned in a broadly east to west direction and this projected route does not extend within the Site.

14.3.3 Record of Monuments and Places

There are two recorded archaeological monuments located within the Site, which comprise an enclosure (CO057-007----) and a field boundary (CO057-006----), while there are a further 15 examples within the surrounding 1 km area, one of which has been classified as 'redundant record' by the Archaeological Survey of Ireland (KE076-071----) (**Figure 14.1**). None of these monuments are designated as National Monuments in State Ownership or Guardianship or have been assigned Preservation Orders but are afforded legal protection by their inclusion in the Record of Monuments and Places. The published Archaeological Survey of Ireland inventory descriptions of these monuments are presented in **Table 14.6**, which also provides their distances from the nearest proposed Development areas.

[15] https://archaeology.ie/sites/default/files/media/pdf/Archaeology-RMP-Kerry-Map-(1998)-0019.pdf

Table 14.6: Recorded Archaeological Monuments within 1 km of Site

Monument no.	Class	Townland	Archaeological Survey of Ireland inventory description	ITM E	ITM N	Approx. distance from nearest development area
CO057-006----	Field boundary	Inchamore	In rough hill grazing on bog, on a gentle S-facing slope, with a view across the valley to Carrignaspirroge. Traces of mainly curvilinear, relict, stone field boundaries (T 0.6 m; H 0.3 m) protrude above the surface of the bog in a roughly rectangular area (c. 150 m E-W; c. 70 m N-S). The relict walls disappear in level areas, where the bog is deeper.	512568	578626	190 m to northwest of T2 hardstand
CO057-007----	Enclosure	Inchamore	In rough hill grazing on bog, on a S-facing slope with views across a valley to Carrignaspirroge. A D-shaped area (6 m N-S) with the straight side at N (L 10.5 m), is defined by a mixture of large slabs and stones set beside the linear face of outcropping rock at N and elsewhere by the curving remains of a stone wall (T 0.65; H 0.5 m) protruding above the surface of the bog. The interior is partially covered with rushes.	512761	578718	150 m to north of T2 hardstand
KE086-007----	Megalithic structure	Derryreag	In a coniferous wood, on the NE-facing slopes of Inchamore Mountain. An irregular-shaped structure (1.75 m NE-SW; 1.4 m NW-SE) of boulder-type stones, roofed with stone lintels, on top of which is a mound of smaller stones. There is a small, partially collapsed chamber (H 1 m) within this structure with an entrance on the E side. Another similar structure (2 m N-S; 1.3 m E-W) lies c. 2 m to the S.	512529	579681	670 m north of T3 hardstand
KE086-002----	Road	Derryreag	In a mixture of rough hill pasture and forestry, on a SE-facing slope. In the 1930s Capt. D. B. O'Connell noted an ancient trackway here (SMR file). The area is obscured by dense forest and overgrowth and the trackway is not visible at ground level.	512805	580064	865 m north of T3 hardstand
CO057-008001-	Field boundary	Inchamore	In rough hill grazing on bog, on a S-facing slope, with views across the valley to Carrignaspirroge. A network of mainly curvilinear, relict, stone field boundaries (T 0.6 m; H 0.3 m), that protrude above the surface of the bog, occurs intermittently throughout a roughly rectangular area (c. 180 m E-W; c. 90 m N-S). Stone slabs set at right angles to the line of the wall are occasionally visible along stretches of the relict boundaries. The walls run on into the deeper bog in hollow or level areas. Four hut sites (CO057-008002-, CO057-008003, CO057-008006, CO057-008008-), two enclosures (CO057-008004-, CO057-008005-) and a fulacht fia (CO057-008007-) are within the field boundary network.	512440	577841	480 m south of Met Mast

Monument no.	Class	Townland	Archaeological Survey of Ireland inventory description	ITM E	ITM N	Approx. distance from nearest development area
CO057-008002-	Hut site	Inchamore	In rough hill grazing, on bog, on a S-facing slope and within a network of relict field boundaries (CO057-008001-). The remains of a D-shaped hut site (4.5 m N-S) defined by a curving stone wall (T 0.5 m; H 0.3 m) with a straight N side (L 4 m). The stone wall protrudes intermittently above the surface of the bog. The interior is raised (H 0.2 m) at the S to compensate for the hillslope. The linear wall at the N is incorporated into an E-W field wall.	512418	577828	510 m south of Met Mast
CO057-008003-	Hut site	Inchamore	In rough hill grazing, on bog, on a S-facing slope and within a network of relict field boundaries (CO057-008001-). The remains of a circular hut site (diam. 2.4 m) defined by a stone wall (T 0.6 m; H 0.4 m) which protrudes above the surface of the bog. The level interior is in pasture. Field walls abut the hut site at the NW and the SE. An enclosure (CO057-008004-) is c. 15 m to the S.	512439	577847	480 m south of Met Mast
CO057-008004-	Enclosure	Inchamore	Within an area of field walls (CO057-008001-) in rough hill grazing on bog, on a S-facing slope with views across the valley to Carrignaspirroge. A right-angled, SW-facing corner is defined by the remains of a N-S (L 5 m) and an E-W (L 6 m) field wall and is enclosed at SW by a curving wall, all of which (T 0.55; H 0.4 m) protrude intermittently above the surface of the bog. There is a hut site (CO057-008003-) c. 15 m to the N.	512443	577835	495 m south of Met Mast
CO057-008005-	Enclosure	Inchamore	In rough hill grazing, on a terrace on a S-facing slope and within a network of field boundaries (CO057-008001-). A D-shaped area (12 m E-W) defined at the straight E side by a drystone wall (L 12 m; T 1 m at the base) narrowing as it rises to a height of 1.2 m. Elsewhere it is defined by the remains of a stone wall (T 1 m; H 0.3 m), protruding above the surface of the bog. The almost level interior is raised (H 0.4 m) at SW. There is a hut site (CO057-008006-) c. 6 m to the SW.	512500	577782	720 m south of Met Mast
CO057-008006-	Hut site	Inchamore	In rough hill grazing, on bog, on a S-facing slope and within a network of relict field boundaries (CO057-008001-). The remains of an oval hut site (2.8 m E-W; 2 m N-S) defined by a stone wall (T 0.5 m; H 0.2 m) which protrudes intermittently above the surface of the bog. An enclosure (CO057-008005-) is c. 6 m to the NE.	512495	577784	520 m south of Met Mast
CO057-008007-	Fulacht fia	Inchamore	In rough hill grazing and within a network of field walls (CO057-008001-). A horseshoe-shaped mound (7 m E-W; 6.1 m N-S; H 1 m) of heat-shattered	512595	577659	620 m south of Met Mast

Monument no.	Class	Townland	Archaeological Survey of Ireland inventory description	ITM E	ITM N	Approx. distance from nearest development area
			stones and charcoal-enriched soil. The opening (Wth 1.7 m) faces W. The S edge of the mound has been damaged due to recent drainage works.			
CO057-008008-	Hut site	Inchamore	In rough hill grazing, on bog, on a S-facing slope and within a network of relict field boundaries (CO057-008001-). The remains of an oval hut site (3.5 m E-W; 2.3 m N-S) defined by the lower courses of a drystone wall (T 0.55; H 0.75 m) which protrude above the surface of the bog. The wall is best preserved along the E arc. Rubble is scattered in the W half of the interior.	512444	577741	580 m south of Met Mast
CO057-005----	Lime kiln	Inchamore	No published description	512455	577587	715 m south of Met Mast
CO057-009----	Holy well	Inchamore	On the N side of a road, on a S-facing slope. Spring water emerges from the base of an earthen bank which is covered with ferns, briars and bushes. According to local information, this is a holy well and its water was used to cure animal ailments.	512272	577561	715 m southwest of Met Mast
CO057-010----	Lime kiln	Inchamore	No published description	512204	577539	860 m southwest of Met Mast
CO057-012----	Structure	Mileeny	No published description	513684	577663	950 m south of T5 hardstand
CO058-001----	Lime kiln	Derreenalig	On N side of laneway, built into slight break in slope. Roughly rectangular kiln (c. 6 m N-S; c. 8 m E-W; front H 3.8 m; rear H 0.6 m), partially collapsed. Front elevation (S) has lintelled recess (H 1.75 m; Wth 1.5 m; D 2.1 m), with sloping slabs to rear. Circular funnel (diam. c. 1.5 m) almost completely infilled.	514293	579793	950 m northeast of T4 hardstand

14.3.4 Topographical Files of the National Museum of Ireland

The National Museum of Ireland's Topographical File archive, which is stored in the museum premises at Kildare Street, Dublin was inspected during the assessment and contains no files for any of the townlands within the study area.

14.3.5 Aerial, Satellite and LiDAR Imagery

A review of online aerial/satellite images of the Site, including those published by the Ordnance Survey of Ireland, Google and Bing, revealed that the proposed turbine locations have been occupied by areas of heathland, improved fields and commercial forestry plantations since at least the 1990s. A study by the Heritage Council of Ireland[16] on the impacts of forestry plantation works on archaeological sites, including their surface and buried elements, has noted that the initial planting process involves a number of ground disturbance activities, such as ploughing, drainage, access roads and planting, that have the potential to destroy or severely impact any sites within the plantation. Further impacts are also likely to occur during the operational phase of the plantation through continued disturbance by extensive root systems, which will entwine with any sub-surface archaeological deposits or features with little or no potential of removal without causing their destruction. Additional impacts during subsequent harvesting and replanting processes were also noted. The study also concluded that given the impossibility of aerial reconnaissance and access constraints during field surveys, the potential for detecting unrecorded sites within forestry plantations is unlikely to be possible. However, the development and widespread use of LiDAR technology in recent years has allowed for the potential for reconnoitring forestry plantations through the use of aerial imagery that can screen out the forestry canopy and allows for the assessment of the presence of surface traces of potential archaeological sites, which can be visible as surface anomalies indicated the presence of features such as enclosing ditches, low mounds and partially levelled structures.

The LiDAR imagery of the Site commissioned by the Developer was made available for archaeological review as part of this assessment (**Figure 14.6**). The imagery encompasses the locations of all turbines as well as other infrastructure within the majority of the Site but it does not extend to the N22 road to the north. The imagery clearly outlines the extent of ground disturbance within the forestry plantations which is visible as close set, linear surface anomalies resulting from cultivation and drainage ground works. The imagery also shows the presence of linear land drains extending through areas of open heath as well as surface traces of ground works undertaken to create areas of improved grassland during modern land reclamation works. The detail on the imagery also depicts the uneven nature of the

[16] Johnson, G. (1998) *Archaeology and Forestry in Ireland*. The Heritage Council of Ireland

ground terrain within areas of rocky heathland. No surface traces of potential unrecorded archaeological sites or architectural heritage structures were noted within the Site during the LiDAR review.

14.3.6 Cork and Kerry County Development Plans

The current Records of Protected Structures for Counties Cork and Kerry, as published in the County Cork Development Plan 2022-2028 and the County Kerry Development Plan 2022-2028, do not list any structures or Architectural Conservation Areas located within the Site or within 1 km of its Redline Boundary.

14.3.7 National Monuments in State Ownership/Care Cork

There are no designated National Monuments in State Guardianship or Ownership located within 10 km of the Site.

14.3.8 National Inventory of Architectural Heritage

The National Inventory of Architectural Heritage does not list any structures, historic landscapes or gardens within the Site or within lands extending for 1 km from its boundary.

14.3.9 Previous Archaeological Work in the Wider Area: Excavations Database

The Database of Irish Excavation Reports contains no entries for any archaeological investigations within the Site. It does contain an entry for archaeological monitoring of the construction of a 15-turbine wind farm in Inchee townland, Co. Kerry in lands located c.2.7 km to the west of the Site which notes that nothing of archaeological significance was encountered (Excavation Licence 05E0112[17]). However, the Archaeological Survey of Ireland description of two standing stones in that area indicates that they were discovered during that project, potentially after the compilation of the Database entry. Archaeological monitoring of ground works during the construction of another two wind farms in Inchincoosh and Lettercannon townlands, located 3 km to the west of the Site, revealed the presence of a previously unrecorded possible hut site and a possible collapsed megalithic tomb which were excluded from the development area (Excavation Licence 08E0437[18]). Archaeological test trenching of the location of a potential fulacht fia site in an area of Coomacullen townland located 1.9 km to the north of the Site revealed nothing of archaeological significance (Excavation Licence 97E0184[19]). A review of the results of archaeological assessments and site investigations undertaken during the development of wind farms located within 10 km of the Project was also carried out as part of the Cumulative impact assessment and the results are presented in **Section 14.6**.

[17] https://excavations.ie/report/2005/Kerry/0013693/
[18] https://excavations.ie/report/2008/Kerry/0019629/
[19] https://excavations.ie/report/1997/Kerry/0002784/

14.3.10 Ordnance Survey Maps

The first edition 6-inch Ordnance Survey (OS) map published in 1846 shows the majority of the lands within the Site occupied by open, vacant, marginal heathland (**Figure 14.4**). A now demolished small farm building and an associated cluster of surrounding irregular fields are shown within the western end of the Site. The former location of the farm building is outside the footprint of the Development within the Site and the nearest Development area to its location is the Turbine 2 hardstand located in forestry c.90 m to the west. The locations of all of the turbines and associated infrastructure are shown as vacant, open heathland on the map, apart from the substation location which is shown as a small vacant field c.140 m to the east of the farm building. The coverage of the 25-inch OS map (1888-1913 series) does not extend into the Site. The detail on the second edition 6-inch OS map, which was published in 1900, demonstrates that the only notable alteration to the layout of the Site during the second half of the 19th century was the expansion of the reclaimed fields within the lower ground in the central area and the construction of second farm building within the east end of the Site (**Figure 14.5**). This building is also outside the footprint of the Development within the Site and the nearest proposed construction area is an access road to the substation located c.130 m to the north (**Figure 14.3**). The layout of the former location of the farm building in the west end of the Site appears unchanged and no additional structures are indicated within its environs. No potential unrecorded archaeological sites were noted within the Site during the review of the historic OS maps.

14.3.11 Undesignated Cultural Heritage Assets

While encompassing the protected archaeological and architectural heritage resources, cultural heritage also includes various undesignated assets such as demesne landscapes and vernacular structures as well as intangible assets such as folklore, placenames and historical events and associations. As noted in **Section 14.3.10**, the review of historic OS maps revealed the presence of two farm buildings within the Site and neither of these are located within the Development footprint. No other buildings or structures of potential vernacular heritage significance were noted within the Site.

The Site extends into two townlands (Inchamore and Milleeny) which are the smallest unit of land division in the Irish landscape, and many may preserve early Gaelic territorial boundaries that pre-date the Anglo-Norman conquest. Townland boundaries were recorded and standardised by the Ordnance Survey (OS) during the 19th century and their names typically comprise anglicisations of their original Irish names which often refer to natural topographical features, past landowners and farming practices, but some may also indicate the presence of archaeological sites within the townland, e.g. lios or rath typically indicate the presence of a ringfort while temple, saggart, termon or kill may record associations with a church site. The translations of the names of the two townlands that extend into the Site were sourced from the Placenames Database (www.logainm.ie) and neither refer to potential archaeological sites (**Table 14.7**). The boundary between these two townlands is formed by a narrow stream which extends in a north to south direction through the centre of the Site.

Table 14.7: Translation of Townland Names

Townland	Irish Origin	Translation	Placename Database notes	Archaeological Indicator?
Inchamore	An Inse Mhór	'large river meadow'	Mentioned in an 18th century registry of deeds	No
Milleeny	Na Millíní	'little hillocks'	Mentioned in an 18th century registry of deeds	No

The online database of the Irish National Folklore Collection (www.duchas.ie) was reviewed and it contains two entries relating to past activities in Inchamore and Milleeny townlands which are summarised below (**Table 14.8**).

Table 14.8: Summary of recorded folklore accounts

Source	Summary of Transcript	Observations
Síle Bean Uí Loingsigh	Provides an alternate origin for Milleeny placename which refers to the former presence of a grinding mill at the foot (south end?) of the townland.	This may be due to a mistranslation of the name or may alternatively refer to a milling activity within the south end of the townland, which is in the environs of Coolea
Diarmuid Ó hÉalaighthe	Records that Inchamore townland contained a number of small farm holdings with 2-room thatched cottages and refers to a clochan (hut site) in the west end of the townland where a herdsman formerly lived	The reference to a clochan may record the presence of a hut site of archaeological interest at an unknown location in the west end of Inchamore, perhaps associated with booleying farming activity in recent centuries. There are no construction works proposed in that area of the townland.

The proposed Development is located within the Múscraí Gaeltacht area with a number of settlement centres located within the wider landscape, e.g., Réidh na Doírí (Reenaree), Cúil Áodha (Coolea), Béal Átha an Ghaorthaidh (Ballingeary), Baile Bhúirne (Ballyvourney) and Baile Mhic Íre (Ballymakeera). The location has seen a general decline in population within the modern period and there are no settlement centres located within the Site or within 1 km of the Redline Boundary. The region also has notable associations with other intangible elements of the cultural heritage resource such as music, including Sean-nós singing, poetry and dance traditions. There are no institutions, such as local museums or other heritage centres, associated with the intangible cultural heritage of the area located within the Site or surrounding study area. The Cork County Council *Múscraí Heritage Plan:*

conservation, management and interpretation plan 2018-2032[20] identifies a range of assets and attributes considered to be of cultural heritage significance within the region, including specific assets considered to be of archaeological, architectural, historic, artistic and scientific interest. While the Plan does not purport to be an exhaustive list of such assets, it is noted that none of the identified examples are located in townlands within or adjacent to the Project.

14.3.12 Grid Connection Route

The Grid Connection Route will extend for c.80 m through a green field area to the west of the onsite substation and will thereafter follow sections of existing forest tracks extending from the Site to the existing Ballyvouskill substation. The section of the study area centred on the Grid Connection Route comprises a 100 m wide corridor centred on the route and this contains one recorded archaeological site which is listed as a redundant record in the Sites and Monuments Record (KE076-071----) and is not included in the Record of Monuments and Places (**Figure 14.8**). The below Archaeological Survey of Ireland inventory description of this redundant record has been published on the National Monuments Service's Historic Environment Viewer and confirms that the Archaeological Survey of Ireland have concluded that a potential enclosure reported to them at this location does not warrant acceptance as an archaeological monument. The entry also states that this redundant record is not scheduled for inclusion on the next edition of the Record of Monuments and Places and the Historic Environment Viewer mapping contains no Zone of Notification around its location:

KE076-071----
Class: Redundant record
Townland: DERRYREAG
Scheduled for inclusion in the next revision of the RMP: No
Description: Reported to the Archaeological Survey of Ireland as the location of a possible enclosure. This feature is located in forestry on sloping mountainside part of the Derrynasaggart Mountain range. Views are restricted because of the forestry, but the general aspect is towards the N towards the Paps Mountains. This is marked as a large D-shaped field on the Ordnance Survey 1st Edition map, and measures approximately 200m NE-SW, and 200m NW-SE. This has now been planted with forestry. It appears that the enclosing element is now a ditch, and has been widened and deepened by forestry works. At the SE side this is 3m wide and .1.5m deep. The drain on the north side of the site is of similar dimensions. The NE side (straight edge) is also a townland boundary between Derryreagh and Cummeenavrick. This is a 3m wide, 1.5m deep ditch along which a stream runs. It appears to have been widened as part of the forestry works. No trace of an

[20] https://www.corkcoco.ie/sites/default/files/2019-01/M%C3%BAscra%C3%AD%20Gaeltacht%20CMIP%20Final%20Draft%20Jan%202019.pdf

enclosing bank was noted. The evidence is not sufficient to warrant accepting this as the remains of an archaeological monument.

A section of the Grid Connection Route within County Kerry follows an existing forestry road that extends outside the southern boundary of The Paps Archaeological Landscape as designated in the Kerry Development Plan 2022-2028[21] (**Figure 14.11**). The nearest section of this existing forestry road to this archaeological landscape is located c.30 m outside its boundary. This landscape is described as follows in the County Kerry Development Plan 2022-2028:

According to legend The Paps are the earthly manifestation of the breasts (Paps) of the Mother Goddess Anu and would have been venerated as such throughout prehistory. The cairns on the summits of the mountains are likely to contain small passage tombs, while other features on the summit are also likely of similar date. The slopes of the mountains and surrounding area are littered with hut sites, enclosures, megalithic structures, triple banked barrow etc. While the locally important Christian focus at 'The City' in Gortnagane is likely to be of prehistoric origin also given the name Caher Crov Dearg and the likely association with the triadic mother goddess in the form Badb Catha or Raven of Battle. These sacred mountains and their surrounding archaeological, mythological and historic landscape are still venerated, albeit in Christian guise, to this day.

There are no archaeological sites associated with this landscape located within the 100 m wide study area centred on the existing forestry road that the Grid Connection Route will follow in the area outside the boundary of this archaeological landscape.

There are no Protected Structures or structures listed in the National Inventory of Architectural Heritage located within the study area centred on the Grid Connection Route and it does not extend through any historic settlements or Architectural Conservation Areas. The existing forestry roads that the Grid Connection Route follows are shown as areas of vacant uplands on historic Ordnance Survey mapping. No potential unrecorded archaeological sites or other cultural heritage assets were noted in the environs of the route.

14.3.13 Turbine Delivery Route

The Turbine Delivery Route will extend along the existing public road network from Ringaskiddy, Co. Cork to the Site entrance on the N22 road and will thereafter extend along an existing forestry road that forms the Site Access Road. The only recorded cultural heritage asset located within the environs of this section of the route along the Site Access Road is the redundant record (SMR KE076-071----) described in **Section 14.3.12** above. This is located within a forestry plantation in the lands to the west of the existing forest track

[21] https://consult.kerrycoco.ie/sites/default/files/4%20Archaeological%20Landscapes.pdf

that will form the delivery route. The other recorded archaeological sites within the 100 m wide study area corridor centred on the Turbine Delivery Route to Ringaskiddy comprise thirteen examples which are all located within adjoining private lands, and none contain any elements that extend into the public road network which will form the Turbine Delivery Route (**Table 14.9** and **Figure 14.10**). In addition, none of these archaeological sites are listed as National Monuments in State Care. The recorded sites within the study area are located within private properties adjacent to the public roads and no works to facilitate the delivery of turbines to the Site are proposed at their locations or environs. The reviewed study area also contains a number of archaeological sites which were uncovered during archaeological investigations carried out as part of the construction of the Ballincollig Bypass. These sites were completely excavated in advance of the construction of the bypass and no longer remain within the study area.

The 100 m wide study area corridor centred on the Turbine Delivery Route also contains thirteen designated architectural heritage structures, all within County Cork, which are listed in the Record of Protected Structures or are included in the National Inventory of Architectural Heritage (**Table 14.10** and **Figure 14.9**). The Turbine Delivery Route does not extend through any designated Architectural Conservation Areas. The study area includes two road bridges that are listed in the Record of Protected Structures, and these comprise Laney Bridge (RPS 0835) in the eastern outskirts of Macroom and Athsellis Bridge (RPS 0545) in Carrigderry townland (**Figure 14.9**). The Turbine Delivery Route does not extend across either of these bridges. The remainder of the other designated architectural structures within the study area are located within private properties adjacent to the public roads and no works to facilitate the delivery of turbines to the Site are proposed within any of these properties.

Table 14.9: Recorded Archaeological Sites within 100 m corridor centred on TDR

Monument no.	Class	Townland	ITM E	ITM N
CO058-002----	Kiln - lime	AN DOINAN ALAINN	515024	579449
CO058-045----	Ringfort - rath	BAILE MHIC IRE	522175	576675
CO058-051----	Fulacht fia	TONN LAIN	523052	575787
CO058-079----	Burnt mound	TONN LAIN	522582	576314
CO070-012----	Standing stone	CASIL AN BHUACAIGH	526192	574325
CO070-079----	Standing stone	INCHINLINANE	527840	573632
CO071-015----	Souterrain	BEALICK	535203	572930
CO071-016----	Mill - corn	BEALICK	535262	572862
CO083-069----	Fulacht fia	CLODAH	541404	566803
CO083-070----	Standing stone	CLODAH	541685	566670
CO083-140----	Bridge	CARRIGDARRERY	538949	568062
CO073-071----	Cave	CARRIGANE	555141	569905
CO073-137----	Burnt mound	CURRAHEEN	560815	569368

Table 14.10: Designated Architectural Heritage structures in 100 m corridor centred on TDR

Designation	Name	Townland	ITM E	ITM N
RPS 0835	Laney Bridge	Bealick	535274	572790
NIAH 20907102	Firville House	Bealick	535219	572890
NIAH 20907106	House	Coolcour	535810	570708
RPS 0545	Athsellis Bridge	Carrigderry	538948	568062
NIAH 20908319	Monument	Ballymichael	540705	566844
NIAH 20908326	Crookstown House gate	Inchirahilly	542637	566711
NIAH 20908403	Horan's Bar	Inchirahilly	544234	567381
RPS 0553	Rosemount House	Currahaly	548761	568947
NIAH 20907221	House	Currahaly	549560	569133
NIAH 20907226	House	Knockanemore	553105	570136
NIAH 20907308	Srelane House	Knockanemore	553610	570265
NIAH 20987029	Church of the Immaculate Heart of Mary	Shanbally	575595	564469
NIAH 20987044	The Oratory	Ringaskiddy	578224	564274

14.3.14 Field Work

The Project location, including the Site, Grid Connection Route and Turbine Delivery Route from the N22, was inspected in clear weather conditions by the author on 22nd June 2020, 19th May 2021, 26th July 2021 and 3rd November 2021. These inspections included field walking surveys of the locations and environs of all turbines and associated infrastructure, as well as the locations of known archaeological monuments within the Site. The purpose of the field surveys was to assess the potential for direct and indirect impacts on the locations and settings of known monuments, to establish if any unrecorded features of cultural heritage interest exist at proposed Development locations and to appraise the potential for the presence of sub-surface archaeological sites or features at these locations.

The results of the field survey are presented below in table formats which include descriptions of the results of the inspection of known archaeological monuments within the Site (**Tables 14.11** and **14.12**). Descriptions of two potential previously unrecorded archaeological features noted during inspections of the lands *c.*40 m to the north of Turbine 2 are provided in **Table 14.13** and their locations are shown on **Figure 14.2**. These features comprise an upright stone and a nearby small arc of surface stones which may form the remains of a potential hut site and both are located at distances of 30 m outside the Site. While the potential exists that both of these features are non-archaeological in origin, their locations were provided to the Project design team at an early stage in the design process to ensure that they will be avoided, and both will be retained *in situ*.

Two farm buildings are shown within the Site on the historic OS maps. The farm building in the west end of the Site has been levelled and a later concrete-surfaced farmyard, which also contains a number of semi-derelict outbuildings of 20th century appearance is now located in the area to the north and is shown on **Figure 14.1**. This farmyard is not indicated on the historic OS maps and does not contain any features deemed to be of any architectural or vernacular heritage merit. An overgrown, derelict farmhouse occupies the location of the farm building depicted in the east half of the Site on the second edition 6-inch map and it appears to have been abandoned in recent decades (**Figure 14.3**). While this late 19th century building does not comprise a well-preserved structure of architectural heritage merit it is considered to be of likely local (low) vernacular heritage interest.

Descriptions of the inspections of the turbine locations and associated infrastructure within the Site are presented in **Table 14.14**, which also collates information gathered during reviews of historic mapping as well as aerial/satellite (OSI and Google Earth) and LiDAR imagery for each location.

Table 14.11: Collated information on Field Boundary CO057-006----

Recorded Monument	Class	Townland	Recorded ITM (ASI)	Confirmed ITM
CO057-006----	Field Boundary	Inchamore	512568, 578626	512568, 578626
ASI Description	*In rough hill grazing on bog, on a gentle S-facing slope, with a view across the valley to Carrignaspirroge. Traces of mainly curvilinear, relict, stone field boundaries (T 0.6 m; H 0.3 m) protrude above the surface of the bog in a roughly rectangular area (c. 150 m E-W; c. 70 m N-S). The relict walls disappear in level areas, where the bog is deeper.*			
Survey Notes	The visible surface expression of the field boundary is orientated north-northwest to south-southeast (NNW-SSE) and comprises a c.50 m long section of a drystone wall footing (c. 40cm-60cm wide) which extends 10cm-30cm above existing ground surface. This likely forms the west end of the rectangular area described by the Archaeological Survey of Ireland and is located c.250 m to the northwest of T2. The visible northern section of this section extends to an area of natural bedrock outcrop and terminates at the margin of a level area of upland heath. There was no visible surface trace of any walling extending to the east or west of this area, which is dominated by bedrock outcropping, and the potential exists that the wall either terminates at this point or continues beneath the existing ground surface within the area of upland heath to the north. The southern end of the visible section of the wall has been truncated by an east-west land drain (c.1 m wide) and an inspection of the drain section in this area revealed that the wall stones extend c.40cm below existing ground surface and appear to rest on the surface of the underlying natural subsoil. A number of surface stones which may form part of the wall are visible for c. 2 m to the south of the drain and no visible traces were observed thereafter. The land drain continues to the east for a distance of c.145 m from the point where it intersects with the north-south section of wall along a slightly curvilinear course before it turns to the south and extends into forestry. It is noted that the length of the east-west section of this drain extending from its intersection with the visible section of the field boundary corresponds to the length of the east-west section of the field boundary described in the above archaeological inventory entry. The drain is flanked on the southern side by a low deposit of stones and soil which may form part of the east-section of the field wall noted in the inventory entry, although the potential that this deposit actually represents upcast material from the drain which was interpreted as a field wall is noted. No surface traces of the field boundary were noted extending towards the location of any proposed construction area within the Site.			

Table 14.12: Collated information on Enclosure CO057-007----

Recorded Monument	Class	Townland	Recorded ITM (ASI)	Confirmed ITM
CO057-007----	Enclosure	Inchamore	512761, 578718	512761, 578718
ASI Description	*In rough hill grazing on bog, on a S-facing slope with views across a valley to Carrignaspirroge. A D-shaped area (6 m N-S) with the straight side at N (L 10.5 m), is defined by a mixture of large slabs and stones set beside the linear face of outcropping rock at N and elsewhere by the curving remains of a stone wall (T 0.65; H 0.5 m) protruding above the surface of the bog. The interior is partially covered with rushes.*			
Survey Notes	This site survives as described by the Archaeological Survey of Ireland and comprises a small enclosure with a low surface expression that is not visible at ground beyond its immediate environs. The northern side of the enclosure has been constructed against a natural rock outcrop which supplements the enclosing element on this side and screens its location entirely from the east. The drystone wall contains stones of varying size and shape with a number of large, upright angular 'orthostat' type stones forming the north-western enclosing element, while elsewhere, a mix of large horizontal slabs and smaller sub-rounded stones are present. The extant walls measure between 0.6 m and 1.2 m in width and between 0.4 m and 1.1 m in height. While there are a number of narrow gaps in the east and west sides it is unclear whether any these comprise an entrance feature or are the result of localised overgrowth or collapse of the walling. The interior of the enclosure slopes gently downwards to the east and is grass covered with areas of rush growth. The size and layout of the enclosure is not suggestive of an early medieval cashel monument, and the potential exists that it may have functioned as a small animal pen associated with historical transhumance farming activity. The site is located c.130 m from the nearest element of the Development which comprises the Turbine 2 hardstand to the south.			

Table 14.13: Potential unrecorded archaeological sites identified during field survey

Feature Type	ITM	Description
Potential Hut	512856, 578650	Situated a gentle slope approximately 100 m downslope and to the southeast of enclosure (CO057-007----), the possible footing of a hut site was noted during field inspections. It comprised an arc of loose stones measuring c.2.5 m in length (NE-SW) containing one to two stones forming a feature measuring c.0.4 m to 0.5 m in width. The stones were only evident to a maximum height of c.0.3 m above ground level but grass growth and sod formation may obscure further traces. If these stones do form the basal remains of a potential hut site, a projection of the visible arc is suggestive of a feature measuring 2 m-2.5 m in diameter. The interpretation of this feature as being of potential archaeological origin is tentative as it is located within a large glacial scatter of surface stones and is abutted by prone stones in all directions. No clearance activity appears to have been carried out in its environs and the potential that it comprises a random arrangement of stones within this area is considered possible.
Upright Stone	512840, 578643	Another potential archaeological feature was noted c.18 m to the southwest of the potential hut site described above and this comprises an upright stone within the same glacial scatter of surface stones. The long axis of the stone is aligned in a northwest to southeast direction, it measures a maximum height of 1.68 m, a maximum width at base of 0.88 m and tapers to width of 0.2 m near the top. The thickness of the stone also tapers inwards towards its top with a thickness of 0.6 m at base and 0.2 m at top. While the slight potential exists for this to be a prehistoric standing stone, its alignment does not correspond to the northeast to southwest alignment of the majority of such monuments and its presence within a glacial stone scatter may be suggestive of a natural origin.

Table 14.14: Field survey results

Development Element	Townland	Distance to nearest archaeological site	1st edition 6-inch OS map	Aerial/Satellite and LiDAR images	Field Survey Notes
Turbine 1	Inchamore	Enclosure located c. 450 m to southeast (CO057-007----)	Map shows the location of turbine, hardstand and access road as vacant marginal land.	Shown within area of vacant rocky land on aerial images. No potential archaeological sites or built structures were noted at the location during a review of LiDAR imagery	Location comprises an area of open heathland on a large rocky ridge. The access road will extend to its location from T3 to the east across an area of rocky heath and an area of improved grassland at east
Turbine 2	Inchamore	Enclosure located c. 110 m to north of hardstand (CO057-007----)	Map shows the location of turbine, hardstand and access road as vacant marginal land. A farmyard is shown c.90 m to the east of the nearest section of the hardstand	Shown within a forested area with grassland at north end of hardstand. No potential archaeological sites or built structures were noted at the location during a review of LiDAR imagery	The turbine and southern end of hardstand are within a commercial forestry plantation while the north end of the hardstand and access route extend through semi-improved pasture. A visual appraisal of the plantation indicated that the underlying ground surface has been heavily disturbed by tree growth and cultivation works. The grassland area at the north end of the hardstand is marginal in quality with machine cut drains along the edges. There are frequent surface stones in the areas outside the improved grassland which appear geological in origin but may also include stones from early modern field clearance activity. The access route to the north end of the turbine will cross a narrow stream, which appears to have been recut by machine. The stream was nearly dry at the time of inspection and no potential fords, steeping stones or other features of cultural heritage potential were noted. The proposed crossing will entail a clear span structure and no in-channel works will be required.
Turbine 3	Inchamore	Enclosure located c. 370 m to southwest (CO057-007----)	Map shows the location of turbine, hardstand and access road as vacant, unenclosed marginal land.	Majority of hardstand is shown within forestry on aerial images while turbine and north end of hardstand are within an area of vacant heath land. Access route to northeast is within forestry while routes to west and southwest extend through marginal lands. No potential archaeological sites or built	Majority of hardstand shown within forestry on aerial images while turbine and north end of hardstand are within an area of disturbed marginal land. Access route to northeast is within forestry while routes to west and southwest extend through marginal lands.

Development Element	Townland	Distance to nearest archaeological site	1st edition 6-inch OS map	Aerial/Satellite and LiDAR images	Field Survey Notes
				structures were noted at the location during a review of LiDAR imagery	
Turbine 4	Milleeny	Enclosure located c. 895 m to southwest (CO057-007----)	Map shows the location of turbine, hardstand and access road as vacant, unenclosed marginal land.	Shown within forestry on aerial images. No potential archaeological sites or built structures were noted at the location during a review of LiDAR imagery	Located within an area of forestry on a west-facing slope. The ground surface has been heavily disturbed by tree roots and forest cultivation.
Turbine 5	Milleeny	Enclosure located c. 1,110 m to west (CO057-007----)	Map shows the location of turbine, hardstand and access road as vacant, unenclosed marginal land.	Shown within forestry on aerial images. No potential archaeological sites or built structures were noted at the location during a review of LiDAR imagery	Located within an area of forestry on a west-facing slope. The ground surface has been heavily disturbed by tree roots and forest cultivation.
Site Compound	Inchamore	Enclosure located c. 760 m to southwest (CO057-007----)	Map shows the location as vacant, marginal land.	Shown within forestry on aerial images. No potential archaeological sites or built structures were noted at the location during a review of LiDAR imagery	Located within a level area within forestry plantation. The ground surface has been extensively disturbed by tree planting
Substation	Inchamore	Enc losure located c. 440 m to west (CO057-007----)	Map shows small fields at location which are associated with a farm building located 140 m to west of substation	Shown within vacant field on aerial images. No potential archaeological sites or built structures were noted at the location during a review of LiDAR imagery	Recent forestry plantation ground preparation works were visible within the field containing the proposed substation location at the time of inspection and this included linear, machine excavated land drains. No potential archaeological or architectural heritage structures were noted at the location. The existing farmyard c.100 m to the west is not indicated on the historic OS maps and contains a number of small 20th century outbuildings. No remains of the farm building shown in the area to the south of the yard on the 1st edition 6-inch OS map were identified. No features of vernacular heritage significance were noted within the existing yard. It is accessed from a farm lane to the south which is outside the proposed development areas within the site. The second farm building shown in the east end of the Site on the second edition 6-inch OS map survives extant and comprises an overgrown

Development Element	Townland	Distance to nearest archaeological site	1st edition 6-inch OS map	Aerial/Satellite and LiDAR images	Field Survey Notes
					farmhouse that appears to have been abandoned in recent decades. The access route to the substation will cross a narrow stream, which forms the boundary between Inchamore and Milleeny townlands. The stream comprised a moderately flowing, shallow channel, averaging c.1 m in width by 0.5 m in depth, at the time of inspection and no potential fords, steeping stones or other features of cultural heritage potential were noted. The proposed crossing will entail a clear span structure and no in-channel works will be required.
Met Mast	Inchamore	Hut site located c.480 m to south (CO057-008003-)	Map shows the location as vacant, marginal land.	Shown within forestry on aerial images. No potential archaeological sites or built structures were noted at the location during a review of LiDAR imagery	The location of the met mast and proposed access road from the northeast remain occupied by a forestry plantation. An inspection of the area revealed that the ground surface has been disturbed by forestry plantation works and tree root activity.
Grid Connection	Various	Redundant record (KE076-071----) located within an area of route using horizontal directional drilling. The nearest section of the boundary of the Paps Archaeological Landscape as designated in the Kerry County Development 2022-2028 is located c.30 m the north of an existing forestry track which occupies the grid route in the	Map shows the route extending through as vacant uplands.	The forestry roads and adjacent plantations along the route are visible on aerial images from the 1990s onward. The imagery indicates that the southern section of the forest road extending to the Site on the south side of the N22 was constructed post-2005. The route extends outside the LiDAR coverage of the Site	No potential unrecorded features of archaeological, architectural or cultural heritage interest were noted during inspections of the localised green field areas along the section of the route to the west of the proposed substation within the Site. The construction of the existing forestry tracks has resulted in the reduction of ground surface along the route and adjoining lands on both sides have been disturbed by forestry plantations. The forest tracks extend across three small streams within the plantation to the north of the N22 and the use of horizontal direction drilling under these watercourses will not require any in-channel works. The location of redundant record (KE076-071----) is within an inaccessible forestry plantation. The use of horizontal direction drilling in this area will not require any trench excavations at its location.

Development Element	Townland	Distance to nearest archaeological site	1st edition 6-inch OS map	Aerial/Satellite and LiDAR images	Field Survey Notes
		area to the north of the N22			
Borrow Pit	Milleeny	Lime kiln located c.980 m to north (CO058-001----)	Map shows the location as vacant, marginal land.	Shown within forestry on aerial images. No potential archaeological sites or built structures visible on LiDAR imagery.	Localised mechanised ground works were ongoing within the southern end of area during the inspection and appeared to be associated with the extraction of bedrock material. The remainder of the proposed borrow pit location was occupied by forestry
Turbine Delivery Route	Derryreagh and Derreenaling	Redundant record (KE076-071----) located within adjoining forestry to west of Site access Road section. As detailed in Tables 14.9 and 14.10, there are various cultural heritage assets located within properties adjacent to the public roads that form the section of the route to Ringaskddy	Map shows the route extending through as vacant lands and roadways.	The imagery indicates that the southern half of the forest road extending to the Site on the south side of the N22 was constructed post-2005. The forest road in the north end of the route is present on imagery from the 1990s. Location of route extends outside the LiDAR coverage. The public roads along the route to Ringaskiddy are visible on the reviewed aerial and satellite images, including recent images of the Macroom bypass	The route from the N22 to the north of the Site extends along existing stone surfaced forest roads which are flanked by drains and adjacent sections of the forestry plantations. No potential features of cultural heritage interest were noted within the environs of the route. A windshield survey of the public roads extending to Ringaskiddy revealed no elements of the cultural heritage resource extending into the road carriages that will be used to transport turbines to the Site.

14.3.15 Summary

There are two recorded archaeological sites within the Site, and these comprise a field boundary (CO057-006----) and a small, stone-built enclosure (CO057-007----). The identified remains of these sites are located at respective distances of 190 m and 150 m from the Turbine 2 hardstand location. There are an additional 15 recorded archaeological sites within lands extending for 1 km from the Site and none of these are located within 480 m of any proposed construction areas (**Table 14.6** and **Figure 14.1)**. All of these external archaeological sites are located within private lands not accessible to the public and none have been designated as National Monuments in State Care. Two features of archaeological potential, an upright stone and a potential hut site, were identified during the field surveys carried out as part of this assessment (**Table 14.13**). While these are only tentatively interpreted as being of potential archaeological origin, both are located c.30 m outside the Redline Boundary and will be retained *in situ* (**Figure 14.2**)

There are no designated architectural heritage structures located in the Site or within the lands extending for 1 km outside its Redline Boundary. No potential undesignated features of architectural heritage interest, such as country houses with associated designed gardens/demesne lands, are located within the Site or within 1 km of the Redline Boundary. The derelict remains of a farmhouse shown within the east end of the Site on the second edition 6-inch OS map (1900) survives extant and is a structure of vernacular heritage interest. No proposed construction areas are within 110 m of its location, and it will be retained *in situ* within the Site (**Figure 14.3**).

The Grid Connection Route extends through the location of a redundant record listed in the Sites and Monuments (KE076-071----). The Archaeological Survey of Ireland have concluded that this record does not warrant acceptance as an archaeological monument and it is not scheduled for inclusion in the next edition of the Record of Monuments and Places (see **Section 14.3.12**). It is located within a forestry plantation to the south of the N22 road and the proposed methodology for the section of the Grid Connection Route will entail horizontal directional drilling under its location and will not require any trench excavations (**Figure 14.8**). There are no other recorded archaeological sites or any architectural heritage structures located within the 100 m wide corridor centred on the Grid Connection Route. A section of the route in the area to the north of the N22 follows an existing forestry road that extends outside the southern boundary of The Paps Archaeological Landscape as designated in the County Kerry Development Plan 2022-2028[22] (**Figure 14.11**).

[22] https://consult.kerrycoco.ie/sites/default/files/4%20Archaeological%20Landscapes.pdf

The Turbine Delivery Route to the Site entrance on the N22 road will extend along the public road network from Ringaskiddy, Co. Cork. The route will thereafter extend to the Site along an existing forestry road from the N22 road. The only recorded cultural heritage asset located within the environs of this section of the route is the redundant record (SMR KE076-071----) described in **Section 14.3.12**. This is located within a forestry plantation in the lands to the west of the existing forest track that will form the delivery route. The remainder of the route from Ringaskiddy to the Site will extend along public roads. There are various recorded archaeological sites and designated architectural heritage structures located within the reviewed 100 m study area corridor centred on these roads and none contain any elements that extend into the road carriageways (**Tables 14.9** and **14.10** and **Figures 14.9** and **14.10**).

a. The known archaeological sites within the study area are commonly found within the Irish landscape, are located within inaccessible private lands and retain no discernible amenity or tourist attributes. Their current condition as well as potential sensitivities to indirect impacts of a visual nature, have been assessed based on their classifications, designations, inventory descriptions, reviews of historical maps and modern aerial/satellite images and the ICOMOS guidelines summarised in **Table 14.2** of this chapter. The values assigned to these archaeological sites are identified in **Tables 14.15** and **14.16**. It should be noted that many archaeological sites, including levelled examples, have the potential to possess subsurface features, artefacts and other archaeological remains, that may be of High or Very High values, but this cannot be ascertained without recourse to archaeological excavation, and these are attributes unlikely to be subject to effects in the absence of direct impacts.

14.4 ASSESSMENT OF POTENTIAL EFFECTS

14.4.1 Construction Phase – Direct Impacts

The construction phase will result in no predicted direct impacts on the two recorded archaeological monuments located within the Site (Field Boundary CO057-006----and Enclosure CO057-007----) neither of which are located within 150 m of any proposed construction areas. An upright stone and a small arc of ground stones noted *c.*40 m to the north of the T2 hardstand during the field surveys are deemed to be potential archaeological features, but this interpretation is intended as tentative (see **Table 14.13** and **Figure 14.2**). Both of these potential archaeological features are located c.30 m outside the Redline Boundary and will remain *in situ* outside the Site. There are no designated architectural structures located within the Site and no undesignated features of cultural heritage interest were identified at any proposed construction areas. The remains of a farm building within the east end of the Site, which is indicated on the second edition OS map (published 1900), will be avoided and retained *in situ*. The boundary between Inchamore and Milleeny townlands comprises a small stream that extends north to south through the central area of the Site. There will be one crossing over this stream to facilitate access to the onsite substation and this will entail a clean span bridge which will require no in-channel works. It is, therefore, concluded that the construction phase will not result in any direct impacts on any identified elements of the cultural heritage resource.

The locations of T2, T4 and T5, and their associated hardstands and sections of access routes, as well as the site compound and met mast locations are within forestry plantations. The cultivation and drainage ground works combined with the subsequent development of root networks within such plantations result in extensive ground disturbance which has a high potential to have removed or severely degraded any unrecorded archaeological features at these locations. While there is a low potential for the presence of unrecorded, archaeological sites within the forested locations, the potential for the survival of elements of unrecorded archaeological remains cannot be completely discounted. The potential for the presence of sub-surface archaeological sites and artefacts exists within the areas of improved pasture and heathlands within the Site and these comprise T1, an area of the T2 hardstand, T3 and the substation as well as sections of the access roads to their locations. While the existence as well as the location, extent and nature of such unrecorded, sub-surface archaeological remains are indeterminable the potential exists for direct, negative impacts on any such remains that may exist within Development areas and this will require mitigation. The Development will not require in-channel works within any watercourses and will have no predicted impacts on any potential underwater archaeological remains.

The majority of the Grid Connection Route from the existing Ballyvouskill substation extends along existing forestry tracks with a localised section utilising horizontal directional drilling under streams and the environs of the N22 road as well as a section extending through a green field area to the west of the proposed onsite substation. The Grid Connection Route extends through the location of a redundant record listed in the Sites and Monuments Record (KE076-071----). The Archaeological Survey of Ireland have concluded that this record does not warrant acceptance as an archaeological monument and it is not scheduled for inclusion in the next edition of the Record of Monuments and Places. It is located within a forestry plantation to the south of the N22 road and the proposed methodology for the section of the Grid Connection Route entail horizontal directional drilling under its location and will not require any trench excavations (**Figure 14.8)**. There are no other recorded archaeological sites within a 100 m corridor centred on the Grid Connection Route. A section of the route in the area to the north of the N22 follows an existing forestry road that extends outside the southern boundary of The Paps Archaeological Landscape as designated in the County Kerry Development Plan 2022-2028[23] (**Figure 14.11**). The Grid Connection Route does not extend into this landscape and the cable trench will be excavated within areas previously disturbed by the construction of the existing forestry roads.

There are also no designated or undesignated architectural heritage structures, such as historic masonry bridges, located within 100 m of the Grid Connection Route. The existing forestry track along the section of the route to the north of the N22 crosses three small streams and the proposed use of horizontal directional drilling under these watercourses will result in no direct in-channel impacts. The Grid Connection Route will, therefore, result in no predicted direct impacts on the archaeological, architectural and cultural heritage resources.

The Turbine Delivery Route from Ringaskiddy, County Cork to the Site entrance on the N22 road will entail the use of the existing public road network. While there are various cultural heritage assets located within the 100 m study area corridor centred on this route (**Tables 14.9** and **14.10** and **Figures 14.9** and **14.10**), none contain elements that extend into the road carriageways and the transport of turbines from Ringaskiddy to the Site will not result in any predicted direct impacts on the cultural heritage resource. The section of the Site Access Road route from the N22 follows an existing forestry road in this area and the only recorded archaeological site within a 100 m wide corridor centred on this section of the route is the redundant record (KE076-071----) located within the forestry plantation to the west (**Figure 14.8**). Any required upgrading works to this track to facilitate the delivery of turbines to the Site will result in no direct impacts on the cultural heritage resource.

14.4.2 Construction Phase – Indirect Impacts

There are two recorded archaeological sites within the Site, and these comprise a field boundary (CO057-006----), with visible remains located *c.*190 m to the west of T2, and an enclosure (CO057-007----) located *c.*150 m to the north of T2 (**Figure 14.2**). The wider settings of both of these archaeological sites will be subject to short term, slight, negative, indirect impacts during the construction phase. There are 15 other archaeological sites located within private lands within 1 km of the Site and none are located within 480 m of

[23] https://consult.kerrycoco.ie/sites/default/files/4%20Archaeological%20Landscapes.pdf

any proposed Development areas (**Table 14.6** and **Figure 14.1**). In addition, none of these sites are accessible to the public or have been designated as National Monuments in State Care. A review of the landscape extending for 10 km from the Site revealed that there are also no National Monuments in State Care or World Heritage sites (including tentative list) located within this area. The construction phase is, therefore, predicted to result in no predicted indirect impacts on the recorded archaeological monuments located within the lands within 1 km the Site.

There are no designated architectural heritage structures within 1 km of the Site and no indirect negative impacts on this element of the cultural heritage resource are predicted during the construction phase. There is one extant undesignated derelict farm building of low cultural heritage value located within the east end of the Site. No construction phase works are proposed within 110 m of its location and no indirect impacts on this structure are predicted during the construction phase (**Figure 14.3**).

The proposed Project is located within the Múscraí Gaeltacht area. While the construction phase will see the arrival of construction workers to the area, this will be a short term occurrence and will not result in permanent settlement of the area by non-Irish speakers. The Project is, therefore, predicted to result in a negligible, indirect, not significant impact on the Irish language or cultural heritage of the Gaeltacht area during the construction phase.

The Sites and Monuments Record lists a redundant record (KE076-071----) within the environs of the section of the Grid Connection Route and Turbine Delivery Route extending from the N22 road to the Site. As previously noted, the Archaeological Survey of Ireland have concluded that the redundant record does not warrant acceptance as an archaeological monument (see **Section 14.3.12**). The use of horizontal directional drilling to install the Grid Connection Route in this area and the use of the existing forestry road to the east of the site listed as a redundant record (KE076-071----) to facilitate the delivery of turbines will result in no predicted indirect impacts on this redundant record site. The location of the Grid Connection Route that extends along the southern side of The Paps Archaeological Landscape is occupied by an existing forestry road and is screened by forestry on both sides. There are no other recorded archaeological sites or any architectural heritage structures located within 100 m of the Grid Connection Route. The Grid Connection Route will not result in any predicted indirect impacts on the cultural heritage resource during the construction phase.

While there are various cultural heritage assets located within the 100 m study area corridor centred on the Turbine Delivery Route (**Tables 14.9** and **14.10** and **Figures 14.9** and **14.10**), none contain elements that extend into the road carriageways and the transport of turbines from Ringaskiddy to the Site will not result in any predicted indirect impacts on the cultural heritage resource during the construction phase.

Table 14.15: Summary of construction phase impacts on cultural heritage assets in study area

Monument No.	Classification (Condition)	Indicative Value range	Impact Type	Impact Quality	Impact Magnitude	Impact Duration	Impact Significance
CO057-006----	Field boundary (partially extant)	Medium-High	Indirect	Negative	Slight	Short term	Slight
CO057-007----	Enclosure (Extant)	High	Indirect	Negative	Slight	Short term	Slight
KE086-007----	Megalithic structure (Collapsed and in forestry)	Medium-High	No predicted impact	Neutral	n/a	n/a	None
KE086-002----	Road (no surface trace)	Medium	No predicted impact	Neutral	n/a	n/a	None
CO057-008001-	Field boundary (part of group)	High	No predicted impact	Neutral	n/a	n/a	None
CO057-008002-	Hut site (part of group)	High	No predicted impact	Neutral	n/a	n/a	None
CO057-008003-	Hut site (part of group)	High	No predicted impact	Neutral	n/a	n/a	None
CO057-008004-	Enclosure (part of group)	High	Indirect	Neutral	n/a	n/a	None
CO057-008005-	Enclosure (part of group)	High	No predicted impact	Neutral	n/a	n/a	None
CO057-008006-	Hut site (part of group)	High	No predicted impact	Neutral	n/a	n/a	None
CO057-008007-	Fulacht fia (part of group)	High	No predicted impact	Neutral	n/a	n/a	None
CO057-008008-	Hut site (part of group)	High	No predicted impact	Neutral	n/a	n/a	None

Monument No.	Classification (Condition)	Indicative Value range	Impact Type	Impact Quality	Impact Magnitude	Impact Duration	Impact Significance
CO057-001----	Lime kiln (partially collapsed)	Medium	No predicted impact	Neutral	n/a	n/a	None
KE076-071----	Redundant Record	Negligible	No predicted impact	Neutral	n/a	n/a	None
CO057-005----	Lime kiln (no inventory description)	Medium	No predicted impact	Neutral	n/a	n/a	None
CO057-009----	Holy well (overgrown spring)	Medium-High	No predicted impact	Neutral	n/a	n/a	None
CO057-010----	Lime kiln (no inventory description)	Medium	Indirect	Neutral	n/a	n/a	Slight
CO057-012----	Structure (no inventory description)	Medium	No predicted impact	Neutral	n/a	n/a	None
CO058-001----	Lime kiln (partially collapsed)	Medium	No predicted impact	Neutral	n/a	n/a	None
None	Upright stone and potential hut	Low-Medium	No predicted impact	Neutral	n/a	n/a	None
None	Farm building (derelict)	Low	No predicted impact	Neutral	n/a	n/a	None
None	Inchamore Milleeny townland boundary (stream)	Low	Direct	Negative	Negligible	Short term	Not significant
Kerry County Council Archaeological Landscape No.13	The Paps Archaeological Landscape	High	No predicted impact	Neutral	n/a	n/a	None

14.4.3 Operational Phase – Direct Impacts

The operational phase of the Project will result in no predicted direct physical impacts on the known archaeological, architectural and cultural heritage resources. In addition, the successful implementation of the mitigation measures presented in **Section 14.6** will result in the preservation *in situ* (by avoidance) or the preservation in record (by archaeological excavation) of any unrecorded, sub-surface archaeological sites or features that may exist within proposed Development areas. There will, therefore, be no predicted direct impacts on any such potential unrecorded archaeological sites during the operational phase.

14.4.4 Operational Phase – Indirect Impacts

The Site

As detailed in **Table 14.16**, the operational phase will result in a range of indirect negative impacts of a visual nature on the wider setting of a number of recorded archaeological sites within the study area and the surrounding landscape which will range from not significant to moderate in significance. The one predicted indirect negative impact of moderate significance will arise from the presence of three turbines (T1, T2 and T3) and associated access routes within a 500 m area extending to the south, northwest and northeast of an extant archaeological site (Enclosure CO057-007----) (**Figure 14.1**). This is predicted to result in a medium magnitude of impact on the historic landscape setting of this recorded archaeological monument, which is of potential medium-high value and, based on the EPA impact assessment criteria presented in **Table 14.4** (**Section 14.2.8**), this will result in a predicted reversible, negative, indirect, moderate significance of impact.

The recorded archaeological resource within an area extending for 10 km from the Site was assessed to determine the presence of other monuments within the wider landscape that may have potential visual sensitivities, i.e. ritual alignments. This revealed that only one example has a potential direct alignment towards the Site, and this comprises a wedge tomb (CO058-060----) located within a disturbed area of cut-away bog 2.25 km to the northeast (**Figure 14.7**) While this monument has legal protection by its inclusion on the Recorded of Monuments and Places, it is not designated as a National Monument in State Care considered to be of national significance. The monument is located within private lands not accessible to the public and is recorded as being in ruinous condition by the Archaeological Survey of Ireland. Given its distance from the Site in combination with its recorded designation, inaccessibility and partial surviving extent, the potential indirect, negative impact on its wider setting is appraised as being low in magnitude and slight in significance. Given the distances of the other monuments with visual alignment attributes from the Site in combination with the absence of recorded direct visual alignments towards its location, no predicted moderate or significant indirect negative impacts on their settings are predicted and likely slight indirect impacts on their wider settings will be reversed following decommissioning.

A review of the landscape extending for 10 km from the Site revealed that there are no National Monuments in State Care or World Heritage sites (including tentative list) located within this area. The operational phase will therefore not result in any predicted indirect impacts on archaeological sites assigned these designations.

The Landscape and Amenity impact assessment (**Chapter 12**) provides an assessment of potential cumulative visual impacts on the Western Summit of 'the Paps of Anu', which forms a prominent location within The Paps Archaeological Landscape as designated in the County Kerry Development Plan 2022-2028. This assessment concludes that the visual impact, including cumulative, from this location will be low in magnitude and moderate in significance (see **Chapter 12; Section 12.4.3.5** and **Table 12.7**). The Landscape and Amenity assessment also concludes that the heritage area within the Gougane Barra valley, including Saint Finbarr's Oratory which is c.12 km to the southwest, is not contained within the Zone of Theoretical Visibility pattern and the Development has no potential for visibility from within this valley (see **Chapter 12; Section 12.3.3.1**).

In conclusion, while the turbines within the Site will be visible from various cultural heritage assets within the surrounding landscape, no likely significant, indirect impacts on examples with notable visual or amenity sensitivities are predicted during the operational phase.

a. The Project is located within the Múscraí Gaeltacht area. The requirement for low numbers of onsite staff during the operation phase will be intermittent and this will not result in any predicted impacts on the Irish language or cultural heritage of this Gaeltacht area.

Grid Connection Route

As the Grid Connection Route will comprise a buried cable it will, therefore, result in no predicted direct impacts on the cultural heritage resource during the operational phase.

Turbine Delivery Route

In the event that any turbines are required to be replaced using the same delivery route from Ringaskiddy during the operational phase, no likely impacts on the cultural resource are predicted.

Table 14.16: Summary of operational phase impacts on cultural heritage assets in 1 km study area

Monument No.	Classification (Condition)	Indicative Value range	Impact Type	Impact Quality	Impact Magnitude	Impact Duration	Impact Significance
CO057-006----	Field boundary (partially extant)	Medium-High	Indirect	Negative	Low	Long term	Slight
CO057-007----	Enclosure (Extant)	Medium-High	Indirect	Negative	Medium	Long term	Moderate
KE086-007----	Megalithic structure (Collapsed and in forestry)	Medium-High	No predicted impact	Neutral	n/a	n/a	None
KE086-002----	Road (no surface trace in forestry)	Medium	No predicted impact	Neutral	n/a	n/a	None
CO057-008001-	Field boundary (part of group)	High	Indirect	Negative	Low	Long term	Slight
CO057-008002-	Hut site (part of group)	High	Indirect	Negative	Low	Long term	Slight
CO057-008003-	Hut site (part of group)	High	Indirect	Negative	Low	Long term	Slight
CO057-008004-	Enclosure (part of group)	High	Indirect	Negative	Low	Long term	Slight
CO057-008005-	Enclosure (part of group)	High	Indirect	Negative	Low	Long term	Slight
CO057-008006-	Hut site (part of group)	High	Indirect	Negative	Low	Long term	Slight
CO057-008007-	Fulacht fia (part of group)	High	Indirect	Negative	Low	Long term	Slight
CO057-008008-	Hut site (part of group)	High	Indirect	Negative	Low	Long term	Slight

Monument No.	Classification (Condition)	Indicative Value range	Impact Type	Impact Quality	Impact Magnitude	Impact Duration	Impact Significance
KE076-071----	Redundant Record	Negligible	No predicted impact	Neutral	n/a	n/a	None
CO057-005----	Lime kiln (no inventory description)	Medium	Indirect	Negative	Negligible	Long term	Not significant
CO057-009----	Holy well (overgrown spring)	Medium-High	Indirect	Negative	Low	Long term	Slight
CO057-010----	Lime kiln (no inventory description)	Medium	Indirect	Negative	Negligible	Long term	Not significant
CO057-012----	Structure (no inventory description)	Medium	Indirect	Negative	Negligible	Long term	Not significant
CO058-001----	Lime kiln (partially collapsed)	Medium	Indirect	Negative	Negligible	Long term	Not significant
None	Upright stone and potential hut	Low-Medium	Indirect	Negative	Low	Long term	Slight
None	Farm building (derelict)	Low	Indirect	Negative	Negligible	Long term	Not significant
None	Inchamore Milleeny townland boundary (stream)	Low	Direct	Negative	Negligible	Long term	Not significant
Kerry County Council Archaeological Landscape No.13	The Paps Archaeological Landscape	High	Indirect	Negative	Low	Long term	Moderate

14.5 MITIGATION MEASURES AND RESIDUAL EFFECTS

14.5.1 Construction Phase

The wind farm layout was informed by the archaeological desktop studies and fieldwork undertaken during the design and assessment phases and was designed to avoid the known locations of known and potential archaeological monuments as well as an undesignated late 19th century farm building within the east end of the Site.

The mitigation measures presented in this section comprise construction phase archaeological monitoring of ground works as well as protection measures for known and potential cultural heritage assets within the Site. These mitigation measures are in accordance with guidelines for planning conditions for wind energy developments within close proximity to recorded archaeological monuments as published in Section 7.4 of the *2006 Wind Energy Development Guidelines*[24] and Section 7.6 of the *2019 Draft Revised Wind Energy Development Guidelines*[25].

Ground works during the construction phase will be subject to archaeological monitoring by a suitably qualified archaeologist under licence by the National Monuments Service. A systematic advance programme of archaeological field-walking surveys will also be carried out within Development areas in forestry plantations following tree felling to confirm the conditions predicted in this assessment, i.e., that they contain no visible surface traces of potential unrecorded archaeological or architectural heritage sites.

In the event that any sub-surface archaeological features are identified during archaeological monitoring they will be securely cordoned off, cleaned and recorded *in situ*. The National Monuments Service will then be notified and consulted to determine further appropriate mitigation measures, which may include preservation *in situ* (by avoidance) or preservation by record (archaeological excavation).

The archaeologist appointed to monitor the construction phase will also supervise the establishment of minimum 30 m radius concentric buffer zones around the external-most elements of Field Boundary (CO057-006----) and Enclosure (CO057-007----). These buffer zones will be securely fenced off and their locations will be clearly signed as 'No Entry' for the duration of the construction phase. No ground works of any kind (including but not limited to advance geotechnical site investigation) and no machinery, storage of materials

[24] https://www.gov.ie/en/publication/f449e-wind-energy-development-guidelines-2006/
[25] https://www.gov.ie/en/publication/9d0f66-draft-revised-wind-energy-development-guidelines-december-2019/

or any other activity related to construction will occur within these buffer zones. The location of a derelict farm building, which shown on the second edition 6-inch OS map (published 1900), is c.110 m outside the nearest construction area within the Site. This will be clearly signed as "No Entry" during the construction phase. The locations of these onsite archaeological monuments and farm building will also be identified as 'no-entry' areas during the construction phase site inductions. The location of two features located c.40 m to the north of T2, which are tentatively identified as being of archaeological potential (hut site and upright stone), are located in private lands outside the Redline Boundary. The erection of fencing around their locations will therefore not be feasible but, "No Entry" signs will be erected at the north, south and east edges of the Redline Boundary within their environs.

The Project is located within the Múscraí Gaeltacht area and any signage erected within the public realm during the construction phase will include Irish and English text.

14.5.2 Construction Phase Residual Impacts – Direct

The mitigation measures presented in **Section 14.5.1** will provide for either the avoidance of the potential unrecorded, sub-surface archaeological resource within the footprint of proposed construction locations or the proper and adequate recording of this resource by full archaeological excavation. Preservation *in situ* shall allow for a negligible magnitude of impact resulting in a potential not significant/imperceptible significance of effect in the context of residual impact on the unrecorded archaeological resource. Preservation by record shall allow for a high magnitude of impact, albeit ameliorated by the creation of a full and detailed archaeological record, the results of which shall be publicly disseminated. This shall result in a potential slight/moderate range of significance of effect in the context of residual impacts on the unrecorded archaeological resource.

14.5.3 Construction Phase Residual Impacts – Indirect

The buffer zone mitigation measures presented in **Section 14.5.1** will provide for the protection of known archaeological monuments and undesignated historical buildings within the Site. No residual construction phase indirect impacts are predicted following the implementation of these mitigation measures.

14.5.4 Operational Phase

Following the successful implementation of the mitigation measures presented in **Section 14.5.1**, the operational phase of the Project will result in no predicted direct impacts on the known archaeological, architectural and cultural heritage resources and, therefore, no mitigation measures for direct operational phase impacts will be required.

As detailed in **Section 14.4.4**, the wind farm turbines will result in a range of long term, indirect, negative impacts of a visual nature on the wider setting of archaeological sites within the environs of the Site during the operational phase which will range from not significant to moderate in significance (**Table 14.16**). Given the nature of the wind farm turbines there are no mitigation measures that can address these visual impacts, but it is noted that they will be reversed following the decommissioning phase. The Grid Connection Route and Turbine Delivery Route will result in no predicted residual impacts.

14.5.5 Operation Phase Residual Impacts - Direct

No operation phase direct residual impacts on the cultural heritage resource are predicted following the implementation of mitigation measures presented in **Section 14.5.1**.

14.5.6 Operation Phase Residual Impacts - Indirect

The operation phase will result in a range of not significant to moderate, long term, negative residual indirect impacts on archaeological sites within the environs of the Project (**Table 14.16**). It is noted that these will all be reversed following decommissioning of the Project.

14.6 CUMULATIVE IMPACTS

A review of wind farm developments within 10 km of the Project was carried out in order to assess potential cumulative impacts on the cultural heritage resource (**Table 14.17**). This included a review of available archaeological and cultural heritage impact assessments of these developments included in the online planning files published on the Cork County Council (CCC) and Kerry County Council (KCC) planning enquiry systems as well as the Database of Irish Excavation Reports. A review of other developments within 3 km of the Project was also carried out and the results are presented below (**Table 14.18**).

Table 14.17: Review of wind farm developments within 10 km of the Project

Wind Farm	Status	No. of Turbines	Approximate Distance to the Site Boundary	Direction from the Development	Cultural Heritage Review
Cleanrath	Operational	9	9.93 km	South East	Archaeological testing and monitoring carried out as part of this development revealed nothing of archaeological significance[26]
Clydaghroe, Clonkeen	Operational	4	6.05 km	North East	The Excavations Database does not contain any entries for this development. A review of its location revealed that the site does

[26] https://excavations.ie/report/2019/Cork/0029095/

Wind Farm	Status	No. of Turbines	Approximate Distance to the Site Boundary	Direction from the Development	Cultural Heritage Review
					not contain any designated cultural heritage sites
Coumaclovane, Coolea	Permitted	1	3.17 km	South-West	The Excavations Database does not contain any entries for this development. A review of its location revealed that the site does not contain any designated cultural heritage sites
Coolknoohil, Inchee	Operational	2	3.94 km	South-West	Archaeological monitoring of this development revealed nothing of archaeological significance[27]
Coolknoohil, Kilgarvan	Operational	11	4.40 km	South-West	Archaeological monitoring of this development revealed nothing of archaeological significance[28]
Coomagearlahy Kilgarvan	Operational	15	2.70 km	South-West	Archaeological monitoring of this development revealed nothing of archaeological significance[29]
Cummeennabuddoge, Clydaghroe, Cloonkeen	Operational	2	7.23 km	North-East	The Excavations Database does not contain any entries for this development. A review of the EIS for the development revealed that its location does not contain any designated cultural heritage sites[30]
Coomacheo	Operational	15	9.02 km	North-East	Advance archaeological site investigations of the development location revealed nothing of archaeological significance[31]
Derragh	Operational	6	7.52 km	South	A review of the Cultural Heritage Chapter in the EIS prepared for the for this development was carried out and revealed that it was assessed to have no predicted direct or significant impacts on the cultural heritage resource[32]. The assessment also concluded that the visual impacts on archaeological sites within the surrounding landscape would be slight in significance.
Gortnakilla, Clonkeen Killarney	Permitted	4	1.87 km	West	A review of the cultural heritage assessment prepared for this location was carried out and revealed that it contained no known cultural heritage assets[33]
Grousemount, Barnastooka	Operational	24	7.38 km	South-West	Archaeological investigations at this development revealed various features including the remains of upland hut sites (Licence 16E0127[34]). All of these were preserved *in situ* by avoidance apart from one example which was preserved by record by an

[27] https://excavations.ie/report/2013/Kerry/0024269/
[28] https://excavations.ie/report/2004/Kerry/0011861/
[29] https://excavations.ie/report/2005/Kerry/0013693/
[30] http://docstore.kerrycoco.ie/planningfiles/061680.pdf
[31] https://excavations.ie/report/2006/Cork/0015047/
[32] http://planning.corkcoco.ie/ePlan/AppFileRefDetails/156966/0
[33] http://docstore.kerrycoco.ie/planningfiles/061396.pdf
[34] https://excavations.ie/report/2016/Kerry/0025172/

Wind Farm	Status	No. of Turbines	Approximate Distance to the Site Boundary	Direction from the Development	Cultural Heritage Review
					archaeological excavation which revealed it to be a cairn containing a Bronze Age 'short cist' (Licence 18E0324[35]).
Gortyrahilly	Proposed	14	4.7 km	South	The cultural heritage assessment of this proposed development concluded that it would result in no predicted direct or significant impacts on the resource[36]
Inchee, Poulbatha & Foilgreana	Operational	6	3.30 km	South-West	Archaeological monitoring of the construction of this development revealed nothing of archaeological significance [37]
Inchincoosh Kilgarvan	Operational	6	4.51 km	West	Archaeological monitoring of the construction of this development revealed nothing of archaeological significance[38]
Rosseightragh, Lettercannon, Kilgarvan	Operational	7	5.23 km	South West	Archaeological monitoring of the construction of this development revealed nothing of archaeological significance[39]
Knocknamork	Permitted	7	4.42 km	North East	The cultural heritage assessment of this proposed development concluded that it would result in no predicted direct or significant impacts on the resource[40]
Sillahertane Kilgarvan	Operational	10	7.03 km	South-West	Archaeological monitoring of the construction of this development revealed nothing of archaeological significance[41]
Cummeennabuddoge	Pre-planning	17	4.72 km	North East	A review of the location of this proposed development revealed that there are no recorded archaeological sites or designated architectural heritage structures within its boundary

35 https://excavations.ie/report/2018/Kerry/0027273/
36 https://gortyrahillyplanning.ie/environmental/
37 http://docstore.kerrycoco.ie/planningfiles/031188.pdf
38 https://excavations.ie/report/2008/Kerry/0019629/
39 https://excavations.ie/report/2008/Kerry/0019629/
40 http://planningdocs.corkcoco.ie/PlanningDocumentDisplay/documents/18a-194972
41 https://excavations.ie/report/2008/Kerry/0019648/

Table 14.18: Review of other developments within 3 km of the Project

Planning ref.	Development type	Status	Approx. Distance from Project	Cultural Heritage Review
CCC ref. 174167	Solar Farm	Granted	3 km to southwest	A pre-development archaeological assessment concluded there were no recorded archaeological sites located within or in close proximity to the subject site. No likely significant impacts were predicted, and archaeological monitoring of construction phase was recommended[42], This recommendation was included as a condition in the grant of planning.
CCC. ref. 215127	Temporary meteorological mast	Granted	Adjacent	A pre-development archaeological assessment noted the presence of two archaeological sites (enclosure CO057-007---- and field boundary CO057-006----) within the environs of the subject site. The proposed development was designed to avoid their locations and no likely direct or significant impacts were predicted[43]. Archaeological monitoring of construction phase was recommended and this was included as a condition in the grant of planning.
CCC. ref. 217318	Telecommunications structure	Granted	0.6 km to east	The online planning file for this development does not contain an archaeological assessment. A review of its location revealed that it does not contain any recorded archaeological sites
CCC. ref. 224455	House	Granted	2.1 km to south	The online planning file for this development does not contain an archaeological assessment. A review of its location revealed that it does not contain any recorded archaeological sites
CCC. ref. 196555	Land reclamation	Granted	2.8 km to south	The online planning file for this development does not contain an archaeological assessment. A review of its location revealed that it does not contain any recorded archaeological sites
CCC. ref. 204959	Farm buildings	Granted	1.8 km to south	The online planning file for this development does not contain an archaeological assessment. A review of its location revealed that it does not contain any recorded archaeological sites
CCC. ref. 214587	House	Granted	1.8 km to south	The online planning file for this development does not contain an archaeological assessment. A review of its location revealed that it does not contain any recorded archaeological sites
CCC. ref. 186505	House	Granted	1.8 km to southeast	The online planning file for this development does not contain an archaeological assessment. A review of its location revealed that it does not contain any recorded archaeological sites
CCC. ref. 184273	House	Granted	1.8 km to southeast	The online planning file for this development does not contain an archaeological assessment. A review of its location revealed that it does not contain any recorded archaeological sites
CCC ref. 196056	House	Granted	2.8 km to southeast	The online planning file for this development does not contain an archaeological

[42] http://planningdocs.corkcoco.ie/PlanningDocumentDisplay/documents/18a-174167
[43] http://planningdocs.corkcoco.ie/PlanningDocumentDisplay/documents/18a-215127

Planning ref.	Development type	Status	Approx. Distance from Project	Cultural Heritage Review
				assessment. A review of its location revealed that it does not contain any recorded archaeological sites

Given the absence of any direct or significant impacts on the recorded cultural heritage resource arising from the Project, in combination with the results of the above review of wind farms, it is concluded that the proposed Project is not predicted to contribute to any significant direct cumulative impacts on the cultural heritage resource of the wider area.

The Development will result in a range of not significant to moderate, negative, indirect impacts on the settings of archaeological monuments within surrounding lands (**Table 14.16**). Given the distances and locations of the other reviewed wind farm developments from the Development, it is concluded that they will not act in combination to result in any likely significant, negative, indirect cumulative impacts on the settings of these monuments. In addition, as described in **Section 14.3.2**, a review of archaeological monument types with visual alignment attributes within the 10 km of the Site revealed that the Development will not result in any predicted likely moderate or significant indirect negative impacts on any of their settings or alignments. The review of available cultural heritage impact assessments of the wind farm developments listed in **Table 14.17** revealed that none of these assessments predicted any likely significant, indirect impacts on any monuments within the wider environs of the assessed wind farm locations.

The Landscape and Amenity impact assessment (**Chapter 12**) provides an assessment of potential cumulative visual impacts on the Western Summit of 'the Paps of Anu', which forms a prominent location within The Paps Archaeological Landscape. This assessment concludes that the cumulative visual impact from this location is Moderate in significance (see **Chapter 12; Section 12.4.3.5**). The Landscape and Amenity assessment also concludes that the heritage site of Gougane Barra, including Saint Finbarr's Oratory which is c.12 km to the southwest, is not contained within the Zone of Theoretical Visibility pattern and indicated no potential for visibility from within this valley location (see **Chapter 12; Section 12.3.3.1)**.

It is, therefore, concluded that the Development will not act in combination with the reviewed wind farm developments to result in likely significant indirect negative cumulative impacts on the settings or alignments of such ritual archaeological monuments within the wider landscape. There are no National Monuments in State Care or World Heritage sites (including tentative list) located within 10 km of the Site and the Development is not predicted to contribute to any cumulative impacts on such monuments.

The locations of other developments, including residential and agricultural developments, within 3 km of the Development were also reviewed on the County Cork and Kerry planning enquiry systems. The majority of these reviewed developments are small-scale in extent, including dwelling houses and farm buildings, and no examples that will result in direct or indirect significant cumulative impacts, on any recorded archaeological sites or designated architectural heritage structures were noted. Two of the reviewed developments are located within 1 km of the Site and these comprise a temporary meteorological mast and a telecommunication structure (**Table 14.18**; CCC refs 215127 and 217318). These two permitted developments are not predicted to result in any likely significant indirect impacts on the known cultural heritage resource and are not considered likely to contribute to any significant indirect impacts in combination with the Development. This is due to their distance from the Development in combination with the absence of cultural heritage constraints with notable visual sensitivities, such as megalithic tombs, stone rows/circles, within their environs. The review did not identify any other examples that will combine with the Development to result in any likely significant cumulative impacts on the cultural heritage resource.

14.7 DECOMMISIONING IMPACTS

No direct impacts on known elements of the cultural heritage resource are predicted during the decommissioning phase as there are no recorded cultural heritage assets located within or adjacent to the footprint of the various elements of the wind farm that will be subject to decommissioning. Any unrecorded, sub-surface archaeological remains identified during archaeological monitoring of the construction phase will either be preserved *in situ* by avoidance within the Site or preserved by record (excavation) and no decommissioning impacts on such potential features are predicted. The decommissioning of the Development will result in the reversal of the long term, indirect, negative visual impacts on the archaeological monuments located within the environs of the Site and the wider landscape (**Table 14.16**).

14.8 CONCLUSIONS

The Project will not result in any predicted direct negative impacts on any known archaeological monuments or architectural heritage structures. The locations of two recorded archaeological sites within the Site will be cordoned off within fenced buffer zones for the duration of the construction phase. No in-channel works within any watercourses will be carried out and no impacts on any potential underwater archaeological remains are predicted. The potential exists for the presence of unrecorded, sub-surface archaeological features within the Site and archaeological monitoring of the construction phase will be carried out under licence from the National Monuments Service by a suitably qualified archaeologist. In the event that any sub-surface archaeological remains are identified during monitoring, they will be cleaned, recorded and left to remain *in situ* within cordoned off areas while the National Monuments Service are notified and as described above in respect of measures which may entail preservation *in situ* by avoidance or preservation by record by archaeological excavation.

The Project will result in a range of not significant to moderate, indirect negative visual impacts on the settings of archaeological monuments located within surrounding lands during the operational phase (**Table 14.16**). These indirect impacts will be long term in duration and will be reversed following the decommissioning phase.

14.9 SUMMARY OF SIGNIFICANT EFFECTS

No predicted significant direct, indirect or cumulative effects on the Cultural Heritage resource arising from the proposed Project have been identified.

14.10 STATEMENT OF SIGNIFICANCE

An assessment has been made of the potential for significant effects of the Project on the cultural heritage resource. Following the application of effective mitigation measures based on best practice guidelines, including archaeological inputs during the Project design process combined with onsite archaeological monitoring of the construction phase, the Project is not predicted to result in likely significant effects on the cultural heritage resource.

15 TRAFFIC AND TRANSPORT

15.1 INTRODUCTION

15.1.1 Background and Objectives

This chapter assesses the potential traffic and transport effects of the Project, describes the existing transport network, identifies whether there is any potential for significant effects to arise (both in isolation and in combination with other developments) and outlines any mitigation measures as required. The assessment will consider the potential effects during the following phases of the Development:

- Construction of the Project,
- Operation of the Project, and
- Decommissioning of the Project.

For developments of this nature, the construction phase is the critical impact period with impacts experienced on the surrounding road network. These impacts are both the short-term additional traffic volumes and the geometric requirements of the oversized loads associated with the turbine components. The locations on the public road network requiring remedial measures to accommodate turbine delivery will be temporary in nature as shown in **Table 15.12** , apart from the enhancement of the existing junction with the N22, and are outlined in this Chapter.

Construction materials and tree felling for the wind farm and the delivery of turbine components will use the existing public road network as far as the proposed entrance off the N22, which is an existing forestry entrance at Derryreag. Construction materials for much of the grid connection will use an existing access from the N22 to the forest track at Cummeenavrick (see **Figure 15.4**).

While the wind farm site is located in Co. Cork, the site entrance off the N22 at Derryreag is located in Co. Kerry. The site access point for much of the grid connection at Cummeenavrick is located in Co. Kerry (see **Figure 15.4**).

A Swept Path Analysis has been carried out on the Haul Route for the abnormal loads associated with turbine components. The Swept Path Analysis includes an assessment of blade oversail (ie. where the blade protrudes outside the road corridor). The assessment was done using a Siemen SG155 Blade component super wing carrier which is designed to transport the size of blades required for the turbine.

The haul routes proposed for all other construction materials is referred to as the Civil Construction Haul Route.

The grid connection haulage route will overlap with the civil construction route mainly with the entrance to the grid connection works being slightly further North on the N22 in Co. Kerry. The excavation of the grid connection trenches will coincide with the work that will be required on the forest track entrance which will be used as the civil construction haul route.

This chapter outlines potential effects of the Project on traffic and transport based on the Swept Path Analysis which has been undertaken for the abnormal loads Haul Route. It also estimates the number of HGV and other traffic movements on the Civil Construction Haul Route used for materials deliveries and assesses the associated impacts.

Figures are contained in **Volume III**.

Common acronyms used throughout this EIAR can be found in **Appendix 1.2**. This chapter of the EIAR is supported by Figures provided in Volume III and by the following Appendix documents provided in Volume IV of this EIAR:

- **Appendix 15.1: Collett Route Survey Reports of October 2022 and November 2022**
- **Appendix 15.2: Swept Path Analysis Drawings**
- **Appendix 15.3: Road Safety Audit**

15.1.2 Statement of Authority

This chapter of the EIAR has been prepared by David Kiely, Director, Jennings O'Donovan & Partners Limited who holds a BE in Civil Engineering from University College Dublin and MSc in Environmental Protection from IT Sligo. He is a Fellow of Engineers Ireland, a Chartered Member of the Institution of Civil Engineers (UK) and has over 39 years' experience. He has extensive experience in the preparation of EIARs and EISs for environmental projects including Wind Farms, Solar Farms, Waste Water Projects and various Commercial Developments. David has also been involved in the construction of over 60 wind farms since 1997.

The Collett Route Survey Reports for wind turbines were prepared by Spencer Budgen and reviewed by Steven Mangham of Collett & Son, Halifax, West Yorkshire, UK. Collett & Son owns a fleet of over 60 vehicles and 100 trailers and is one of the main transport contractors who deliver wind turbine components to locations in Ireland. They also provide consultancy services in relation to the assessment of turbine haul routes. Mr. Mangham also oversaw the preparation of the Swept Path Analysis drawings for the turbine haul route between Ringaskiddy and Derryreag, west of Ballyvourney. He completed the survey dated 12th October 2022 with the help of Spencer Budgen (renewables surveyor) and Jacob Halstead (transportation specialist)

Mr. Mangham has a BTech in Civil Engineering from Leeds College of Building and a BSc in Civil Engineering from Leeds Beckett University. He has been employed by Collett & Son for over 12 years and is their Consultancy Manager. He has been involved in transport assessments for over 250 wind farms in the UK and for over 40 wind farms in Ireland.

G. Mohammadi from Collett & Son also prepared Swept Path Analysis drawings between Ringaskiddy Port, Co. Cork and the site access junction off the N22 at Derryreag Td., Co. Kerry.

The Swept Path Analysis and design of the site access junction with the N22 and the upgrading works to the existing forest track were prepared and designed by John Doogan, Senior Designer at Jennings O'Donovan & Partners Limited. John has a National Diploma in Civil Engineering from Bolton Street College of Technology, Dublin and has over 32 years of road design experience. He has worked on over 30 wind farms in Ireland and Sweden.

Topographic surveys of the lands for the proposed site access junction (existing forest access) with the N22 were carried out by Mr. Garry Henebry, Managing Director, GHE Surveying, Mitchelstown, Co. Cork. Garry Henebry is the Managing Director of GHE Surveying and has 20 years' experience of surveying. Garry qualified from St. Johns Central College Cork City in 2001 with a Diploma in Architectural Design and since then has established an extensive background in planning, civil engineering and surveying. GHE operates out of Mitchelstown, Co. Cork and are nationwide throughout Ireland with their services. They provide precise and detailed measurement information at all stages of a project and specialise in the provision of innovative solutions to all aspects of engineering surveying in the civil sector and all aspects of land and measured building surveying. Garry has provided surveying services to contractors engaged in the construction of wind farm and grid connections.

15.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

15.2.1 Assessment Methodology

This assessment has involved the following elements, further details of which are provided in the following sections:

- Policy and guidance review;
- Desk study, including review of available maps and published information;
- Site visit (driving the route) including review of road network to be used;
- Topographical Survey of potential 'constraints';
- Swept Path Analysis of the Haul Route;
- Establishment of Baseline Scenario;
- Evaluation of potential effects;
- Evaluation of the significance of these effects;
- Identification of measures to avoid and mitigate potential effects;

Existing, permitted and known proposed developments and projects are cumulatively assessed in the EIAR. This includes projects and developments that are pending a decision from the planning authority and other known projects which are in the advanced stages of being prepared to be submitted for planning and have the potential for in combination effects, namely the Cummeennabuddoge Wind Farm. Cummeennabuddoge Wind Farm is at the pre-planning/concept stage and is being prepared by the same client as Inchamore Wind Farm, and including the evaluation of residual effects following implementation of mitigation measures.

15.2.2 Planning Policy and Guidelines/Guidance

In addition to the EIAR standards outlined in **Chapter 1: Introduction**, the following guidance, guidelines and standards have been used in the preparation of this chapter:

Table 15.1: Policy and Guidance

Policy / Author	Title	Policy
Cork County Council	Cork County Development Plan 2022-2028	The CDP states: *"Objective TM12-2-2: Promote and facilitate an active travel culture in the County where active travel is a viable choice.* *f) Where appropriate, identify alternative routes, signposted for cycling and walking, to improve the experience and uptake of active travel.* *h) Seek to improve connectivity within the County and region for walking routes and commuter cycling routes and recreational amenity functions."*

Policy / Author	Title	Policy
		"Objective TM 12.8: Traffic/Mobility Management and Road Safety *a) Where traffic movements associated with a development proposal have the potential to have a material impact on the safety and free flow of traffic on a National, Regional or other Local Routes, the submission of a Traffic and Transport Assessment (TTA) and Road Safety Audit will be required as part of the proposal.* *d) Ensure that all new vehicular accesses are designed to appropriate standards of visibility to ensure the safety of other road users.* *e) Improve the standards and safety of public roads and to protect the investment of public resources in the provision, improvement and maintenance of the public road network."* *"Objective TM 12.13: National, Regional and Local Road Network* *Key Project 2040 projects:* • *N22 Ballyvourney to Macroom road* *i) Promote the improvement of strategic Regional and Local Roads throughout the County in accordance with the strategies identified for the main settlements in this plan.* *j) Restrict individual access onto national roads in order to protect the substantial investment in the national road network, to improve carrying capacity, efficiency and safety and to prevent the premature obsolescence of the network.* *k) Limit access to regional roads where appropriate so as to protect the carrying capacity of the network and have regard to safety considerations, particularly where access to a lower category road is available.* *l) Ensure that all route upgrades are planned, designed and constructed to be compliant with EU environmental directives and to minimise impacts on biodiversity, built heritage and landscape.* *m) Avoid the creation of additional access points from new developments or the generation of increased traffic from existing accesses onto national roads to which speed limits of greater than 50kph apply.*
Kerry County Council	Kerry County Development Plan 2022 – 2028	The CDP has the following objectives relevant to traffic and transport aspects of the proposed development: **KCDP 14-20** Enhance and improve regional connectivity through upgraded transport infrastructure and effective public transport services. **KCDP 14-21** Improve access for all vulnerable road users and people with disabilities to all modes of transport with provision for universal design thereby increasing and improving transport facilities for all users. **KCDP 14-22** Protect and sustainably develop the county's principal transportation assets including ports, Kerry Airport, and strategic road and rail corridors. **KCDP 14-23** Promote the sustainable development of all transportation links both within and out of the County in co-

Policy / Author	Title	Policy
		operation with adjacent Local Authorities to integrate different modes of transport. Extract fromSection 14.4 "In accordance with Section 2.7 of the DoELG Spatial Planning and National Roads Guidelines for Planning Authorities, particular care must be exercised in the assessment and management of development proposals in the Development Plan relating to development objectives or the zoning of locations at or close to junctions on the national road network in accordance with the provisions of official policy." Extract from Table 14.3: National Primary/Secondary Roads projects N21/N22 Tralee to County Boundary. **KCDP 14-25** Seek to protect and safeguard the significant investment made in strategic economic infrastructure, in particular the network of roads, the existing rail line to Tralee and major water and wastewater projects, through the promotion of appropriate development and settlement patterns and the integration of land use and transportation activities. **KCDP 14-26** Strengthen Steady State Investment in our existing road networks to ensure that existing networks are maintained to a high level to ensure quality levels of safety, service, accessibility and connectivity to transport users of all transport modes. **KCDP 14-27** Provide, or facilitate the sustainable provision of all road infrastructure projects set out in Table 14.3 with priority given to infrastructure serving the key Towns. **KCDP 14-28** Support the development of the Adare, Newcastlewest and Abbeyfeale By-passes and N21 realignment as a strategic link corridor between Co. Kerry and Co. Limerick and support the completion of the Macroom By-pass and further improvements and realignments of the N22 corridor. **KCDP 14-29** Protect the capacity and safety of the National Road and Strategically Important Regional Road network in the County and ensure compliance and adherence to the provisions of official Government policy outlined in the Section 28 Ministerial Guidelines 'Spatial Planning and National Roads Guidelines for Planning Authorities' (DoECLG, 2012) in order to safeguard carrying capacity and safety of National Primary and Secondary Routes and associated national road junctions. **KCDP 14-30** Avoid the creation of any additional access point from new development or the generation of increased traffic from existing accesses to National Roads to which speed limits greater than 60 km/h apply. This provision applies to all categories of development, including individual

Policy / Author	Title	Policy
		houses in rural areas, regardless of the housing circumstances of the applicant. **KCDP 14-31** Consider proposals for access onto National Roads on the approaches to or exit from urban centres that are subject to a speed limit of 60 km/h before a lower 50 km/h limit (otherwise known as transitional zones) subject to a road safety audit and in accordance with the TII publication; The Treatment of Transition Zones to Towns and Villages on National Roads DN-GEO-03084 (2018). **KCDP 14-34** a) Facilitate and support planning applications for economic job creation entitles which require access onto National Primary/Secondary Roads subject to compliance with section 2.5 & 2.6 of the guidelines, with early engagement with the TII. b) Favourably consider new planning applications which require access onto National Primary/Secondary Roads for family members where there are existing entrances which is supported by a detailed Road Safety Audit.
Department of Transport, Tourism and Sport and Department of Environment, Community and Local Government	The Design Manual for Urban Roads and Streets (DMURS)	This document outlines guidelines on the design of urban roads and streets in terms of street networks, street signage, pedestrians and cyclists, carriageways (widths, surfaces, junctions etc.), policies and plans, design process and audits (safety and quality).
Transport Infrastructure Ireland (TII)	Traffic and Transport Assessment Guidelines (PE-PDV-02045, May 2014)	The guidelines provide guidance for developers, planning authorities and the National Roads Authority (NRA) for: • Scoping for traffic and transport assessment for future development and development areas, particularly areas in proximity to national roads, • Defining thresholds where studies are recommended to minimise the impact of future proposals on the national road network, • Contributing to the provision of sustainable forms of development and better-informed planning decisions.
Transport Infrastructure Ireland (TII)	Geometric Design of Junctions (priority junctions, direct accesses, roundabouts, grade separated, and compact grade separated junctions) DN-GEO-03060, June 2017)	Design Standards for Junction Design, excl. major interchanges.
Transport Infrastructure Ireland (TII)	Rural Road Link Design (DN-GEO-03031 June 2017)	This Standard applies to Single and Dual Carriageway roads (including Motorways) in rural areas. It also applies to single carriageway Urban Relief Roads and Urban Dual Carriageways and Motorways. The Standard shall be used to derive the Design Speed, and the appropriate values of geometric parameters for use in the design of the road alignment. It sets out the basic principles to be used in co-ordinating the various elements of the road layout, which together form the three-dimensional design of the road.

Policy / Author	Title	Policy
Transport Infrastructure Ireland (TII)	Design Phase Procedure for Road Safety Improvement Schemes (DN-GEO-03030, April 2021)	This Standard sets out the procedures to be followed for the technical aspects of the Design Phase of the following scheme types: • Road Safety Improvement Schemes • Urban Road Schemes • Road Safety Improvements aspects • Local authority general improvement schemes which have not been identified as Road Safety Improvement Schemes, schemes led, funded or partly funded by other agencies, development led schemes and/or community schemes.
Transport Infrastructure Ireland (TII)	Project Appraisal Guidelines for National Roads Unit 5.3 – Travel Demand Projections (PE-PAG-02017, May 2019)	This document provides guidance on the development of transport models for use in the appraisal of transport infrastructure. The guidance addresses the scoping and construction of transport models which reflect transport demand and supply in a 'Base Year'. It provides guidance on the preparation of future travel demand projections for use in modelling and appraisal.
Transport Infrastructure Ireland (TII)	Expansion Factor for Short Period Traffic Counts (PE-PAG-02039, October 2016)	This document aims to support the conversion of short period traffic counts to annual average daily traffic (AADT).
Transport Infrastructure Ireland (TII)	Road Safety Audit (GE-STY-01024, December 2017)	This Standard outlines the requirements for Road Safety Audits in the management of the national road infrastructure. It sets out the procedures required to implement Road Safety Audits and defines the relevant schemes and stages in the design and construction at which audits shall be undertaken.
Department of the Environment and Local Government and Department of Transport	Traffic Management Guidelines 2012	This document outlines guidelines for traffic management and sustainability, consultation and monitoring, speed management, junctions, vulnerable road users, public transport and parking. The guidelines recommend that consultation is carried out for schemes that involve a long construction period or area. The guidelines outline the relevant legislation governing different types of road works. The guidelines outline safety measures to be taken in the design of roads and junctions. The guidelines outline the arrangements for temporary traffic management where construction and improvement of roads is taking place and who should be consulted in planning for roadworks and the factors to consider.
Department of Transport, Tourism and Sport	Guidelines for Managing Openings in Public Roads (Second Edition, April 2017)	The document prescribes standards in respect of the work of forming openings, backfilling and the reinstatement of road surfaces and the associated materials to be used on all roads other than National Roads. It also prescribes procedures and requirements in relation to the use of MapRoad Roadworks Licensing (MRL) and its use for all road openings in public roads other than those openings carried out by a road authority.
Transport Infrastructure Ireland (TII)	Spatial Planning and National Roads Guidelines	It is in the public interest, in so far as is reasonably practicable, that the national road network continues to serve its intended strategic purpose. The EIAR should identify the methods/techniques proposed for any works traversing/in proximity to the national road network, in order to demonstrate that the development can proceed

Policy / Author	Title	Policy
		complementary to safeguarding the capacity, safety and operational efficiency of that network.

15.2.3 Scoping Responses and Consultation

Consultation responses are shown in **Table 15.2**.

Table 15.2: Consultation Responses

Consultee	Type & Date	Summary of Response	Response to Consultee
Transport Infrastructure Ireland (TII)	Email dated 7th December 2020	With respect to EIAR Scoping issues, the recommendations indicated below provide only general guidance for the preparation of EIAR, which may affect the National Roads Network. The developer should have regard, inter alia, to the following: 1. As set down in the "Spatial Planning and National Roads" Guidelines, it is in the public interest, in so far as is reasonably practicable, that the national road network continues to serve its intended strategic purpose. The EIAR should identify the methods/techniques proposed for any works traversing/in proximity to the national road network, in order to demonstrate that the development can proceed complementary to safeguarding the capacity, safety and operational efficiency of that network. 2. Consultations should be had with the relevant Local Authority/National Roads Design Office, with regard to locations of existing and future national road schemes.	Addressed by this EIAR / Chapter.
		3. In relation to cabling and potential connection routing, the scheme promoter should note locations of existing and future national road schemes and develop proposals to safeguard proposed road schemes. As outlined above, consult with the Local Authority/National Roads Design Office in relation to any schemes in planning in the area, especially on the N22. Proposals should be developed to safeguard proposed road schemes, as TII will not be responsible for costs associated with future relocation of cable routing, where proposals are catered for in an area of a proposed national road scheme. In that regard, consideration should be given to routing options, use of existing crossings, depth of cable laying etc.	Addressed in sections 15.5.16 and 15.6.1 of this Chapter and in Road Safety Audit in Appendix 15.3.
		In the context of existing national roads, alternatives to the provision of cabling along the national road network, such as alternative routing or the laying of cabling in private lands adjoining the national road, should be considered in the interests of safeguarding the investment in and the potential for future upgrade works to the national road network. The cable routing should avoid all impacts to existing TII infrastructure such as traffic counters, weather stations, etc. and works required	Noted, however this is not applicable as the majority (99%) of the grid connection is to be located outside public roads Furthermore there have been

Consultee	Type & Date	Summary of Response	Response to Consultee
		to such infrastructure shall only be undertaken in consultation with and subject to the agreement of TII. Any costs attributable shall be borne by the applicant/developer. The developer should also be aware that separate approvals may be required for works traversing the national road network. 4. Clearly identify haul routes proposed and fully assess the network to be traversed. Separate structure approvals/permits and other licences may be required in connection with the proposed haul route and all structures on the haul route should be checked by the applicant/developer to confirm their capacity to accommodate any abnormal load proposed. 5. Where appropriate, subject to meeting the appropriate thresholds and criteria and having regard to best practice, a Traffic and Transport Assessment (TTA) be carried out in accordance with relevant guidelines, noting traffic volumes attending the site and traffic routes to/from the site, with reference to impacts on the national road network and junctions of lower category roads with national roads. TII's 'Traffic and Transport Assessment Guidelines' (2014) should be referred to in relation to proposed development with potential impacts on the national road network. The scheme promoter is also advised to have regard to Section 2.2 of the TII TTA Guidelines, which addresses requirements for sub-threshold TTA. 6. TII Standards should be consulted to determine the requirement for Road Safety Audit and Road Safety Impact Assessment. 7. Assessments and design and construction and maintenance standards and guidance are available at TII Publications, which replaced the National Road Authority (NRA) Design Manual for Roads and Bridges and the NRA Manual of Contract Documents for Road Works. 8. The developer, in conducting Environmental Impact Assessment, should have regard to TII Environment Guidelines that deal with assessment and mitigation measures for varied environmental factors and occurrences. In particular: a. TII's Environmental Assessment and Construction Guidelines, Including the 'Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes' (NRA, 2006). b. The EIAR should consider the 'Environmental Noise Regulations 2006' (SI 140 of 2006) and, in particular, how the development will affect future action plans by the relevant competent authority. The developer may need to consider the incorporation of noise barriers to reduce noise impacts (see 'Guidelines for the Treatment of Noise and Vibration in National Road Schemes (1st Rev, NRA, 2004). Notwithstanding, any of the above, the developer should be aware that this list is non-exhaustive, thus site and development specific issues should be addressed in accordance with best practice.	recent upgrades in the form of the new N22 from Macroom to Ballyvourney. . Addressed in this Chapter Addressed in Sections 15.3.5 and 15.3.6 Addressed in this Chapter. Noted and referred to in this Chapter where relevant

Consultee	Type & Date	Summary of Response	Response to Consultee
			Addressed in Chapter 13. Addressed in Chapter 11.
Cork County Council	Pre-Planning Consultation meeting Notes 23/11/2022	No specific comments in relation to traffic and transportation.	No response required in this Chapter.
Kerry County Council	Notes from Pre Planning Call with Kerry County Council dated 03.11.2022	1. KCC noted that the Senior Engineer for TII is Paul Curry but they would advise on who the TII point of contact would be to consult with. 2. KCC noted that the location of the site entrance from a sightline's' perspective should be appropriate. 3. KCC queried how many landowners were involved with the proposed works on the turbine delivery route and if they had been signed up. 4. KCC queried if the proposed development would need to utilise the turning area at the island junction similar to what was being proposed for Gortyrahilly Wind Farm.	Noted Proposed in this Chapter..

15.2.4 Study Area

The study area for Traffic and Transport assessment is defined as the wind farm Site, the Haul Route for Turbine Components, the Civil Construction Haul Route for the importation of rock, concrete and other construction materials to the Site primarily from local quarries ,the Grid Connection Route and the Tree felling Haul Routes to the Sawmills..

The Turbine Components Abnormal Haul Route is shown on **Figure 15.1** and **Figure 15.2**, the Civil Construction Haul Route is shown on **Figure 15.3**, the Grid Connection Route is shown on **Figure 15.4** and locations for disposal of spoil from construction of the grid connection are shown on **Figure 15.5**.

It is proposed that the turbine and electrical components will be delivered via Ringaskiddy Port, Co. Cork. The following route is proposed and is discussed in further detail in **Appendix 15.1**:

- Exit Ringaskiddy Port onto N28.
- At the roundabout, continue on N28.
- At the roundabout, continue on N28.
- At the roundabout, take the 2nd exit onto N28.
- Continue on N28, then take the slip road onto N40.

- Continue on N40 to N22, use new Macroom By-Pass which ends north-west of Ballyvourney (to be known as Ballyvourney junction).
- Rejoin the existing N22, Continue on N22, then turn left at site access point at Derryreag. At the site access, Continue on c.2.5 km of forest track to the wind farm site.
- Upon exit from the site (c.2.5 km forest track),turn left onto N22, then turn right at the island junction at the South side of Cummeenavrick (Co. Kerry) and complete a 180 degree turning manoeuvre and continue on the N22.

While sub-base and base course materials for the internal wind farm site Access Tracks and Turbine Hardstand construction will be sourced from on-site excavations and an on-site borrow pit, crushed stone will be imported for the final running layer. Specific grades of rock fill will be required as fill under Turbine Foundations. The crushed stone as well as rock fill and concrete for Turbine Foundations, concrete blocks for the construction of the substation building and precast chambers for site cabling will be sourced from one of the local quarries in the area such as the following which are show on Figure 15.3:

- McGroup Keim Quarry;
- Coppeen Concrete, Enniskeane;
- Mid-Cork Quarries, Gortnadiha;
- McSweeney Bros, Kilmichael;
- Keohane Readymix, Ballygurteen,and
- Murray Bros Tarmacadam Ltd, Ardcahan.

These quarries will also be the source of crushed stone and concrete for grid connection works.

The N22 Macroom By-Pass is a dual carriageway Type 2 road with four junctions:

- Baile Bhuirne (Ballyvourney) grade-separated junction: the tie in with the existing N22 at the western end of the road development west of Baile Bhuirne.
- Tonn Láin (Toolane) grade-separated junction and off-line roundabout: This provides access to and from the existing N22, to the east of Baile Mhic Íre.
- Gurteenroe grade-separated junction and off-line roundabout: The location where the proposed route crosses the regional road, R582.
- Coolcour roundabout: This is the tie-in with the existing N22 at the eastern end of the road development in the townland of Coolcour.

Two of these junctions are at each end of the by-pass with only two in between.

The materials delivery routes proposed are such as to maximise use of the new N22 Macroom By-Pass and to avoid centres of population such as Macroom, Ballyvourney and Ballymakeery.

For the quarries to the south, trucks will use the R599, R586, R587, then the R584, then the existing N22 south-eastwards to join the new N22 Macroom By-Pass, will follow the new N22 Macroom By-Pass to the Ballyvourney Junction, then exit onto existing N22 and travel westwards to Derryreag and then enter the wind farm Site (see **Figure 15.3**).

From Keim, trucks will follow the R582 in a south-easterly direction and join the New Macroom By-Pass (N22) at Gurteenroe Junction. They will then follow the new N22 By-Pass to Ballyvourney Junction and then the existing N22 to Derryreag to access the forest track in the wind farm site (see **Figure 15.3**).

Wood from forestry felling required to accommodate part of the Project will be removed from the site once the civil works are complete. Three suitable locations have been identified in Enniskeane and Lissarda (Enniskeane Timber Products LTD., Graingers Sawmills Ltd. and GP Wood Donniskey). The proposed tree feeling route for transporting wood is shown on **Figure 15.6**. This route is effectively the reverse of the civil construction haul route and trucks will leave the wind farm site via the forest track and turn left on the N22, drive Northwards on the existing N22 to the turning area in Cummeenavrick and then travel to the Ballyvourney junction of the new N22 Macroom By-Pass, follow the By-Pass to the ? N22 junction and then either head south-westwards to the R584, or to the Coolcour junction with the existing N22 and then proceed south-eastwards to the L-7489 shown on **Figure 15.6**.

The proposed grid route is largely independent of the haul routes (see **Figure 15.4**). Leaving the wind farm site, the grid route will follow the forest tracks for c.1.5 km as far as the N22 which will be crossed by directional drilling (70 m). It will then follow the old route of the N22 (also by directional drilling) for a short distance (c.0.58 km) before following forestry tracks to the existing Ballyvouskill Substation. Of the total length of 19.9 km, only 0.07 km will be within public roads with a further 0.58 km under former roads.

For the grid connection, general material excavated from trenches will be graded on top of or adjacent to the existing tracks. As the N22 will be crossed by directional drilling, very little waste (c.30 m^3) will arise from drilling. This soil waste will be transported to one or more of the following licensed facilities (see **Figure 15.5**):

- Tomas Mullins, Scrahanagown, Coolea, Co. Cork;
- Richard & Dennis Carroll Plant Ltd., Clonfadda, Macroom, Co. Cork;
- Ciaran Ryan Plant Hire Ltd., Ballymacorcoran, Clondrohid, Co. Cork, and
- Séan Ó Luasa, Na Foithrí (Fuhirees), Cúil Aodha, Maighchromth, Co. Chorcaí.

Soil and stone spoil from road widening at the site access from the N22 at Derryreagh will be disposed of to the same facilities.

Grid construction traffic for the section of grid south-west of the N22 will be from the N22 at the site access at Derryreag Townland For the section of the grid connection north-east of the N22, access will be gained from the N22 at Cummeenavrick Townland. (see Figure 15.6).

15.2.5 Desk Study

Primary Route Assessments for the turbine component haul route were undertaken by Collett & Sons Ltd., Halifax, U.K. who are specialists in the transportation of wind turbine components. This is included in **Appendix 15.1**.

Desk Studies of the Study Area were largely completed in advance of undertaking the route survey. This involved using Google Maps and Streetview to assess the proposed haul route road network from Ringaskiddy Port and from Foynes Port. The civil construction haul route was assessed in a similar manner as was potential traffic associated with the grid route.

Cork County Council and Kerry County Council were consulted as part of the Scoping process. Cork County Council did not have any specific comments in relation to traffic and transport while Kerry County Council had the comments listed in **Table 15.2**.

Traffic count data from TII was used to assess the current Baseline Scenario on the N22 in the area.

15.2.6 Field Work

A Preliminary Route Assessment was carried out in October 2022 for the turbine component haul route between Ringaskiddy Port and the Site , this included the use of the Macroom By-Pass and to reflect the use of a 76.82 m blade component.

The second route survey (Report of November 2022) examined the route between Foynes Port and the Site and was based on the use of a 77.5 m blade.This is further discussed in **Chapter 3: Alternatives Considered**.

In each case, the route was assessed by a two-person team and the various junctions and constraints were photographed. A copy of each report is included in **Appendix 15.1**.

For the range of wind turbines under consideration, the rotor diameters will vary from 149 m to 155 m. For a typical central hub diameter of 3 m, the blade lengths will range from 73 m to 76.82 m. In terms of turbine transportation, the effects of transporting a 76.82 m blade (maximum blade length under consideration) will be similar to those of 73 m. No additional works are required to facilitate their transportation nor any further impacts predicted.

The distance between Ringaskiddy Port and the Site is c.91.6 km while the distance between Foynes Port and the Site is c.216 km. The route from Ringaskiddy using the Macroom By-pass to Site will be generally wider than the route from Foynes. At the proposed site entrance to the wind farm, vehicles from Foynes would have to turn right onto the forest track while being parked in an overtaking lane. This is considered as a dangerous manoeuvre. Accordingly, due to the much shorter length, better quality road and safer entry to the site, the route from Ringaskiddy was selected.

A Topographical Survey of the area for potential works at the proposed site entrance off the N22 at Derryreag was undertaken during October 2022 by GHE Surveying.

This fieldwork enabled the junction design drawing to be prepared by JOD (see Planning Drawing No. 6225-JOD-XX-DR-C-200/LT1).

15.2.7 Evaluation of Potential Effects

The baseline environment is described in **Section 15.3**. The available data will then be utilised to identify and categorise potential effects likely to affect the national and local road network used for the Turbine Component Haul Route, the Civil Construction/Sawmill Haul Routes and the Grid Connection as a result of the Development.

The statutory criteria (EPA, 2002; EPA, 2003) for the assessment of effects require that likely effects are described with respect to their extent, magnitude, type (i.e. negative, positive or neutral) probability, duration, frequency, reversibility, and transboundary nature (if applicable). The descriptors used in this Environmental Impact Assessment Report (EIAR) are those set out in EPA (2002) 'Glossary of Impacts'.

Effects may be categorised as follows:

- Direct: where the existing traffic and transport environment in proximity to the Development is altered, in whole or in part.
- Indirect: where the traffic and transport environment beyond the Project is altered by activities related to the construction or operation of the Project.
- No Effect: where the Development has neither negative nor positive effect upon the traffic and transport environment.

15.2.8 Sensitivity

The sensitivity of the local transport infrastructure has been identified utilising the criteria outlined within the Traffic and Transport Assessment Guidelines (PE-PDV-02045, May 2014) (TII Guidance).). These criteria are outlined within **Table 15.3** below.

Table 15.3: Receptor Sensitivity

Importance	Description
High	Receptors of greatest sensitivity to changes in traffic flow including: People whose livelihood depends upon unrestricted movement within their environment including commercial drivers and companies who employ them, local residents, schools and colleges.
Medium	Traffic flow sensitive receptors including: People who habitually pass through the area, but whose livelihoods are not dependent on free access. Would also generally include: congested junctions, community services, parks, businesses with roadside frontage and recreation facilities.
Low	Receptors with some sensitivity to changes in traffic flow: People who occasionally use the road network. Would also include: public open spaces, nature conservation areas, listed buildings, tourist attractions, residential roads with adequate footway provision and churches.
Negligible	Receptors with very low sensitivity to traffic flows: People not sensitive to transport effects. Would also refer to receptors that are sufficiently distant from the affected roads and junctions.

Table 15.4 below provides the general approach to determining the importance and sensitivity of a resource or receptor based on The Institute for Environmental Management and Assessment (IEMA) Guidelines[1]. The assessment of environmental impacts arising from road traffic is not an exact science and a degree of professional judgement is required. The definitions set out in **Table 15.4** below are generally applied. This will partially define the magnitude and significance criteria set out in the sections below, while applying thresholds quoted in the IEMA Guidance. Sensitive receptors are generally areas with key facilities associated with high footfall.

[1]The Institute of Environmental Management and Assessment (1993), Guidelines for the Environmental Assessment of Road Traffic

Table 15.4: Determining the Importance / Sensitivity of Receptor

Importance/Sensitivity of Receptor	Resource	Receptor
High	Traffic flows on highway network near schools, colleges, hospitals playgrounds, accident blackspots, retirement homes and roads without footways that are used by pedestrians.	Residents/workers travelling to and from work on foot and by vehicle, school children, leisure walkers.
Medium	Traffic flows at congested junctions and on highway network near shopping areas with roadside frontage, roads with narrow footways, unsegregated cycleways, community centres, parks, recreation facilities.	Residents/workers travelling to and from work on foot and by vehicle, school children, leisure walkers, people visiting shops etc.
Low	Traffic flows adjacent to places of worship, public open space, nature conservation areas, listed buildings, tourist attractions and residential areas with adequate footway provision.	Residents/workers travelling to these places.
Very Low	Receptors with low sensitivity to traffic flows and those sufficiently distant from affected roads and junctions.	Residents/workers travelling by foot or by vehicle.

15.2.9 Magnitude

The magnitude of potential impacts has been defined in accordance with the criteria provided in the 2022 EPA publication 'Guidelines on the information to be contained in Environmental Impact Statements' as outlined within **Table 15.5**.

The Institute for Environmental Management and Assessment (IEMA) Guidelines contains two broad principles to determine the scale and extent of an assessment, which are:

- Principle 1 – include road links where traffic flows are predicted to increase by more than 30% (or where the number of heavy goods vehicles is predicted to increase by more than 30%).
- Principle 2 – include any other specifically sensitive areas where traffic flows are predicted to increase by 10% or more.

If the predicted increase is lower than these thresholds, then the effects can be considered to be low or not significant. If the increases are above the thresholds, then the increase can potentially be significant and assessment is required.

The Traffic and Transport Assessment Guidelines (PE-PDV-02045, TII, May 2014) were developed to assess the potential effects of major developments on the national road network during their operation. These guidelines are applicable to the national roads relevant to the Project and have been used to assess the construction, operation and decommissioning phases non the N22, N28 and N40.

The IEMA Guidelines acknowledge that there are no commonly agreed thresholds for judging the magnitude of change for the effects assessed, with the exception of severance, for which IEMA suggests thresholds of 30%, 60% and 90% for slight, moderate and substantial impacts respectively.

For the most robust approach, the built-up area thresholds in line with the IEMA guidance have been used to guide assessments of magnitude of change. However, a level of professional judgement has been applied to arrive at a set of common thresholds for ascertaining the magnitude of impact. In respect of the environmental effects of traffic, magnitude, based on increase in total vehicular traffic and/or HGV traffic has been determined on the following basis:

- High – considerable deterioration / improvement in local circumstances (total traffic flows of +/-90%).
- Medium – readily apparent change in conditions (total traffic flows of +/- 60 – 90%).
- Low – perceptible change in conditions of circumstances (total traffic flows of +/- 30 – 60%).
- Very Low — no discernible change in conditions (total traffic flows of less than +/- 30%).

Table 15.5: Magnitude of Change

Magnitude of Effect	Description
Significant	The Development could result in a change of length or duration to the current traffic routes or schedules which could result in hardship.
Moderate	The Development could result in delays or the need to reschedule which may cause inconvenience.
Slight	The Development could occasionally cause minor modifications to routes, or slight delays in current schedules, or on activities in the short-term.
Imperceptible	The Development does not cause an effect on movement of road traffic above normal levels.

15.2.10 Significance of Effects

A combination of the magnitude of the impact under consideration and the sensitivity or value of the receiving environment / receptor, as set out in **Table 15.4** can be used in considering the overall significance of an effect. The general approach adopted for classifying effects is outlined in **Table 15.6**. A Major Moderate effect is seen as '**significant'**. A Minor or Negligible effect is seen as '**not significant**'.

Table 15.6: Significance of Effects

Sensitivity/Value of Receptor	Magnitude of Impact			
	High	Medium	Low	Very Low
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible
Very Low	Minor	Negligible	Negligible	Negligible

15.3 BASELINE DESCRIPTION

15.3.1 Site Location, Context and the Development

Separate haul routes are proposed for turbine abnormal components and civil construction materials, tree felling haul route to sawmills and for the various elements of the grid connection. Each are described below.

The proposed Turbine Components Haul Route is shown in **Figures 15.1** and **15.2** and the proposed Civil Construction Haul Route (crushed stone, concrete, concrete blocks and precast units) will come from the quarries as shown on **Figure 15.3**. Incidental building materials will be sourced from either Macroom or Killarney. The grid connection route is shown on **Figure 15.4** as well as traffic access points. Disposal routes for soil and stone arising from the directional drilling of 0.65 km of the grid connection and spoil from widening at the site access at Derryreag are shown in **Figure 15.5**. Disposal routes for forestry logs felled at the wind farm Site are shown on **Figure 15.6**.

It is proposed that the turbine nacelles, tower hubs and rotor blades will be landed at Ringaskiddy Port, County Cork. From there they will be transported to the N22 some 5 km north-west of Ballyvourney and then turn left (south-westwards) onto an existing forest track to gain access to the site.

Whilst a final choice of turbine type for the Development has yet to be made, the vehicle used for the Swept Path Analysis is the largest associated with the turbine range proposed (see **Chapter 2: Project Description**, **Section 2.5.2** for further details). The Swept Path Analysis has been completed for a turbine with 155 m rotor diameter, which has a blade length of 76.82 m. This is the longest blade length of all the turbines currently under consideration[2] and would have the greatest potential impact on road passage requirements. As the shortest blade under consideration would be 73.0 m, the swept paths would be only marginally different and the effects will be similar to the 76.82 m blade. No additional works are required to facilitate their transportation nor are any further impacts predicted.

[2] The GE5.3-158 has a larger blade overall but has a two-part construction and so will not be as long for transportation purposes.

While a detailed assessment of the route is presented in this chapter and associated appendices, it should be noted that road signage and street furniture can change between planning and construction stages. So as to confirm the suitability of any changes to the roadway or to street furniture along the route between EIAR and pre-construction, a further survey of the route will be undertaken using a transport vehicle prior to the delivery of turbine components to Site.

For the civils works during construction, crushed stone materials for the running surfaces of the Site Access Tracks and Turbine Hardstands will be sourced from one of the local authorised quarries in the area. Ready-mix concrete for Turbine Foundation construction and substation foundations will also be sourced from one of the local authorised quarries. The local quarries are located either to the north-east at Keim or to the south-east at Kilmichael, Coppeen, Gortnadiya, Ardcahan or Ballygurteen as described in **Section 15.2.4** above. HGV's from any of these quarries will use the same routes between the N22 and the Development Site. The proposed Civil Construction Haul Route is outlined in **Figure 15.3**. Other incidential material deliveries will use standard HGVs and use the local, national and regional road network.

Wood from the Tree Felling activity will be hauled to sawmills shown in **Figure 15.6.** After turning left onto the N22, then turning right at the northern end of the existing island junction at Cumeenavrick and complete a 180 degree turning manoeuvre and continue on the N22 , at the end of the Macroom Bypass, Trucks will use either the R584, R587, R585, then the R586, or alternatively the L7489 to the proposed sawmills. There are 3 proposed sawmills for the felled wood obtained on Site.

For the section of grid connection north of the N22, traffic for the delivery of crushed stone, ducting, cables and precast components will access the grid route from the N22 eastwards along forest tracks to Ballyvouskill. Access to the grid route between the N22 and the wind farm Site will be via the forest tracks/site access at Derryreag. **Figure 15.5** shows the grid connection access routes and spoil disposal locations and routes for the relatively small volume of material arising from directional drilling.

Workers employed on the Site will generally use the N22 and the construction traffic routes to reach the Site.

15.3.2 Sensitive Receptors

The Site is generally served by the N22 which runs between Cork City and Tralee. The N22 is approximately 0.9 kilometres (km) to the north-east of the Site and has a speed limit of 100 km / hour (hr). The N22 by-pass opened on the 9th December 2023, and will avoid traffic through Macroom, Ballymakeery and Ballyvourney.

Receptors considered as having 'high' sensitivity are primarily premises which are directly on the N28, N40 and N22 which have significant potential to generate traffic.

Between Ringaskiddy Port and the Wind Farm Site, the sensitive receptors are assessed in **Table 15.7**.

There are no sensitive receptors along the grid connection route. Therefore, a table is not required.

Table 15.7: Sensitivity of Receptors – Turbine Component Haul Route

Receptor	Sensitivity	Reasons/Comments
Various Businesses and Factories on N28 including Pfizer Ireland Pharmaceuticals	Very Low	Located north of N28 but with multiple junctions onto N28.
Shanbally Shop & Deli	Medium	Shop has direct access onto Shanbally Roundabout/N28 with pedestrians crossing.
Shanbally National School	High	Located on Maroon Terrace south of roundabout/N28.
Residences at Shanbally	Low	Roadside residences as well as multiple junctions onto N28 giving access to residential developments.
Church of the Immaculate Heart of Mary, Shanbally, Co. Cork	Medium	The church is located along the N28 and fronts onto the Haul Route. Some mass attendees are highly likely to use the N28 to get to the church and increased traffic on the road may affect access and egress from the church car park.
Shamrock GAA Club	Medium	Located to south of N28, junction onto N28.
Various Businesses/ Factories incl. Enva and Zenith	Very Low	Located north of N28 but with multiple junctions onto N28.
Raffeen Bridge, Accommodation, Monkstown, Co. Cork	Very Low	Located to south of N28, access via Raffeen Road onto N28.
Various Private Dwelling in Raffeen area	Very Low	Located to north and south of N28. Access onto N28 via R610, L2470 and Raffeen Road.
Storage Yard, Raffeen	Low / Very Low	Located to south of N28 with direct access.
Various Businesses and Private Residences in Hilltown Area	Very Low	Access to N28 via L6469, L6477 and other Local Roads.
Maxol Service Station	Medium	Adjacent to N28.

Receptor	Sensitivity	Reasons/Comments
Agricultural Landholdings, Farmsteads and Private Dwelling	Low	Occasional direct access onto N28.
Douglas, Rochestown, Deanrock, Bishopstown, Maryborough, Togher, Urban Areas of Cork City – Residences, Businesses	Very Low	Major junctions only onto N28 and N40/South Ring Road. Mast Receptors sufficiently distant from affected roads and junctions.
Marymount University Hospital & Hospice	High	The Hospital is located off the Curraheen Road Junction of the N40. Slow movement of traffic components could delay access to the slip road.
Cork City Football Club; Curaheen Park Greyhound Stadium. Cork Show Grounds, Agricultural landholdings, Farmsteads and Private Dwellings.	Medium / Low	Major junctions only onto N40 & N22 from (Curraheen Road) and Maglin Road.
Urban Area of Ballincollig, Coolroe, Classis Lake,	Very Low	Major junctions only onto N22. Most Receptors sufficiently distant from affected roads and junctions.
Roadstone Quarry, Classis, Co. Cork.	Very Low	Major junctions only onto N22 via R608.
The Ovens Bar, Ovens, Co. Cork	High	Roadside Access onto N22.
Agricultural Landholdings, Farmsteads, Businesses and Private Dwellings between Ovens and Farranavarra.	Very Low	Occasional direct access onto N22.
Roadstone Quarry, Garryhesta	Very Low	Not in commercial use. Direct access onto N22.
White Lodge Bed & Breakfast, and Farran House self-catering accommodation, Farranavarra, Co. Cork; Farranavarra Village.	Medium/Low	Some properties and businesses have direct access onto N22.
Agricultural Landholdings, Farmsteads, Businesses and Private Dwellings between Farranavarra and Crookstown, Co. Cork	Medium/Low	Occasional direct access onto N22.
Crookstown Village	Very Low	To the North of N21 and largely contained within two junctions with N22. Properties to south join N22 via Ryecroft Manor Road.
Roadstone Quarry, Castlemore	Medium / Low	Located to south of N22. Access to N22 is via R585.
Agricultural Landholdings, Farmsteads, Businesses, and Private Dwellings between Crookstown and Lissarda, Co. Cork	Medium / Low	Occasional direct access onto N22.
Lissarda Village & Kilmurray Cross incl. O'Leary's Garage, Circle K	High	Direct access onto N22. Route is through centre of village.

Receptor	Sensitivity	Reasons/Comments
Filling Station, Ma Fitz's Bar & Restaurant, Garden Centre, Chinese Restaurant, Other Business Units, Roadside Residences		
Agricultural Landholdings, Farmsteads, Businesses and Private Residences between Kilmurray Cross and Coolcour	Medium / Low	Occasional Direct Access onto N22.
Fountain House Bed & Breakfast, Mashanageass, Co. Cork	Medium	Close to N22.
The Lee Valley Park	Medium	Amenity Area on R584 west of N22.
Urban area of Macroom between Gurteenroe Coolcour Junction and Junction on Re-aligned N22	Very Low	New By-Pass Road with entry/exit from major junctions only.
Rural Area between Gurteenroe Junction and Toolane Junction on re-aligned N22	Very Low	New By-Pass Road with entry/exit from major junctions.
Villages of Ballymakeery and Ballyvourney between Toolane Junction and Bhaile Bhuirne Junction on re-aligned N22	Very Low	N22 is being realigned so as to avoid villages. However, they will have access junctions onto N22.
Hillview House Bed & Breakfast 1, Coolcower Macroom, Co. Cork	Low/Medium	Close to junction of old and new realignment of N22.
Rural Area between N22 By-Pass (Ballyvourney) junction and Commeenavarick	Very Low	Occasional entry via N22.

For the civil works construction haul route, the sensitive receptors are assessed in **Table 15.8**.

Table 15.8: Sensitivity of Receptors – Civil Construction Haul Route

Receptor	Sensitivity	Reasons/Comments
Agricultural Landholdings, Farmsteads, Businesses and Private Residences on R584, R587, R585, R586 and R599	Medium/Low	Occasional direct access onto Regional Roads.
Agricultural Landholdings, Farmsteads, Businesses and Private Residences on R582	Medium/Low	Occasional direct access onto R582.

Receptor	Sensitivity	Reasons/Comments
N22 Macroom By-Pass between Coolcour Junction and Ballyvourney Junction	Very Low	New By-Pass road with no direct access by sensitive users.
Existing N22 between Ballyvourney Junction and forest entrance/access to windfarm. Agricultural Landholdings, Farmsteads, Business and Private Residents	Medium/Low	Direct access onto N22.
Agricultural Landholdings, Farmsteads, Businesses and Private Residences on existing N22 between Ballyvourney Junction and Cummeenavrick for grid connection.	Medium/Low	Direct access onto N22.

15.3.3 Road Access to the Site

15.3.3.1 Turbine Haul Route

For the turbine haul route, much of journey from Ringaskiddy Port to the Wind Farm Site will be on National Primary Roads shown on **Figure 15.1** and **Figure 15.2**. These include the N28, N40 and N22. These roads vary in terms of width, number of lanes and types of junctions.

Leaving Ringaskiddy Port, the N28 initially has two lanes westwards from the R613 junction. This narrows to one lane prior to the Pfizer Roundabout and continues towards Shanbally in a similar manner with traffic islands at either side of junctions. The speed limit is 50 km/h. Shanbally is the transition from an industrial area to a largely residential area.

After Shanbally, the road has a central reservation (painted) to allow for right turning at junctions while the speed limit is 60 km/h (see **Appendix 15.1**).

From Raffeen, the road widens such that there is a hard shoulder in each direction and the speed limit increases to 100 km/hr.

A central reservation with splitter islands (splitter islands accommodate street furniture which will need to be relocated temporarily to allow passage of turbine blades) is present at the approach to the R611 Roundabout. A contraflow manoeuvre is required at this location, street furniture to be removed and a tree to be pruned at the approach to the R611 Roundabout (see **Appendix 15.2**).

It is also present following the roundabout on the N28/R617 junction. Westwards from that junction, there is a climbing lane prior to the road narrowing to two single lanes without hard shoulders for a short distance before widening again with one lane and hard shoulder westwards and two lanes and hard shoulder eastwards. Approaching N40 junction, the N28 widens to three lanes in each direction.

The N40 (South Ring Road) has two lanes and hard shoulder in each direction, it widens further towards the junction with the N27. All junctions are merge type junctions. At Ballincollig, the N40 becomes the N22. The N22 continues generally as one lane plus hard shoulder in each direction to Lissarda where it narrows to one lane in each direction with no hard shoulders for a short distance. It also narrows approaching the first River Lee crossing and continues as a single lane in each direction (no hard shoulder) to Coolcour.

At Coolcour, a new section of the N22 has opened to general traffic on the 9th December 2022 (N22 Baile Bhuirne to Macroom Road Development). . This route will be used for the proposed Inchamore Wind Farm which is likely to start construction in 2025 (should permission be granted).

Turbine delivery vehicles will re-join the existing N22 at Baile Bhuirne Junction which is c.2 km north-west of the village of Ballyvourney. They will then proceed westwards towards the existing forest entrance at Derryreag near the Kerry county boundary. The existing N22 between the proposed Ballyvourney Junction (N22 By Pass) and Derryreag has a hard shoulder in each direction. An overtaking lane in the eastwards direction ends close to the forest entrance. The overall existing surfaced road width at the forest entrance location (proposed access to wind farm) is 15.5 m as follows:

- Westbound hard shoulder 3.0 m
- Westbound lane 4.0 m
- Eastbound overtaking lane 4.0 m
- Eastbound lane 3.5 m
- Eastbound hard shoulder 1.0 m

See Photos 15.1 and 15.2 of the N22 and forest entrance. Delivery vehicles will then follow the forest track to the wind farm, a distance of c.2.5 km, see Photos 15.3, 15.4 and 15.5.

Photo 15.1 – N22 at Derryreag

Photo No. 15.2 – Forest Entrance

Photo 15.3 – Existing Forest Road at Chainage 1000 m

Photo No. 15.4 – Existing Forest Road at Chainage 1800 m

Photo 15.5 – Existing Forest Road near Chainage 2250 m

Photo Locations are shown on **Figure 15.7**.

Vehicles will exit the site and turn left onto the N22, then turn right at the northern end of the existing island junction at Cumeenavrick and complete a 180 degree turning manoeuvre and continue on the N22.

15.3.3.2 Civil Construction Haul Route

From Keim, trucks will follow the R582 in a south-easterly direction to the N22 Macroom Bypass (Gurteenroe Junction), follow the bypass westwards to the Ballyvourney Junction with existing N22, follow the existing N22 westwards to the forestry entrance at Derryreag and then turn left and follow the forest track to the wind farm site or to the grid connection on the southern side of the N22.

For the grid to the northern side of the N22, trucks will follow the same route but go past the forestry entrance to Cummeenavrick, turn right and then follow the forest route of the N22 for c.400 m before following forestry tracks along the route.

For the quarries to the south, trucks would use the R587, then the R584 to the existing N22, proceed south-westwards to the Coolcour Junction of the Macroom By-pass, proceed north-westwards along the bypass to the Ballyvourney Junction with existing N22, follow existing N22 westwards to the forestry entrance at Derryreag and then turn left and follow the forest track to the wind farm site or to the grid connection on the southern side of the N22. For the grid to the northern side of the N22, trucks will follow the same route but go past the forestry entrance to Cummeenavrick, turn right and then follow the forest route of the N22 for c.400 m before following forestry tracks along the route.

The grid connection will be laid within existing/proposed trails for a distance of 1.3 km within the wind farm site. From there, it will follow forest tracks as far as the N22 which will be crossed by directional drilling. It will then follow the old route of the N22 for a short distance (also by directional drilling) (c.0.58 km) before following forestry tracks to the existing Ballyvouskill Substation. Of the total length of 19.9 km, some 19.2 km will be laid within lands and forest tracks.

15.3.4 Delivery Vehicle Specification

Delivery of wind turbine components will be carried out using oversized vehicles. Two different types of loads will arise via very long loads for turbine blades and wide/high loads for tower bottom sections. The longest vehicle used during deliveries will be for the rotor blades and will be an approximately 7 m long articulated vehicle with a trailer length of 55.5 m trailer and a 17 m overhang for the blade. An indicative delivery vehicle schematic is shown in **Figure 15.8** below. The Swept Path Analysis (see **Appendix 15.2**) assesses the extent of obstacles to be removed (e.g. tree pruning) or relocated (street furniture or poles) or the extent of any potential oversail into private lands associated with blade transportation. It was based on the use of a 76.8 m blade which is the longest blade for the range of turbines under consideration. The outcome would be similar for a 73 m blade which is the shortest blade for the range of turbines under consideration. No additional works are required to facilitate their transportation and no further impacts are predicted.

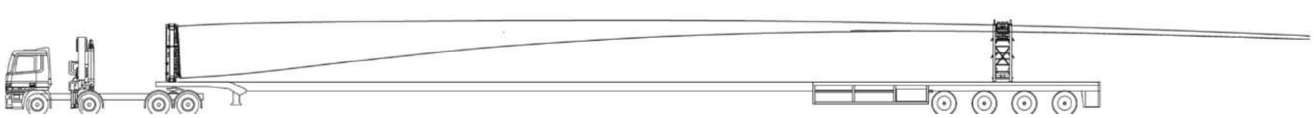


Figure 15.8: Turbine Delivery Vehicle for Turbine Rotor Blades (SG155)

The widest and tallest turbine delivery vehicle from the ground will be for the turbine tower sections. The bottom tower section will be 4.69 m wide which is 0.14 m wider than the blade delivery vehicle. These dimensions will be similar for the range of turbines under consideration. They are 4.435 m tall which is 1.035 m taller than the blade delivery vehicle and 0.335 m taller than the hub delivery vehicle. This vehicle is shown in **Figure 15.9**.

For the tower sections associated with the range of turbines under consideration, no additional works outside of those required for the blades are required to facilitate their transportation and no further impacts are predicted.

A survey of the Haul Route has been undertaken by Collett & Sons (see **Appendix 15.1**) to identify the extent of works required. The blade delivery vehicle has a total height of 3.936 m. The proposed delivery vehicle length, width and height parameters used to complete the SPA are based on the worst-case scenario using the SG 155 Blade component super wing carrier.

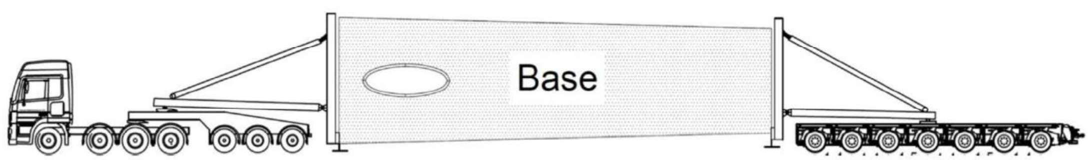


Figure 15.9: Turbine Tower Section Delivery Vehicle (SG155)

Delivery of other materials to Site for the construction of the wind farm will be undertaken using standard HGVs, the largest of which is expected to be a 16.5 m standard 6 axle articulated vehicle.

15.3.5 Existing Traffic Volumes

15.3.5.1 TII DATA

There is one TII traffic counter located(TII count traffic continuously)[3] on the N22 at Slieveragh Cross, north-west of Ballyvourney (Station Id: TMU N22 060.0E) and c.5.5 km east of the forest access at Derryreag, see **Figure 15.10**. This is c.0.48 km from the Ballyvourney Junction of the new N22 Macroom By-Pass. The Average Annual Daily Traffic (AADT) volume on the road was recorded as being 7,258 vehicles in 2019 (2020 and 2021 values are less due to Covid Restrictions) as outlined in **Table 15.09**. From this figure, the number of HGVs was 385 with light vehicles making up the remaining 6,873 of the total of 7,258. The 2022 figure reflects traffic counted between 1st January and 28th November 2022 and, when extrapolated forward, is likely to be similar to the 2019 value.

[3] https://trafficdata.tii.ie/public multinodemap.asp

Table 15.9: TII Traffic Data

Station Id. TMU N22 060.0E Description: N22 Between Killarney and Macroom, Ballyvourney, Co. Cork			
	AADT	**% HGV**	**Coverage**
2022*	7,032	5.4%	90.1%
2021	5,784	6.4%	100.0%
2020	4,941	6.9%	99.7%
2019	7.258	5.3%	96.8%
2018	7,159	5.4%	99.7%
2017	6,933	5.1%	99.7%

*Up to 28th November 2022

The TII traffic counter is located on all haul routes to the site and as there are no junctions of significance between the counter and the site entrance at Derryreag and the grid entrance at Cummeenavrick, it is considered as being representative of traffic volumes in the vicinity of the proposed development.

15.3.6 Predicted Future Traffic Volumes

TII publication "Project Appraisal Guidelines for National Roads Unit 5.3 – Travel Demand projections, PE-PAG-02017, May 2019 can be used to predict future growth in traffic volumes across Ireland. Traffic volumes are predicted to increase in the coming years (predictions are for the period 2016 to 2030) when construction of the Development is likely to take place. **Table 15.10** shows the multiplier for County Cork under different growth rate scenarios.

Table 15.10: Traffic Annual Growth Predictions Formulae (Multipliers) for County Cork 2016 to 2030

Low Sensitivity Growth Rate		Central Growth Rate		High Sensitivity Growth Rate	
LV	HV	LV	HV	LV	HV
1.0173	1.0361	1.0189	1.0377	1.0223	1.0411

LV = Light Vehicles, HV = Heavy Vehicles

Assuming that construction will take place in 2026, under the high sensitivity scenario, the amount of light vehicles on the N22 will increase to 8,020 in 2026 from the 2019 AADT of 6,873 and heavy vehicles will increase to 510 in 2026 from 385 in 2019.

The estimated capacity of the N22 national primary road in the vicinity of Ballyvourney is based on Table 6.1 of the TII publication DN-GEO-03031 – Rural link design which provides a table of recommended rural road layouts and capacities for each cross section.

The N22 at Derryreag and Cummeenavrick is similar in section to a 7.3 m Type 1 single carriageway. A Type 1 carriageway has a guidance capacity of 11,600 AADT for level of service D (approaching unstable flow). The new N22 Macroom By-Pass will be a Type 2 Dual Carriageway. Such a road has a guidance capacity of 20,000 for Level of Service D.

When the growth predictions are applied to the recorded traffic figures, the N22 is predicted to be running at approximately 73.5% capacity at the Derryreag and Cummeenavrick locations (existing N22 west of the by-pass) in 2027 and therefore has capacity to accommodate additional traffic in the future. The N22 Macroom By-Pass is predicted to be running at approximately 11,100 to 11,200 AADT in 2027[4] or at 56% capacity.

15.3.7 Accident Statistics

The Road Safety Authority publish tables on "Road Casualties and Collisions in Ireland" each year. The last published table for National Routes is for 2017.

Statistics are divided into those occurring "Inside Built-up Areas" and those occurring "Outside Built-up Areas". **Table 15.11** below presents a summary of accidents for the N22 for the years 2013 to 2017.

Table 15.11: Summary of Accidents for the N22 for the years 2013 to 2017

Year	Inside Build Up Areas			Total	Outside Built Up Areas			Total	Overall Total	Collision Rate per km
	F	SI	MI		F	SI	MI			
2017	1	1	14	16	1	7	21	29	45	0.39
2016	0	4	19	23	2	5	21	28	51	0.44
2015	0	2	23	25	1	7	22	30	55	0.47
2014	0	0	12	12	4	8	21	33	45	0.38
2013	0	1	8	9	4	3	13	20	29	0.25

F = Fatal

SI = Significant Injuries

MI – Minor Injuries

For the N22, historical accidents were more prevalent outside built-up areas than inside them.

[4] N22 Baile Bhuirne – Macroom (Baile Bhuirne to Coolcour) Environmental Impact Statement, Volume 3 – Figures, McCarthy Hyder Consultants, October 2009

15.4 PROPOSED WORKS

15.4.1 Construction Phase

The construction period of the Project is anticipated to take approximately 21 months. The majority of HGV deliveries to Site will take place during turbine foundation (reinforcing steel and ready-mix concrete), turbine hardstands and Site access track upgrade works. During this period, there will be trips associated with the arrival and departure of construction staff. While much of the stone for site tracks and hardstands will be sourced from on-site borrow pits and from the excavation works, a finishing layer of imported stone will be required prior to turbine delivery.

Staff trips will mainly be made using cars and vans, while deliveries of steel, concrete, and rock and construction materials will be made by HGVs. The majority of deliveries will be during the first half of the construction period. It is important to note that it is anticipated that ready-mix concrete and hardcore materials will be sourced from local quarries in the area either to the north or south of the N22, will use the new N22 Macroom By-Pass to Ballyvourney Junction with N22, then the existing N22 to the forest access to the wind farm Site at Derryreag or will continue to Cummeenavrick for access to the grid connections such that Ballymakeery and Ballyvourney villages will be avoided and the urban area of Macroom will also largely be avoided.

It is expected that construction hours will be between 07:00 and 19:00 Monday to Friday and 07:00 – 13:00 on Saturdays with no working on Sundays or on Bank or Public Holidays unless agreed otherwise with Cork County Council (e.g. for concrete works for foundations which may start before 07:00). Some special deliveries such as turbine components and concrete for Turbine Foundations are likely to be required to be delivered outside of these times in consultation with Cork County Council (see Section 15.4.2).

15.4.2 Turbine Component Haul Route

For abnormal loads between Ringaskiddy Port and the wind farm Site, some minor works will be required to facilitate the delivery of turbine components. Some of these will be relatively minor in nature for example temporary removal (and reinstatement on completion of delivery) of street furniture and signage. The extent of works has been determined by reference to the Collett Report of October 2022 (see **Appendix 15.1** for Swept Path Analysis Drawings prepared by Collett for that part of the haul route between Ringaskiddy Port and Derryreag) and to the results of a swept path analysis prepared by JOD (see **Appendix 15.2**) for the forest entrance off the N22 at Derryreag.

The JOD Swept Path Analysis drawings were created using AutoTrack Software and was informed by the results of topographic surveys carried out by GHE Surveying during October 2022.

The use of special transporter vehicles with rear wheel steering in the delivery of wind turbine components will ensure safe transportation and manoeuvrability on the roads. Extendable transporter vehicles will be retracted on return journeys which allays the need for a SPA of the Cummeenavrick N22 junction at Co. Kerry.

Table 15.12 presents a summary of the works required on the turbine component haul route. Photographs of each location are included in the Collett Report of October 2022.

Table 15.12: Temporary Works Required on Turbine Component Haul Route

Reference Point in Collett Report	Potential Constraint	Works Description	No works required / Temporary works required / Permanent works required
1	Exit from Ringaskiddy Port	Flower pots and fencing to be removed. Bollards to be removed. Localised area of road widening required at bollard location. See Collett Drawing 343154-10A1.1.	
2	N28 Roundabout at Pfizer	Signage and Street furniture to be temporarily removed for central area of roundabout and from Splitter Island beyond roundabout. Road widening required into roundabout and at Splitter Island. See Collett Drawing 343154-20A1.1.	
3	Splitter Island on N28	No works required	
4	Splitter Island on N28 at Shanbally	No works required	
5	N28 Roundabout at Shanbally	Signage and bollards to be temporarily removed. Road widening required at Splitter Island. See Collett Drawing 343154-30A1.1.	
6	Splitter Island on N28	No works required	
7	Splitter Island on N28	No works required	
8	Splitter Island on N28	No works required	
9	Splitter Island on N28	No works required	
10	Splitter Island on N28	No works required	
11	Splitter Island on N28	No works required	
12	Splitter Island on N28	No works required	
13	N28 / R611 Roundabout	Signage and Street Furniture to be Temporarily Removed from Entry Splitter Island. Tree to be pruned. See Collett Drawing 343154-10A0.1.	
14	Splitter Island on N28	No works required	
15	N28 / N40 Junction	No works required	
16	Splitter Island on N22	No works required	
17	Splitter Island on N22 at Srelane	Flexi Bollards to be Temporarily Flattened	

Reference Point in Collett Report	Potential Constraint	Works Description	No works required / Temporary works required / Permanent works required
18	Splitter Island on N22 near Ovens	Flexi Bollards to be Temporarily Flattened	
19	Splitter Island on N22 at Ovens	No works required	
20	Splitter Island on N22 at Ovens	No works required	
21	Splitter Island on N22 at Ovens	No works required	
22	Splitter Island on N22	No works required	
23	Splitter Island on N22	No works required	
24	Splitter Island on N22	No works required	
25	Splitter Island on N22	No works required	
26	Splitter Island on N22	No works required	
27	Splitter Island on N22	No works required	
28	Splitter Island on N22	Flexi Bollards to be Temporarily Flattened	
29	Splitter Island on N22	No works required	
30	Splitter Island on N22	No works required	
31	Splitter Island on N22	No works required	
32	Splitter Island on N22	No works required	
33	Splitter Island on N22	No works required	
34	Left Bend on N22	No works required	
35	Right Bend on N22	No works required	
36	Macroom By-Pass Interchange	Localised triangular area of Road Widening Required on approach to Roundabout. Signage may need to be temporarily removed =. See Collett Drawing 343154-50A1.1.	
37	N22 By-Pass Interchange at Ballyvourney	Street Furniture/Signage to be temporarily removed. Road bearing surface to be provided across part of Roundabout. See Collett Drawing 343154-60A1.1.	
38	Forest Entrance / Site Access off N22 at Derryreag	Remove vertical hump through junction so as to reduce gradient towards N22.	
38	Forest Junction	Remove earth berm at eastern side of junction so as to increase junction width.	
38	Forest Junction	Remove vegetation at western side of junction so as to increase junction width.	
38	Forest Junction	Provide additional stone for junction tracked area.	
38	Forest Junction	Provide double layer of bitumen macadam surfacing between edge of N22 and some 30 m into junction.	
38	Forest Junction	Provide road drainage incl. heavy duty "ACO" type interceptor drain at interface between widened junction and edge of N22.	
38	Junction	Provide new fencing, road signs and markings	

Reference Point in Collett Report	Potential Constraint	Works Description	No works required / Temporary works required / Permanent works required
38	Junction	Provide new road signage.	
n/a	Junction	Widen Forest Track at bend at Chainage 200 (Drawing: JOD-01.1 Survey Inchamore AT Rev0 3D)	
n/a	Forest Track	Grade and stone and fill potholes at Chainage 1000 (Drawing: JOD-01.3 Survey Inchamore AT Rev0 3D)	
n/a	Forest Track	Widen bend at Chainage 1800 (Drawing: JOD-01.5 Survey Inchamore AT Rev0 3D).	
n/a	Forest Track	Widen bend at Chainage 2250. (Drawing: JOD-01.6 Survey Inchamore AT Rev0 3D)	

From **Table 15.12** above, it is evident that very minor temporary works are required between Ringaskiddy Port and the forest entrance at Derryreag. These are shaded in "Orange" in **Table 15.12**. However, works are required at the forest junction and to the existing forest track between Derryreag and the Wind Farm Site **–** these are shaded in red in **Table 15.12** and shown on Drawings 6226-PL-101 and 6226- PL-102, **Appendix 15.2**.

At the forest entrance at Derryreag, an earth berm is to be removed on the eastern side, vegetation is to be removed on the western side, the track is to be widened and realigned vertically so as to remove a hump and reduce the gradient towards the N22. The junction will be surfaced with a double layer (60 mm base course + 40 mm wearing course) of bitumen macadam), drainage will be provided including a heavy duty 'Aco' type drain across the junction near the edge of the N22. New fencing will be provided shown on Drawing 200-LT1. For slow moving HGV's leaving the site on the forest track construction haul route, a right turn would have to cross the eastbound overtaking lane, which is considered to be a potentially dangerous manoeuvre . To address this, the empty turbine delivery HGV's will turn left onto N22, then turn right at the northern end of the existing island junction at Cummeenavrick and complete a 180 degree turning manoeuvre and continue on the N22 (See **Figure 15.1)**. In addition, it is proposed that a 'Stop' sign, a 'No Right Turn' sign and road markings will be placed at the exit from the forest road and the N22 such that HGV's only turn left (westwards) and will turn around at the former N22 area at Cummeenavrick which is c. 2.5 km from the wind farm (see **Appendix 15.1**).

The upgrade to the forest track works are shown on Drawing 6226-PL-210. For the c.2.5 km distance between the Cummeenavrick N22 junction and the wind farm road, the forest track is generally in a good condition. However, bends need to be realigned at three locations. These works are shown on Drawings 6226-PL-101 and 6226- PL-102.

15.4.3 Civil Construction Haul Route

No upgrade works are necessary to the N22 to facilitate the delivery of materials. However, preparatory works such as signage and directions to the wind farm Site will be installed pre-construction on the approach to the site entrance on the N22 in accordance with Chapter 8 of the Traffic Management Guidelines. August 2019 (see **Section 15.6 Mitigation Measures**).

A condition survey of the existing N22 between Ballyvourney Junction and Cummeenavrick will be carried out prior to commencement of construction and another post-construction. The Developer will lodge a bond with Kerry County Council (and Cork County Council if required) prior to commencement of construction in the amount to be agreed with the Council(s) for the possible repair/upkeep of the road. During the construction period, the road will be inspected weekly by the Developer's Resident Engineer. The Contractor will be instructed to repair any defects within the following week. At the end of the construction period, any further defects will be remedied to the satisfaction of Kerry County Council, Cork County Council and TII.

Similar to returning turbine delivery vehicles discussed above, for slow moving HGV's leaving the site on the forest track construction haul route, a right turn would have to cross the eastbound overtaking lane which is considered to be a potentially dangerous manoeuvre. To address this, empty turbine delivery HGV's will turn left onto the N22, then turn right at the northern end of the existing island junction at Cummeenavrick and complete a 180 degree turning manoeuvre and continue on the N22 (see **Figure 15.1**). In addition, it is proposed that a 'Stop' sign, a 'No Right Turn' sign and road markings will be placed at the exit from the forest road and the N22 such that HGV's only turn left (westwards) and will turn around at the former N22 area at Cummeenavrick.

15.4.4 Grid Connection

No road upgrade works are proposed to facilitate the delivery of materials.

No trenches or joint bays will be installed within public roads.

15.4.5 Wind Farm Internal Access Tracks

Within c.50 m of entering the wind farm site, the road splits into two branches, each giving access to three turbines.

The eastern branch will give access to turbines T4 and T5 as well as to the 38 kV sub-station and to the borrow pit.

The western branch will give access to the temporary site compound, turbines T1, T2 and T3 as well as the anemometer mast.

One borrow pit (located north of Turbine T5) will service the Site.

15.5 ASSESSMENT OF POTENTIAL EFFECTS

15.5.1 HGV Deliveries

15.5.1.1 The estimated timescale for the completion of the construction phase is 21 months, inclusive of all works to Site Access Tracks, access routes, substation building and erection and commissioning of turbines and grid connection works.

Tables 15.13 to **Table 15.16** present a summary of the estimated HGV and abnormal load deliveries of materials required to construct the wind farm, the turbine component haul route improvement works and the grid connection.

15.5.1.2 It is estimated that 840 m^3 of structural concrete and 60 m^3 of blinding concrete will be required for each turbine foundation and that an additional 360 m^3 will be required for the substation buildings and plinths, met mast foundation and other miscellaneous works. This gives a total volume of concrete of 4,860 m^3. . Based on 6 m^3 per concrete truck, some 810 loads will be required.

15.5.1.3 It is estimated that 90t of reinforcing steel will be required for each turbine foundation and that an additional 50t will be required for the substation, met mast foundation and miscellaneous works. These total 500t. At 20t/load, some 25 deliveries of reinforcing steel will be required. Obtaining the reinforced steel from Cork is an option.

15.5.1.4 For the proposed area of new Site tracks of 15,998 m^2 (see **Chapter 2: Project Description**, Section 2.5.5, - 3,555 m long x 4.5 m wide), some 1,599 m^3 of imported crushed stone will be required for a 100 mm finishing layer. Allowing for additional stone at bends and junctions, the total volume is estimated at 1,700 m^3.

For the upgrading works to 3,102 m of existing track, some 1396 m^3 will be required. Allowing for widening at bends, the total volume is estimated at 1400 m^3.

For the total hardstand area of 5 x 4,740 m^2 (see **Chapter 2: Project Description**, Section 2.5.3), some 2,844 m^3 of imported stone will be required for the finishing layer.

These volumes of imported stone total 5,470 m^3. At 12 m^3/load, some 456 deliveries will be required.

15.3.1.5 For the substation area of 50.24 m x 23.251, (see TLI Drawing 05836-DR-226 in the planning drawings), a volume of 233 m^3 or 12 loads are required.

15.3.1.6 Depending on the soil/rock profile, imported crushed stone (engineering fill) may be required under turbine foundations as upfill. Allowing 0.3 m depth per foundation, then 766 m^3 is required. At 12 m^3/load, some 64 loads are required.

15.3.1.7 For the 38 kV on-site substation, most of the deliveries will be crushed stone, building materials, electrical switchgear and equipment. However, there will be a transformer (38 kV/20 kV) which will be an abnormal load but can be accommodated on the Civil Construction Haul Route.

For the 38 kV substation, it is estimated that 20 loads will be required for concrete blocks, precast concrete elements, timber, steel doors, rendering materials, fencing, electrical cabling, panels, transformer and other equipment. The majority of these (18 No.) are expected to come from Cork.

15.3.1.8 Two electrical circuits are proposed within the wind farm site, one to serve Turbines T1, T2 and T3 and the other to serve T4 and T5. Each circuit will connect to the on-site substation at 20 kV. The total length of 20 kV single circuit is estimated at 3,900 m while there will be 900 m of double circuit to the substation. Imported bedding/backfill material will be required within the trenches. This will give a requirement of 76 loads. Each single circuit trench will have 4 No. 110 mm diameter ducts and the double circuit will have 8 No. Thus, the total length of ducts is estimated at 22.8 km. This is typically delivered in 6 m lengths at 3 km per load which would give rise to 8 loads. Ducting will be imported via Ringaskiddy.

For 20 kV cables, the total length will be 17.1 km. For a typical mass/metre of 5.8 kg, the total mass is 99.18 t which will require 5 loads. These will be imported via Ringaskiddy.

For fibre optic cable, one load will be required. This will be imported via Ringaskiddy.

For precast concrete joint bays, one load will be required.

The total of the above related to the internal electrical circuits is 91 loads (76+8+5+1+1).

15.3.1.9 Four loads are estimated for met/anemometer mast materials while 30 loads are estimated for general civil engineering materials such as geofabrics, drainage pipes, water crossings, fencing etc. These will be delivered via Cork.

15.3.1.10 Forest felling will be required in advance of construction works. It is anticipated that brash will be left on site and that logs will be removed off site following felling and will not be left stacked on site.. During the delivery period, if turbines are delivered at night, then logs will be removed by day using the Site access tracks.

The total felling area is estimated at 32.36 ha and the total volume of wood is estimated at 11,140 m^3. This is equivalent to 5,013 tonnes. This is equivalent to 251 loads. Allowing for part loads, voids etc., the total allowance is for 300 loads over a 12-week period equivalent to 5 loads per day. Good quality logs will be used for timber manufacture and transported to:

- Grainger's Sawmills, GP, Enniskeane, Ballymoney, Co. Cork;
- Enniskeane Timber Products Ltd., Ballineen, Co. Cork, and
- GP Wood, Lissarda, Co. Cork.

These locations are shown on **Figure 15.6**.

Should the quality be poor, the timber will be transported to either Clonmel or Waterford for sheeting board manufacture via the N22.

15.5.1.11 Very little waste is envisaged from the construction phase and likely to result from offcuts of timber, electrical cables, cable drums and packaging. These materials will be segregated on site and removed to a licensed recycling facility listed in Section 15.2.4above, once a load accumulates. On average, 1 load/month is envisaged. Cable drums will be transported to the cable manufacturer for re-use.

15.5.1.12 Based on the quantities of materials described above, it is estimated that during civil construction, approximately 1, 781 HGV loads will be delivered to the wind farm Site. Much of these deliveries will be over the 11-month period between months 2 to 12. This equates to approximately 162 loads per month or an average of 7 to 9 loads per day. The peak number of deliveries per day will occur during the concrete pour for turbine foundation construction. An estimated 140 concrete deliveries will be required per turbine foundation as the entire concrete pour has to be placed within 8-10 hours. Some other materials will also be delivered on such days, so a realistic estimation of peak deliveries is approximately 150 deliveries per day (for at least 6 separate days in the construction programme when the turbine foundations will be poured). On these concrete pour days, some 14-18 deliveries per hour will be required.

A summary of estimated loads for the Civil/Electrical Construction Works is presented in **Table 15.13**.

Table 15.13: HGV and Abnormal Load Deliveries – Associated with Civil/Electrical Construction Works

Materials	Quantity	No. of Deliveries
Site Establishment and Removal	10 no.	10
Concrete	4,860 m^3	810
Reinforcing Steel	500t	25
Substation Building and electrical equipment	-	20
Other – Geotextile Mats, Tools, Fencing etc.	-	30
Internal Cabling Materials incl. bedding	-	91
Met Mast Materials	-	4
Imported Crushed Stone (engineering fill) as Upfill to Foundations	766 m^3	389
Imported Crushed Stone for Substation, 200 mm thick	233 m^3	12
Imported Crushed Stone for Site Access Track and Turbine Hardstands (assumes 100 mm thick wearing course)	5,470 m^3	456
Forestry Removal	11,140 m^3	300
Site Reinstatement	-	5
Waste – 1 container/month	-	21
Total	-	1, 848

15.5.1.13 Turbine components will be delivered to Site over a period of approximately 8-10 weeks after civil works are completed. It is estimated that approximately 48 loads of turbine components and 50 loads of crane parts will be delivered/removed during this period. The majority of these loads will be classified as abnormal loads and the relevant approvals and permits[5] will be obtained by the turbine supplier or by its appointed haulage contractor before deliveries take place.

[5] Abnormal Loads Permit

The expected number of HGV deliveries for turbine components are based on specifications from the potential turbine manufacturers, on best estimates of trips generated by similar sized windfarms and previous experience in windfarm planning and civil construction. These figures are likely to vary to some degree depending on the individual lengths of tower sections offered by different manufacturers, but not to the extent that impacts are likely to be significantly changed. A summary of the estimated HGV loads to Site associated with wind turbine components is presented in **Table 15.14**.

Following completion of the construction works, it is estimated that approximately 10 loads will be needed to remove all temporary equipment and materials used onsite e.g. temporary compound, fencing, cabins, storage containers, etc.

The total number of HGV loads associated with turbine components and the N22/Forestry Junction upgrade works is estimated at 175.

Table 15.14: HGV and Abnormal Load Deliveries – Associated with Wind Turbine Components And Associated Works

Materials	Quantity	No. of Deliveries
Site Establishment and Removal	10	10
Anchor Cages & Foundation Templates	5	5
Tower Sections	-	20
Nacelles	5	5
Rotor Blades	15	15
Transformers, Panels and Cabling	-	3
Tools etc.	-	1
Crane Deliveries to Site, including ballast, booms, etc. and removal of same	2 Cranes	50
Road Widening on Turbine Haul Route N22 Forest Access – Soil Disposal	500 m^3	25
Crushed Stone for Widening and Strengthening of Turbine Haul Route at N22 Forest Access	400 m^3	20
Road Surfacing for Turbine Haul Route at N22 Forest Access	200 t	10
Fencing and Miscellaneous Deliveries to N22 Forest Access	2	2
Total		**166**

15.5.1.14 For the grid works, it is assumed that 0.92 m^3 of concrete blinding is required per joint bay and 0.16 m^3 per communication/link chamber. These will require 20 m^3 lean mix concrete or 4 loads at up to 6 m^3 per load. The locations of joint bays are shown on **TLI Drawing No. 05934-DR-201 to 05934-DR-210** included in **Volume III: Figures**.

Some 20 loads of precast components are required for joint bay walls and roof slabs as well as complete communication and link chambers.

For joint bay floor slabs, some 51 m^3 concrete is required which is equivalent to 9 loads.

For 38 kV cables, 800 mm^2 aluminium, the weight per km of cable is 6.251 t. For a total length of 61.0 km (19.85 km x 3 phases plus 2.5% for wastage), the weight will be 381 t and will require 20 loads. Allowing another load for fibre optic cables brings the total to 21 loads. These will be delivered via Ringaskiddy.

Some 80 km of ducting is required which is typically delivered in 6 m lengths, typically 3 km per load. Thus, some 27 loads are required. These will be delivered via Ringaskiddy.Some 30 m^3 of material will arise from directional drilling under the N22 for disposal off site at a licenced facility.

Some 0.290 m^3 of lean mix concrete is required per linear metre of trench. This will give a requirement for 5,597 m^3 of lean mix concrete which is equivalent to some 932 deliveries to Site for the complete grid connection route.

Table 15.15 provides a break down of the various deliveries relevant to the grid connection.

Table 15.15: 38 kV Grid Connection between On-Site Substation and Ballyvouskill Substation

Length of Grid Connection in Roads by Directional Drill	**650**		
Length of Grid Connection in Tracks, Lands	19,200		
Number of Joint Bays	18		
Materials	**Quantity**	**Unit**	**No. of Deliveries**
Site Establishment and Removal	8	No.	8
Concrete Blinding for Joint Bays, Comms Chambers and Link Boxes	20	m^3	4
Concrete for Floors of Joint Bays	51	m^3	9
Pre-Cast Concrete Joint Bays and Communication Chambers	20	No.	20
Other – Steel mesh, Geotextiles, Silt Fencing, Fencing, Danger Tape, etc.	4	No.	4
Grid Connection Cables	381	t	20
Grid Connection Ducting	80	km	27
Disposal of Excavated materials from Directional Drill Trenches in Public Roads	30	m^3	2
Lean Mix Concrete for Trenches	5,597	m^3	932
Total No. of Deliveries	-	-	1,026

15.5.1.15 **Table 15.16** shows an indicative potential breakdown of loads delivered to Site over a 21 month period. The total number of loads is estimated at 3,040.

Table 15.16: Indicative No. of HGV and Abnormal Load Deliveries Over 21 Month Construction Period

Activity	Month																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Wind Farm Site Establishment/ Fencing of Environmental Areas, Buffer Zones,etc.	5	15	10	5																5	
Internal Access Road Upgrade & Construction (imported stone)			90	90																12	
Substation & Compound Construction Civil Works			2	2	2	2	2	12													
Substation Electrical Works									2	2	2	2	2								
Substation Commissioning																					
Excavation and Construction of Turbine +Met Mast Foundations			26	41	175	145	145	145	145	145											
Excavation and Construction of Hardstands										97	98										
Forestry Removal													100	100	100						
Internal Cabling Installation										21	21	21	21	2	5						
Road Widening, Turbine Haul Route – Forest Entrance			25	20		10	2														
Turbine Delivery and Erection			5								4	37	11	23	2					24	4
Grid Connection						97	93	93	93	93	93	93	93	93	93	88	4				
Energisation																					
Turbine Commissioning																					

Activity	Month																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Met Mast Delivery and Erection																		4			
Site Reinstatement and Finishing Works																					5
Waste Management	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Totals	6	16	159	159	178	255	243	251	241	359	219	154	228	219	201	89	5	5	1	42	10

Based on the indicative timetable outlined above the peak times for HGV deliveries will be in months 5 to 10 when the turbine foundations will be constructed, hardstands and Site tracks will be finished in imported stone and the grid connection works will be ongoing. This is estimated to result in a maximum of 359 trips during month 10 with an average of 16 HGV trips per day in this period. Peak deliveries are expected to be during the period of concrete pours for turbine foundations when there will be approximately 140 loads per Turbine Foundation. If one foundation is poured per month, then the balance of the loads in the busiest month would be 219 loads or 10 loads per day over the remaining days of the month.

15.5.2 Staff/Worker Light Goods Vehicle Traffic

For the wind farm construction, a peak workforce of 40 persons are anticipated on the main Site (see **Chapter 4: Table 4.7**) . There will be peaks and troughs in the numbers, with the peak workforce during the general Site works.

In addition to the onsite construction workforce, additional construction staff will be required for the grid connection cable laying works. Two gangs will be required for the grid connection. A maximum of 20 construction staff are anticipated. Thus, up to 60 workers could be employed at peak times between the wind farm and grid connection.

The 60 workers will generally travel to the Site via light vehicle (LV) (i.e. car or small van) assuming 1 person per vehicle, or 60 trips to and 60 trips from the site per day. This is made up of:

- 40 trips each way to/from wind farm Site.
- 20 trips each way to/from grid construction works.

15.5.3 Predicted Additional Traffic on Roads During Construction Phase, Magnitude and Significance of Impacts

Based on the analysis in **Section 15.5.1** above, **Table 15.17** below has been prepared which summarises the peak additional HGV deliveries per road element while **Table 15.18** provides a summary of the peak additional traffic movements (ie. HGV and LGV and one delivery equating to two traffic movements). **Figure 15.11** Shows the various road nodes referred to in these tables.

For each road element, the maximum potential for load deliveries is assumed e.g. from B to A, it is assumed that all deliveries will come from suppliers to the south while for Keim to C, it is assumed that all deliveries will come from suppliers to the north.

It is assumed that 92% of grid connection deliveries will be via Cummeenavrick in direct proportion to the length of grid connection to the north of the N22.

It is assumed that all HGV's leaving the wind farm site will turn westwards and then proceed to turn at Cummeenavrick so as to turn eastwards.

Table 15.17: Summary of Peak Additional HGV / Abnormal Load Deliveries to Site Per Road Element

Node	Road	Civil & Electrical	Turbine	Grid	Total
Ringaskiddy to A	Ringaskiddy Port to Coolcour Junction of New N22 Macroom By-Pass	66	98	48	212
B to A	Existing N22 between R584 Junction and Coolcour Junction with New N22 By-Pass	1,923	48	978	2,949
Keim to C	Keim to Gurteenroe Junction on New N22 By-Pass	1,923	48	978	2,949
A to C	New N22 By-Pass between Coolcour Junction and Gurteenroe junction	1,989	146	1,026	3,161
C to D	New N22 By-Pass between Gurteenroe Junction and Ballyvourney Junction	1,989	146	1,026	3,161
D to E	Existing N22 between Ballyvourney Junction of New N22 By-Pass and Forest Access at Derryreag	1,989	146	1,026	3,161
E to F	Existing N22 between Forest Access at Derryreag and Grid Entrance at Cummeenavrick	1,989	146	1,026	3,161
F to G	Forest Track	0	0	944	944

Table 15.18: Summary of Peak Additional HGV / Abnormal Traffic Movements on Roads

Node	Road	Total No. Of Deliveries	Peak Deliveries/ Month	Peak Deliveries/ Day	Staff	Peak Traffic Movements/ Day[6]
Ringaskiddy to A	Ringaskiddy Port to Coolcour Junction of New N22 Macroom By-Pass	212	45	5	0	10
B to A	Existing N22 between R584 Junction and Coolcour Junction with New N22 By-Pass	2, 949	480	150	40	380
Keim to C	Keim to Gurteenroe Junction on New N22 By-Pass	2, 949	480	150	40	380
A to C	New N22 By-Pass between Coolcour Junction and Gurteenroe junction	3, 161	485	150	60	420
C to D	New N22 By-Pass between Gurteenroe Junction and Ballyvourney Junction	3, 161	485	150	60	420
D to E	Existing N22 between Ballyvourney Junction of New N22 By-Pass and L Forest Access at Derryreag	3, 161	485	150	60	420
E to F	Existing N22 between Forest Access at Derryreag and Grid Entrance at Cummeenavrick	3, 161	485	150	60	420
F to G	Forest Track	944			20	60

The numbers of HGVs generated by the Development (420 movements per day at peak) could be considered a significant increase on the numbers of HGVs which are predicted to use the existing N22 in 2026 (510) (see Section 15.3.6). However, the construction stage traffic movements between Ringaskiddy Port and Macroom (node Ringaskiddy Port to A)

[6] On the basis of each delivery equating to two traffic movements.

(N28, N40 and N22 to Macroom) will be low at 10 movements (5 deliveries) per day. Assuming that the majority of the route between Ringaskiddy and Macroom has a capacity of 11,600 AADT, the change would be 0.1%. The magnitude of change is considered as being "Very Low" (see **Section 15.2.9**).

The magnitude of change is summarised within **Table 15.19** below.

For the existing N22 near Macroom between the R584 and the Coolcour Junction of the new N22 Macroom By-Pass (Nodes B to A), an additional 380 traffic movements per day will arise during concreting of turbine foundations. The predicted flows (see **Section 15.3.6**) for the N22 for 2027 would be 8,900 – 9,500 AADT around Macroom. Assuming a guidance capacity of 11,600 AADT, adding a further 380 traffic movements would increase flows to 9,280 – 9,880 which would still be within the guidance capacity of 11,600 AADT. The flows would increase by 4.1% which, in terms of magnitude, are considered as being "Very Low" (see **Section 15.2.9**).

For the new N22 Macroom By-Pass, the peak additional 420 traffic movements per day will arise during concreting of turbine foundations. The peak only occurs on 5 days when the concrete foundations are being poured. The predicted flows for the N22 Macroom By-Pass for 2027 are 11,100 to 11,200 AADT (see **Section 15.3.6**). This is 56% of the guidance capacity of 20,000 AADT. Adding a further 420 movements would increase the 2027 flows to 11,490 to 11,590 which is still well within the guidance capacity of 20,000. The flows would increase by 3.8% which, in terms of magnitude, are considered as being "Very Low" (See **Section 15.2.9**) x.

For the existing N22 between the new Ballyvourney Junction and Derryreag/ Cummeenavrick (node A to F), an additional 420 traffic movements will arise. As discussed in **Section 15.3.6**, flows on the existing N22 would be 8,356 AADT in 2026. As discussed in **Section 15.3.6**, the guidance capacity of this section of the N22 is 11,600 AADT. The predicted additional flows would increase flows by 5.0% to 8,776 which is still well inside the AADT of 11,600. In terms of magnitude, the change is considered as "Very Low" (see **Section 15.2.9**).

From the wind farm Site to the Forest track/N22 junction (node F to G), an additional 60 traffic movements will arise. As discussed in **Section 15.3.6**, flows on the existing N22 would be 8,356 AADT in 2026. As discussed in **Section 15.3.6**, the guidance capacity of this section of the N22 is 11,600 AADT. The predicted additional flows would increase flows by 1.0% to 8,416 which is still well inside the AADT of 11,600. In terms of magnitude, the change is considered as "Very Low" (see **Section 15.2.9**).

From the analysis above, the significance of the impacts are assessed (with reference to **Table 15.6**) and are presented in **Table 15.19**. The significance of the impacts are "Negligible" to "Minor" on the N22 (existing and new Macroom By-Pass).

Table 15.19: Magnitude and Significance of Impacts

Node	Road	Sensitivity[7]	Magnitude	Significance of Effects	Duration
Ringaskiddy to A	Ringaskiddy Port to Coolcour Junction of New N22 Macroom By-Pass	Very Low to High	Very Low	Negligible to Minor	Short Term
B to A	Existing N22 between R584 Junction and Coolcour Junction with New N22 By-Pass	Medium to Low	Very Low	Negligible	Short Term
Keim to C	Keim to Gurteenroe Junction on New N22 By-Pass	Medium to Low	Low	Negligible to Minor	Short Term
A to C	New N22 By-Pass between Coolcour Junction and Gurteenroe junction	Very Low	Very Low	Negligible	Short Term
C to D	New N22 By-Pass between Gurteenroe Junction and Ballyvourney Junction	Very Low	Very Low	Negligible	Short Term
D to E	Existing N22 between Ballyvourney Junction of New N22 By-Pass and Forest Access at Derryreag	Low	Very Low	Negligible	Short Term
E to F	Existing N22 between Forest Access at Derryreag and Grid Entrance at Cummeenavrick	Low	Very Low	Negligible	Short Term
F to G	Forest Track	Low	Very Low	Negligible	Short Term

[7] Sensitivity referenced to Table 15.3 and Table 15.4.

Therefore, the effects on the local road network (including abnormal turbine delivery route, civil construction haul route, grid connection route and tree felling haul route) can be predicted to be direct, negative, negligible to minor (depending on the section of road as detailed in **Section 15.5.3**) but short-term in nature as it will arise for less than two years.

15.5.4 Works on the Haul Route

As outlined in **Table 15.12**, works will be required at a number of locations along the Turbine Components Haul Route from Ringaskiddy Port to the Site. These works may cause some short-term disruption to local road users. However, these effects will be confined to a relatively short period during the construction phase, prior to the delivery of turbine components and hence are not predicted to have a significant effect. Street furniture will be adjusted (where necessary) such that it is socketed into the ground. Street furniture will be removed daily in advance of turbine delivery (which will occur at night) and be replaced immediately following the passage of the abnormal vehicles such that daytime traffic can continue as normal. The proposed works on the forest junction off the N22 at Derryreag and at the grid entrance at Cummeenavrick can be carried out without the need for traffic disruption. Signage will be provided warning of the new site entrances and that there are construction sites ahead.

Tie-in surfacing works to the edge of the N22 at Derryreag will be carried out during periods of low traffic flows.

15.5.5 Works on the Grid Connection

For the grid connection, all of the works will be constructed off the public roads.

15.5.6 Light Vehicles/Vans and Construction Personnel

The number of staff on the Site will vary according to the phase of works, peaking at up to approximately 40 during turbine foundation construction. It is expected that the majority of workers will arrive onsite in mini-buses and crew vehicles which are used to transport teams of workers from the various contractors. Subject to public health conditions, vehicle sharing will be actively encouraged to reduce vehicular movements.

It is expected that a maximum of 40 vehicles will visit the Wind Farm Site on a daily basis during the peak construction period (Turbine Foundation construction). This is estimated to be an increase of 0.8 % on predicted levels for 2026 on the N22. Parking for staff will be provided at the Temporary Construction Compound. Given the distance between the Site and the public roadway, no parking is expected or will be allowed on the N22. A number of additional unscheduled visits may be required throughout the construction period for site inspections, site meetings, and unforeseen circumstances. The predicted effect is negligible to low due to the relatively low increase in traffic over the baseline situation.

15.5.7 Air Quality

Good local air quality is essential for the health and quality of life of residents along the Haul Route. Transport accounts for a significant proportion of pollutants in the atmosphere namely, CO_2 emissions, nitrogen dioxide (NO_2) and particulate matter (PM_{10}). NO_2 emissions can also be harmful to vegetation and ecosystems in the vicinity of the Haul Route. The increase in traffic movements on the local road network of an average of approximately 76 (average 16 HGV's + 60 cars and vans) trips per day over a short-term period is low relative to the baseline and therefore the effect of the Development on air quality will be imperceptible.

15.5.8 Noise and Vibration

There is likely to be some noise and vibration from HGV movements along the Haul Route on the regional roads, particularly on the R587, R584 and R582 which can cause disturbance to residents living along these roads. Due to the relatively low number of trips generated per day, (apart from the six days when concrete pours are taking place) the restrictions on working hours and the short-term nature of the construction phase, the effects of noise and vibration are not predicted to be significant. Mitigation measures are discussed in **Section 15.6** and in **Chapter 11: Noise**.

15.5.9 Pedestrians and Vulnerable Road Users

Pedestrian intimidation can occur where there are large changes to traffic flow and composition. No local roads will be used and there is no significant pedestrian traffic in the area.

15.5.10 Driver Delay

The existing N22 is estimated to be at 73.9 % of its capacity in 2026 with HGV and LGV traffic for the Development taking it to 77.2% considering peak movements. No delay is envisaged due to capacity. Apart from the presence of the additional volumes of slower moving HGVs on the road, no specific driver delay is envisaged.

There is potential for some driver delay on the turbine component haul route during the delivery of abnormal load components. Abnormal load deliveries will be timed to take place outside of peak times, possibly at night, and therefore the potential effects are not considered to be significant.

15.5.11 Severance

As all haul routes are either Regional or National Roads which are well established and as no road closures are proposed, severance (i.e. the separation of residents from local amenities or social networks is unlikely to arise.

15.5.12 Mud and Debris on the Local Road Network

HGVs leaving the Site have the potential to transport mud, stones or other debris from the Site to the surrounding road network on wheels of the vehicles. This could cause nuisance to local road users or damage to vehicles from loose debris. This effect can be predicted to be direct, negative, minor and short-term in nature confined to the initial decommissioning and construction phases only and will be subject to mitigation measures. Mitigation measures are also prescribed in **Section 15.6** and in **Chapter 10: Air Quality and Climate**.

15.5.13 Effects on Road Network during Construction Phase

Traffic numbers during construction are outlined in **Section 15.5.1**. As the roads are estimated to have sufficient spare capacity, the overall potential effect on the roads is assessed to be minor to negligible, negative effect of short-term duration and high probability during construction of the Development.

15.5.14 Operational Phase – Traffic

During the operational phase of the Project, the wind farm will normally be unmanned. Operational and remote monitoring activities will be carried out on an ongoing basis via telephone and computer links. However, regular visits to the Site will be necessary for maintenance and routine inspections. A car or van will normally be required for these routine inspections. Under normal circumstances the operation of the windfarm would require 1-2 visits to the Site per week by trained personnel and/or accompanied visitors. Parking will be provided outside the electrical compound at the onsite substation. In the case of a major fault e.g. breakdown of a turbine component, larger machinery, including possibly mobile cranes, will require access to the Site. Should a major turbine component need to be replaced e.g. wind turbine blade, the blade can be transported to site using the same route as for the construction of the turbines. Typically, once every 5 years, paintwork may need to be touched up on turbines and the blades cleaned. A Mobile Elevating Work Platform (MEWP) will be used for such activities.

The remaining forestry on Site i.e. surrounding the footprint of construction works will not be felled until 2035.

There will be a low volume of traffic generated during the operational phase of the Project. The effect of traffic associated with the operation of the Development on the existing public road network will be imperceptible due to the type of traffic and the low volume of traffic generated during operation. However, there will be slight temporary short-term effects should major turbine components need to be replaced.

The grid connection will, following commissioning, be taken in charge by ESB Networks and no regular ongoing maintenance is predicted. Due to the strict requirements of ESB Networks Functional Specification, the level of supervision normally provided by the Developer and by ESB Networks, and the extent of testing prior to commissioning, the probability of the occurrence of faults on 38 kV cable connections is very low. However, should a fault occur it would most likely be within a joint bay which could be exposed and the joint repaired over 3-4 days.

Warning signage for drivers exiting the development together with advance stop signage will be installed at the N22 junction. A suitable surface friction will be provided and maintained on the forest track/N22 junction approach, though a bound surface to the access road will need to be provided. The turning area will not appear as a continuation of the National Road under any lighting conditions.

15.5.15 Traffic Impact During Decommissioning Phase

During decommissioning, it is envisaged that the total volume of HGV traffic will be relatively small compared to the construction period (5 – 10 HGV per day) on the basis that the Site Access Tracks will remain in place to serve ongoing forestry and agriculture activity and the turbine hardstands will be allowed to revegetate into the surrounding habitat with only the turbines being removed from Site for recycling/reconditioning. This phase could be expected to last approximately 12-24 weeks. With the site access tracks and turbine hardstands left in place and revegetated, the effect is predicted to be an imperceptible effect on traffic. As the turbine blades can be cut into manageable lengths on decommissioning, there is are requirements to adjust street furniture on the turbine supply haul route for decommissioning.

15.5.16 Need for a Road Safety Audit

A Road Safety Audit is required for all National Road Schemes. TII Publication GE-STY-01024, Dec. 2017 sets out two categories of scheme:

- Road Scheme – A scheme which results in new road construction or permanent change to the existing road or roadside layout.

- Development Scheme – A Scheme which results in a change to the road or roadside layout that is indicated and/or executed for commercial or private development.

The Development will use and cross the N22 National Road but does not propose any modifications to the National Road. None of the modifications in TII Publication GE-STY-01024, (Dec. 2017) Appendix A – Scheme Type and Audit Stage of GE-STY-01024 are proposed.

Objective TM 12.8 of the Cork County Development Plan 2022-2028 requires that:
"Where traffic movements associated with a development have the potential to have a material impact on the safety and free flow of traffic on a National, Regional or other Local Routes, the submission of a Traffic and Transport Assessment (TTA) and Road Safety Audit will be required as part of the proposal".

Sight distance at the forest entrance at Derryreag is excellent in both directions (i.e. several hundred metres). However, the existing forest entrance/junction will be expanded and traffic will be intensified during the construction and decommissioning phases. The existing road layout is such that vehicles exiting the site entrances would have to cross an overtaking lane. Vehicles entering the site from the west could potentially have to park in the overtaking lane while awaiting a gap in traffic. Both of these scenarios are considered as potential to have a material impact on safety. Accordingly, a Road Safety Audit has been completed (please see **Appendix 15.3**).

A stage 1 Road Safety Audit was done in April 2023 and highlights the following as results form the audit:

Collision Data

Road Collision Data is not currently available on the Road Safety Authority Database, therefore no collision trends in the immediate vicinity of the proposed site can be analysed.

National Road Climbing Lane

Problem: The proposals indicate barriers to be provided to close down the national road southbound offside lane, where the climbing lane exists. This area of the national road is up a steep gradient.

Hazard: Faster moving traffic may attempt to overtake slower moving vehicles that are particularly slow due to the road gradient, and cut back in just prior to the temporary barriers. Collisions with the barriers or side swipe collisions with the slow moving vehicle may result.

Recommendation:

- Retain the dual lane set up for the full extent of the climbing lane.
- Adjust the refuge island within the mouth of the development junction such that right turning into the junction is near impossible for long vehicles.
- Ensure all drivers destined for the development are instructed to approach from the south only.

National Road Signage

Problem: Users may attempt to turn right into the development from the national road. These users are likely to wait in the N22 offside lane for gaps in opposing traffic.

Hazard: The stationary vehicle may be subject to rear end shunts from though traffic.

Recommendation: Provide suitable signage prohibiting right turning into the development junction. Additionally, provide signage guiding development traffic to a suitable turning location further to the east.

Development Junction – Gradient

Problem: The development junction is to a steep downhill gradient. Users exiting the development may proceed towards the National Road at excessive speed and fail to stop for the junction.

Hazard: Overshoot incidents may result.

Recommendation: Provide suitable warning signage for drivers exiting the development together with advanced stop signage and also ensure suitable surface friction is provided and maintained on approach to the junction.

Vehicle Swept Paths

Problem: It is not clear from the drawings if delivery vehicles have sufficient space to enter the development left from the National Road.

Hazard: Users may slow/stop with the tail of the vehicle protruding into the National Road. Rear-end shunts may result.

Recommendation: Undertake swept path analysis and adjust the paved area accordingly.

Turning Area

Problem: The audit team have been advised that vehicles departing the development will turn left from the development junction and undertake a turn at a location further to the north. The formation of the inbound junction for turning may appear as a continuation of the National Road during hours of darkness.

Hazard: Northbound National Road drivers may errantly divert from the mainline to enter this new junction. Impact with southbound National Road traffic may result.

Recommendation: Ensure this junction does not appear as a continuation of the National Road under any lighting conditions.

15.6 MITIGATION MEASURES

15.6.1 Construction Phase

The potential effects of the construction of the Project have been identified as being negligible to minor (see **Table 15.19**), but temporary in nature. The following mitigation measures are proposed:

- A Traffic Management Plan (TMP) has been developed (see Management Plan 7 attached to the CEMP). Prior to construction and once the Contractor's have confirmed their suppliers, the TMP will be updated in consultation with Cork County Council, Kerry County Council and An Garda Síochána as necessary to take account of any conditions attached to a grant of p55ermission. All drivers will be made aware of the location and presence of sensitive receptors at an induction session prior to construction activities taking place and will be made aware of the speed limits of the various roads on the route which are contained in the TMP and on the traffic arrangements for entering and exiting the site. This is to ensure compliance with speed limits, and traffic management arrangements.
- At the forest junction at the N22 (wind farm access) bitumen macadam surface will be provided some 30 m into the junction with room to park HGV's clear of the N22.
- The forest access track will be regraded so as to reduce the gradient towards the N22. An "Aco" type drain shall be provided to intercept rainfall run-off.

- All the traffic to the wind farm site will approach from the east such that they turn left at the forest access. All traffic leaving the wind farm site will turn left only and, if required, can turn around at Cummeenavrick turning area. Signage and road markings will be provided to facilitate/promote these manoeuvres.
- The new N22 Macroom By-Pass will be used to transport turbine components, materials for upgrading the turbine haul route, materials for construction of the civil and electrical works to and from the wind farm site, as well as materials for the grid connection so as to minimise traffic through built-up areas such as Macroom, Ballymakeery and Ballyvourney.
- All significant traffic likely to be generated by Inchamore Wind Farm will be during the construction of the Project and will be temporary in nature. It is envisaged that the construction period for the wind farm will span a 21-month period with the underground cable being installed over a concurrent 12-month period. The construction-phase Traffic Management Plan will mitigate these impacts. A number of mitigation measures are embedded within the design:
    - The design is such as to minimise the extent of the new build requirement by using existing forestry tracks where possible, thereby minimising materials requirements.
    - The design is such as to maximise the use of onsite resources (particularly stone material for track construction) to minimise the requirement for material import. Some 49,842 of stone is proposed to be won from the borrow pit which equates to a 4,154 HGV trips to the site avoided (see **Chapter 2: Table 2.4a**).
    - Retaining surplus excavated material on the Site so as to reinstate the borrow pits, thereby eliminating traffic associated with the disposal of same. Some50,276 m^3 of spoil are proposed to be stored in the on-site borrow pit or in roadside berms, resulting in a saving of 4,190 HGV trips off the site (see **Chapter 2: Table 2.4b**).
    - Designing the cable for installation in pre-laid ducts, rather than directly installing the cable in the ground. The latter would require the entire trench from joint bay to joint bay to be fully open for cable laying.
- There will be special transporter vehicles with rear wheel steering used in delivery of wind turbine components to ensure safe transportation and manoeuvrability on the roads. Extendable transporter vehicles will be retracted on return journeys.
- Prior to the delivery of abnormal loads i.e. turbine components, the Applicant or their representatives, will consult with An Garda Síochána and Cork and Kerry County Council Roads Departments to discuss the requirement for a Garda escort.
- The Developer will confirm the intended timescale for abnormal deliveries and every effort will be made to avoid peak times such as school drop off times, church services,

sporting events, peak traffic times where it is considered this may lead to unnecessary disruption.

- Abnormal loads are likely to travel at night and outside the normal construction times as may be required by An Garda Síochána. Due to the relatively modest distance between Ringaskiddy Port and the Site of c.92.8 km, the journey is achievable within a 2-3 hour timeframe. Accordingly, locations for resting will not be required. Local residents along the affected route will be notified of the timescale for abnormal load deliveries.
- A condition survey of the existing N22 between Cummeenavrick and the Ballyvourney Junction of the Macroom Bypass will be carried out prior to commencement of construction and another will be undertaken post-construction. The Developer will lodge a bond with Kerry County Council and or Cork County Council prior to commencement of construction in the amount to be agreed with the respective Council for the possible repair/upkeep of the road. During the construction period, the road will be inspected weekly by the Developer's Resident Engineer and the Contractor will be instructed to repair any defects within the following week. At the end of the construction period, any further defects will be remedied to the satisfaction of Kerry Council Council, Cork County Council and Transport Infrastructure Ireland.
- Wheel cleaning equipment will be used at the exit from the wind farm Site at Derryreagh and also at the exit from the Grid Connection Works at Cummeenavrick to prevent any mud and/or stones being transferred from Site to the public road network. All drivers will be required to see that their vehicle is free from dirt and stones prior to departure from the construction Site.
- The Site entry point will also be appropriately signed. Access to the wind farm construction Site will be controlled by on Site personnel and all visitors will be asked to sign in and out of the Site by security / Site personnel on entering and exiting the Site. All Site visitors will undergo a Site induction covering Health and Safety issues at the Contractor's temporary compound and will be required to wear appropriate Personal Protective Equipment (PPE) while onsite.
- Any dust generating activities will be minimised where practical during windy conditions, and drivers will adopt driving practices to minimise the creation of dust. Where conditions exist for dust to become friable, techniques such as damping down of the potentially affected areas will be employed.
- To reduce dust emissions, vehicle containers/loads of crushed stone will be covered during both entrance and egress to the Site.
- A survey of the turbine component haul route will be undertaken prior to commencement to identify if any new overhead lines or broadband lines will need to be

raised along the route to allow abnormal loads such as tower sections and nacelles to be delivered.

- During the construction phase, clear construction warning signs will be placed on the N22 as necessary, which will advise road users of the presence of a construction Site and of the likelihood of vehicles entering and exiting the Site or road construction areas. This will help improve road safety.
- Works on public roads on the turbine delivery haul road and grid connection will be strictly in accordance with "Guidance for the Control and Management of Traffic at Road Works – 2nd Edition 2010" as well as "Traffic Signs Manual 2010-Chapter 8- Temporary Traffic Measures and Signs at Roadworks".
- Where required, . Road Opening Licence will be obtained for the directional drill of the grid connection under the N22.
- All vehicles using or while in operation at the wind farm site shall either have roof mounted flashing beacons or will use their hazard lights.
- A speed limit of 25 km/h shall apply to all vehicles within the wind farm site.

15.6.2 Operational Phase

Effects during operation have been assessed as being imperceptible. However, it is still important that any effect is minimised as for as is possible. Therefore, the following measures are recommended:

- All vehicles using the wind farm site shall either have roof mounted flashing beacons or will use their hazard lights.
- A speed limit of 25 km/h shall apply to all vehicles within the wind farm site.
- Locational signage shall be maintained throughout the operational period.
- Road surfaces shall be inspected on a quarterly basis and will be repaired within one month of the inspection.
- Safety arrangements at the forest road entrance/exit at Derryreag shall be reviewed every two years to confirm that traffic management arrangements are adequate.

15.6.3 Decommissioning Phase

As the turbine blades can be cut into manageable lengths on decommissioning, there are no requirements to adjust street furniture on the turbine supply haul route for decommissioning.

The wind turbines proposed as part of the proposed Development are expected to have a lifespan of up to 35 years. Following the end of their useful life, the wind turbines may be replaced with a new set of machines, subject to planning permission being obtained, or the site may be decommissioned fully, with the exception of the electricity substation.

Upon decommissioning (4 - 6 months) of the proposed wind farm, the wind turbines will be disassembled in reverse order to how they were erected. All above ground turbine components will be separated, cut and removed off-site for recycling. Turbine foundations will remain in place underground and allowed to revegetate or reseeded as appropriate. Leaving the turbine foundations in-situ is considered a more environmentally prudent option, as to remove that volume of reinforced concrete from the ground could result in potentially significant environment nuisances such as noise, dust and/or vibration. The site roadways will be in use for additional purposes to the operation of the wind farm (e.g. for forestry and recreational use) by the time the decommissioning of the project arises and therefore the site roads will remain in situ for future use. .

The grid connection, when completed, will be handed over to ESB Networks as the Distribution System Operator and thus it will not be removed.

The traffic management of the decommissioning phase will be informed by the road conditions at the time of decommissioning. It is not possible to predict the changes to the public road infrastructure and policies in the next 30-40 years. It is envisaged that a Traffic Management Plan will be developed for the decommissioning phase.

Nevertheless, the following traffic management measures are likely to be required:

- Signage will be erected at the site entrance and on the N22 approaching the site.
- Construction traffic associated with decommissioning will be scheduled so as to avoid school drop off and collection times.
- All vehicles using or while in operation at the wind farm site shall either have roof mounted flashing beacons or will use their hazard lights.
- A speed limit of 25 km/h shall apply to all vehicles within the wind farm site.

15.7 CUMULATIVE EFFECTS

15.7.1 Construction Phase

Table 2.1 of **Chapter 2: Project Description** as well as **Figure 2.2** sets out the existing and proposed wind farms within 20 km of the Site.

The Cork County Council Planning portal and the Kerry County Council Planning Portal were accessed to check planning permissions granted within a 20 km radius of the wind farm.

Various wind farms have been granted permission and amendments/additions (e.g. Battery Energy Storage) to consented wind farms have also been granted.

Much of the non-wind planning permissions relate to (see **Appendix 2.4**):

- Dwelling houses;
- Extensions to dwelling houses;
- Agriculture buildings;
- Sports/Recreation facilities, and
- School Extensions.

In terms of their scale, it is considered that the construction of the dwelling houses or extensions to dwelling houses or the agricultural buildings or the sports/recreation facilities or the school extensions would only have a negligible to minor localised impact on traffic should their construction be concurrent with the Project because the roadways have capacity to handle the increase in traffic volumes.

Should any projects to the north of the N22 be developed concurrently with the Project then the most likely effects will be on the N22 and on the N28/N40/N22 from Ringaskiddy. In such an event, deliveries from the port and and concrete deliveries will be co-ordinated such that there will not be any intensification of deliveries.

The Sites identified as being within 20 km of the proposed Development (see Figure 2.3) which are permitted but not yet constructed or which are proposed or which are at pre-planning are:

- **Coolea – Single turbine, 3.17 km to south-west – Status: Permitted**
  Likely to use N22 as haul route. Potential for cumulative effects.

- **Coolknoohil Inchee – Two turbines, 3.93 km to south-west – Status: Permitted**
  Likely to use N22 as haul route. Potential for cumulative effects.

- **Curraglass – Seven turbines 14.97 km to south-west – Status: Permitted**
  The roads to be used for Inchamore are remote from this Site and no cumulative impact on roads or traffic is envisaged.

- **Cummeenabuddoge – Seventeen turbines, 4.72 km to north-east – Status: Pre-Planning/Concept Stage**
  Likely to use N22 as haul route and likely to use same grid connection route to Ballyvouskill. Potential for cumulative effects.

- **Gneeves Milstreet – Four turbines, 10.20 km to north-east – Status: Operational**
  The haul route to be used for Inchamore are remote from this Site and no cumulative impact on roads or traffic is envisaged.

- **Gortnakilla – Four turbines, 1.87 km to west – Status: Permitted**
  Likely to use N22 as haul route. Potential for cumulative effects.

- **Gortyrahilly – Fourteen turbines, 4.95 m to south – Status: Proposed/SID project pending decision from An Bord Pleanála**
  Likely to use same grid connection route to Ballyvouskill and turbine delivery route as the Project . Potential for cumulative effects.

- **Knocknamork – Seven turbines 4.42 km north-east – Status: Permitted**
  Likely to use N22 for haul route and likely to use same grid connection route to Ballyvouskill. Potential for cumulative effects.

The proposed Gortyrahilly, Cummeenabuddoge and Knocknamork wind farms are also likely to connect to Ballyvouskill substation. The proposed grid routes are shown in **Figure 15. 12**. All three will share the forest track with the Inchamore grid connection. The above information is summarised in **Table 15.20** below.

Table 15.20: Potential for Cumulative Effects from the Construction of Neighbouring Wind Farms

Proposed Wind Farm	Use of N22 Between Coolcour and Cummeenavrick	Use of Forest Track for Grid Connection
Coolae	Yes	No
Coolknoohil Inchee	Yes	No
Curraglass	No	No
Cummeenabuddoge	Yes	Yes
Gneeves Hillstreet	No	No
Gortnakilla	Yes	No
Gortyrahilly	Yes	Yes
Knocknamark	Yes	Yes

Any of the six wind farms shown in **Table 15.20** which will use the N22 will have the potential for similar impact during days when concrete pours for turbine foundations are scheduled.

Should four wind farms have a concrete pour on the same day, then the existing N22 would be close to its guidance capacity for those particular days. However, it is unlikely that it would be possible for any more than two to proceed in any one day with one project being serviced from Keim and the other from a quarry to the south of the N22 as these have limited capacity to supply more than that.

Construction activity between the various developers will need to be scheduled such that, ideally, concrete pours will only take place on one site on any particular day.

Construction activities along the forest track to be used for the four grid connections (Inchamore, Gortyrahilly, Cummeenabuddoge and Knocknamork) , will be scheduled through cross project communication such that there is free access for traffic along the forest track and such that no queues will arise on the N22 should the wind farms be constructed in the same timeframe.

There could also be cumulative effects should blades need to be replaced in an operational wind farm during the construction phase. However, in the unlikely event of such a scenario the replacement blades would have a 3-4 month lead time and deliveries can be co-ordinated. It would not lead to significant effects. Wind farms do not generate a significant amount of traffic during operation as outlined in **Section 15.5.13**.

If the construction phases of the consented but not yet constructed windfarms were to overlap, then there is potential for cumulative effects on the road network from construction traffic and turbine delivery. However, the Coolae and Coolknoohil projects are already consented and so are likely to be constructed prior to the construction of the Development. Should there be overlap, the projects are relatively small with localised works and the effect is predicted to be low, negative, direct but short-term on the N22 with the potential increase in HGV movements. Accordingly, any cumulative impact will be limited and is considered as being slight to moderate and of short duration.

It is possible that a blade (or set of blades) could require replacement if damaged for example by lightning on the nearby wind farms such as Grousemount or Derragh Wind Farms. Should this coincide with the construction period for Inchamore, then there is the potential for cumulative transport affects. However, these are considered as being of low probability, slight impact and of short duration.

15.7.2 Operational Phase

The level of maintenance traffic is normally 1-2 visits per week per wind farm with 5-6 visits per week for a month per year during servicing.

Traffic during the operation periods of Inchamore Wind Farm as well as neighbouring sites will be low and in the range of 0 – 10 trips per day. The effect is rated as being insignificant.

15.7.3 Decommissioning

All of the wind farms listed in **Table 15.20**, have operational periods (generally 25-35 years following commissioning) prescribed by their planning permissions and application documents. No two wind farms will be connected at the same time by ESB/EirGrid due to issues of electrical safety. Therefore, the operational life of the various wind farms will expire on different dates. The decommissioning periods are relatively short (4-6 months). . Accordingly, only slight impacts over those assessed in **Section 15.5.14** are predicted. It is unlikely that any significant cumulative impacts will arise.

15.8 RESIDUAL EFFECTS OF THE DEVELOPMENT

15.8.1 HGV Deliveries and Construction Phase Residual Effects

On the turbine component haul route, there is likely to be a slight, negative, short-term residual effect on the national road network with an increase in traffic volumes on the roads and works at a number of locations as outlined in **Table 15.12**.

The potential effects of the construction of the Project have been identified as being negligible to minor (see **Table 15.19**), but temporary in nature. The mitigation measures are highlighted in **Section 15.6.1**.

The Project is likely to have a minor/negligible effect on the N22 road given increased traffic volumes are unavoidable. However, with the mitigation outlined, these will be minimised.

15.8.2 Operational Phase Residual Effects

There will be no residual effects during the operational phase as only occasional light vehicles and mobile elevation work platforms (MEWP's) are envisaged to visit the wind farm Site during operation for routine checking and maintenance should a significant component of the wind farm require replacing.

15.8.3 Final Decommissioning Phase Residual effects

On the Turbine Component Haul Route, there is likely to be a slight, negative, short-term residual effect on the road network with an increase in traffic volumes on the roads and works at a number of locations as outlined in **Table 15.12** assuming the turbine components are transported back to Ringaskiddy Port. However, the extent of such works will be less than for the construction stage as blades can be cut prior to transportation.

Effects during the decommissioning phase have been assessed to be low compared to the construction phase if hardstand areas are left in place and revegetated . In this case, the effect can be assessed as being imperceptible.

15.9 MONITORING

The condition of the road surface of the N22 near the Site (between Cummeenavrick and the Ballyvourney Junction of the Macroom By-Pass) used to transport construction materials will be monitored during construction so that any damage caused by construction traffic associated with the Project can be identified and maintenance works carried out as soon as practicable to avoid issues for other road users and the local population of the area.

The appointed Contractor will be responsible for seeing that HGV drivers travelling to and from the Site obey the designated speed limits, rules of the road and that they only use the designated civils construction haul route. This will be undertaken through regular tool box talks for drivers during the construction of the Project

15.10 SUMMARY OF SIGNIFICANT EFFECTS

This section has assessed the significance of potential effects of the Project on traffic and transport. The construction stage of the Project has generally been assessed as having the potential to result in effects of a negative to minor, direct, short-term, high probability effect or lower (depending on the road element) during the construction phase only. After mitigation, the residual effects have been assessed as minor to negligible, negative and short-term in nature.

The operational stage impacts are considered as being imperceptible.

The decommissioning stage impacts are considered as being slight, negative, direct, negative to minor probability and short-term in nature.

Potential cumulative effects as detailed in **Section 15.7** were assessed as being slight to moderate, negative, short-term and low probability in nature.

Given that only effects of significant effect or greater are considered "significant" in terms of national legislation, the potential effects of the Project on traffic and transport are considered to be **not significant**.

15.11 STATEMENT OF SIGNIFICANCE

This assessment has identified that the potential effects of the Project on traffic and transport are considered to be **not significant**, given the mitigation measures embedded in the design and proposed for the implementation of the Project.

16 MAJOR ACCIDENTS AND NATURAL DISASTERS

16.1 INTRODUCTION

This section of the Environmental Impact Assessment Report (EIAR) describes the likely significant effects on the environment arising from the vulnerability of the Project, as detailed in **Chapter 2: Project Description**, to risks of major accidents and/or natural disasters. It has been completed in accordance with the guidance set out by the Environmental Protection Agency (EPA) in 'Guidelines on Information to be contained in Environmental Impact Statements' (EPA, 2022) and the European Commission in relation to Environmental Impact Assessment of Projects (Directive 2011/92/EU, as amended by 2014/52/EU), namely 'Guidance on the preparation of the Environmental Impact Assessment Report'.

The assessment of the vulnerability of the Project to major accidents and natural disasters is carried out in compliance with the EIA Directive as amended which states the need to assess:
"the expected significant adverse effects of the project on the environment deriving from the vulnerability of the project to risks of major accidents and/or natural disasters which are relevant to the project concerned."

The objective of this assessment is to ensure that appropriate precautionary actions are taken for those projects.
"because of their vulnerability to major accidents and/or natural disasters, are likely to have significant adverse effects on the environment".

Based on the requirements of the EIA Directive, this chapter seeks to determine:

- The relevant major accidents and/or natural disasters, if any, that the Project could be vulnerable to;
- The potential for these major accidents and/or natural disasters to result in likely significant adverse environmental effect(s), and
- The measures that are in place, or need to be in place, to prevent or mitigate the likely significant adverse effects of such events on the environment.

16.1.1 Statement of Authority

This chapter has been prepared by Ms. Sarah Moore with the assistance of Ms. Shirley Bradley of Jennings O'Donovan & Partners Limited.

Ms. Sarah Moore is a Senior Environmental Consultant and holds a Bachelor (Hons.) Degree in Environmental Science from University of Limerick and a MSc (Dist) in Environmental Engineering from Queen's University, Belfast. She has worked in environmental consultancy for over fourteen years and has prepared AA Screenings, Environmental Reports and EIARs.

Ms. Shirley Bradley is a Graduate Environmental Scientist with a First-Class Honours Degree (BSc Hons) in Environmental Science from the Institute of Technology, Sligo. She was also awarded with the Governing Body award for a BSc in Environmental Protection. Shirley's key capabilities are in report writing, assisting Senior Consultants and GIS.

16.2 ASSESSMENT METHODOLOGY

The following sources of information and literature pertinent to the area were used in the preparation of this section:

- Census of Ireland;
- Regional Spatial and Economic Strategy (RSES) 2020-2032, published by the Southern Regional Assembly on 31 January 2020;
- Cork County Development Plan 2022 – 2028;
- Cork County Council Website, and
- Fáilte Ireland.

Major accidents or natural disasters are hazards which have the potential to affect the Project and consequently have potential impacts on the environment. These include accidents during construction and operation caused by operational failure and/or natural hazards. The assessment of the risk of major accidents and/or disaster considers all factors defined in the EIA Directive that have been considered in this EIAR, i.e., population and human health, biodiversity, land, soil (peat stability), water, air and climate and material assets, cultural heritage and the landscape.

16.2.1 Legislative Context

16.2.1.1 Legislation

An assessment of the following key elements was undertaken in accordance with the EIA Directive as amended:

- The vulnerability of the Project to potential accidents and disasters
- The Project's potential to cause major accidents or disasters which pose a risk to the environment

The information relevant to major accidents and/or disasters to be included in the EIAR is set out in paragraph 8 of Annex IV of the EIA Directive as follows:

"(8) A description of the expected significant adverse effects of the project on the environment deriving from the vulnerability of the project to risks of major accidents and/or disasters which are relevant to the project concerned. Relevant information available and obtained through risk assessments pursuant to Union legislation such as Directive 2012/18/EU of the European Parliament and of the Council or Council Directive 2009/71/Euratom or relevant assessments carried out pursuant to national legislation may be used for this purpose provided that the requirements of this Directive are met. Where appropriate, this description should include measures envisaged to prevent or mitigate the significant adverse effects of such events on the environment and details of the preparedness for and proposed response to such emergencies".

16.2.1.2 Guidance Documents

The following guidance documents have been consulted in the preparation of this section:

- European Commission (2017) Environmental Impact Assessment of Projects – Guidance on the preparation of Environmental Impact Assessment Reports;
- Environmental Protection Agency (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;
- Department of Environment, Heritage and Local Government (2010) A Guide to Risk Assessment in Major Emergency Management;
- Environmental Protect Agency (2014) Guidance on Assessing and Costing Environmental Liabilities;
- Department of Defence (2020) A National Risk Assessment for Ireland, and
- Cork County Council (2021) Major Emergency Plan.

16.2.2 Categorisation of the Baseline Environment

A desk-study has been completed to establish the baseline environment for which the proposed risk assessment is being carried out. This will influence both the likelihood and the impact of a major accident or natural disaster. Local and regional context has been established prior to undertaking the risk assessment to develop an understanding of the vulnerability and resilience of the area to emergency situations.

Further detail on the baseline environment is provided in **Section 16.3**.

16.2.3 Impact Assessment Methodology

16.2.3.1 Introduction

This assessment is focused on an understanding that the Project will be designed, built and operated in line with the methodologies and measures prescribed in this EIAR. Therefore, the overall vulnerability of the Project to risks of major accidents and natural disasters is considered low.

An assessment of potential accidents and disaster scenarios such as pollution incidents to ground and watercourses as well as assessment of flooding events and peat instability are described in detail in the relevant EIAR assessment chapters (Refer to **Chapters 8: Soils and Geology** and **Chapter 9: Hydrology and Hydrogeology** for further details).

16.2.3.2 Site-Specific Risk Assessment Methodology

A site-specific risk assessment identifies and quantifies risks focusing on unplanned, but possible and plausible events occurring during the construction, operation and decommissioning of the Project. The approach to identifying and quantifying risks associated with the Project by means of a site-specific risk assessment is derived from the EPA 'Guidance on Assessing and Costing Environmental Liabilities' document[1]. The following steps were taken as part of the site-specific risk assessment:

- Risk identification;
- Risk classification;
- Likelihood and consequence; and
- Risk evaluation.

16.2.3.2.1 Risk Identification

Risks have been reviewed through the identification of reasonably foreseeable risks in consultation with relevant contributors to this EIAR (Please see **Chapter 1: Introduction** for *Curriculum Vitae* of contributors). The identification of risks has focused on non-standard but plausible incidents that could occur at or as a result of the Project during construction, operation and decommissioning phases.

In accordance with the European Commission EIAR Guidance, risks are identified in respect of the projects:

1. Potential to cause accidents and/or disasters, and
2. Vulnerability to potential disaster/accident.

[1] EPA (2014) Guidance on assessing and costing environmental liabilities. [Accessed online 05/09/2022] Available at https://www.epa.ie/publications/compliance--enforcement/licensees/reporting/financial-provisions/EPA_OEE-Guidance-and-Assessing-WEB.pdf

16.2.3.2.2 Risk Classification

Classification of Likelihood

After identifying the potential risks, the likelihood of occurrence of each risk has been assessed. An analysis of safety procedures and proposed environmental controls was considered when estimating likelihood of identified potential risks occurring. **Table 16.1** defines the likelihood ratings that have been applied.

The approach adopted has assumed a 'risk likelihood' where one or more aspects of the likelihood description are met.

Table 16.1: Classification of Likelihood (Source: DoEHLG, 2010)

Ranking	Likelihood	Description
1	Extremely Unlikely	May occur only in exceptional circumstances; once every 500 or more years.
2	Very Unlikely	Is not expected to occur; and/or no recorded incidents or anecdotal evidence; and/or very few incidents in associated organisations, facilities or communities; and / or little opportunity, reason or means to occur; may occur once every 100-500 years.
3	Unlikely	May occur at some time; and /or few, infrequent, random recorded incidents or little anecdotal evidence; some incidents in associated or comparable organisation's worldwide; some opportunity, reason or means to occur; may occur once per 10-100 years.
4	Likely	Likely to or may occur; regular recorded incidents and strong anecdotal evidence and will probably occur once per 1-10 years.
5	Very Likely	Very likely to occur; high level of recorded incidents and/or strong anecdotal evidence. Will probably occur more than once a year.

Classification of Consequence

The consequence rating assigned to each risk has assumed that all proposed mitigation measures and/or safety procedures have failed to prevent the major accident and/or disaster. Furthermore, the Cork County Council Major Emergency Plan (2021), if implemented as intended, would work to reduce the consequence of any major accident or disaster. The consequence of the impact if the event occurs has been assigned as described in **Table 16.2**.

The consequence of a risk to/from the Project has been determined where one or more aspects of the consequence description are met, i.e., risks that have no consequence have been excluded from the assessment.

Table 16.2: Classification of Impact (Source: DoEHLG, 2010)

Ranking	Likelihood	Impact	Description
1	Minor	Life, Health, Welfare	Small number of people affected; no fatalities and small number of minor injuries with first aid treatment.
		Environment	No contamination, localised effects
		Infrastructure	<€0.5M
		Social	Minor localised disruption to community services or infrastructure (<6 hours).
2	Limited	Life, Health, Welfare	Single fatality; limited number of people affected; a few serious injuries with hospitalisation and medical treatment required. Localised displacement of a small number of people for 6-24 hours. Personal support satisfied through local arrangements.
		Environment	Simple contamination, localised effects of short duration
		Infrastructure	€0.5-3M
		Social	Normal community functioning with some inconvenience
3	Serious	Life, Health, Welfare	Significant number of people in affected area impacted with multiple fatalities (<5), multiple serious or extensive injuries (20), significant hospitalisation. Large number of people displaced for 6-24 hours or possibly beyond; up to 500 evacuated.

Ranking	Likelihood	Impact	Description
			External resources required for personal support.
		Environment	Simple contamination, widespread effects or extended duration
		Infrastructure	€3-10M
		Social	Community only partially functioning, some services available.
4	Very Serious	Life, Health, Welfare	5 to 50 fatalities, up to 100 serious injuries, up to 2000 evacuated
		Environment	Heavy contamination, localised effects or extended duration
		Infrastructure	€10-25M
		Social	Community functioning poorly, minimal services available
5	Catastrophic	Life, Health, Welfare	Large numbers of people impacted with significant numbers of fatalities (>50), injuries in the hundreds, more than 2000 evacuated.
		Environment	Very heavy contamination, widespread effects of extended duration.
		Infrastructure	>€25M
		Social	Serious damage to infrastructure causing significant disruption to, or loss of, key services for prolonged period. Community unable to function without significant support.

Risk Evaluation

Once classified, the likelihood and consequence ratings have been multiplied to establish a 'risk score' to support the evaluation of risks by means of a risk matrix.

The risk matrix sourced from the DoEHLG Guide to Risk Assessment in Major Emergency Management (and as outlined in **Table 16.3**) indicates the critical nature of each risk. This risk matrix has therefore been applied to evaluate each of the risks associated with the Project. The risk matrix is colour coded to provide a broad indication of the critical nature of each risk:

- The red zone represents 'high risk scenarios';
- The amber zone represents 'medium risk scenarios', and
- The green zone represents 'low risk scenarios.

Table 16.3: Classification of Impact (Source: DoEHLG, 2010)

		Consequence Rating				
		1.Minor	2.Limited	3. Serious	4.Very Serious	5.Catastrophic
Likelihood Rating	5.Very Likely					
	4. Likely					
	3. Unlikely					
	2. Very Unlikely					
	1. Extremely Unlikely					

16.3 PROJECT HAZARD ANALYSIS

The HSE Emergency Management: Emergency Plans outline several hazard categories which may have the potential to lead to a major emergency. The hazard categories include Natural, Transportation, Technological and Civil. The hazard categories, types and subtypes, and their relevance to the Project, are listed below in **Table 16.4**.

As of November 2022, there is no Emergency Plan publicly available for Area 4 (Cork, Kerry). **Table 16.4** below was modelled on available Emergency Plans namely Area 1 (Donegal, Sligo, Leitrim, Cavan, and Monaghan) and Area 2 (Galway, Mayo, and Roscommon).

Table 16.4: HSE Emergency Plan hazard types (HSE, 2022)

Category	Type	Subtype	Relevance to the Project
Natural Hazards			
Meteorological	Storm / Gale Both coastal and inland areas can be affected by high winds	Both coastal and inland areas can be affected by high winds	Poor driving conditions Loss of infrastructure Flooding Falling Trees
	Heavy Snow	Blizzards- 'Poor visibility	Poor Driving conditions
	Severe Cold / Frost extremes of Temperature	Icy Roads/Impassable Roads Hypothermia Freezing of Supply Network	Poor Driving Conditions Public Health Risk Lack of Road Grit
	Thunder & Lightening Dense/ Persistent Fog Heat Wave /Drought	Road Traffic collisions	Loss of Infrastructure Poor driving conditions Public Health Risk Water Shortage
Hydrological	Flooding	Coastal / Inland	Potential for flooding via on-site rivers
	Heavy Rain		May lead to flooding in Low Lying areas or areas with poor drainage
Geological	Landslide		Peat Instability
	Forest / Wilderness fire - Air Pollution		Majority of the Site and some of surrounding area is forested.
Transportation Hazards			
Aviation	Aircraft Collision /Loss	Mid Air and Land	Not Applicable
Road	Multiple Road Traffic Collision		Public Roads via which construction staff and materials access the site.
	Hazmat		Fuel Transport to/from site
	Bridge		Not Applicable
Water	Inland Water ways	Pleasure Craft/Cruises Pollution from above	Not Applicable
	Coastal	Car Ferry/ passenger Ferries	Not Applicable

Category	Type	Subtype	Relevance to the Project
Technological Hazards			
Industrial Accidents	Explosions		Damage to Infrastructure Personal Injuries/ fatalities
	Petrochemical Fires		Personal Injuries, severe burns/ fatalities Air Pollution
	Industrial Fires	LPG Tank Fire	Not Applicable
	Gas Emission		Not Applicable
	Fluid/ Fuel Emission		Refuelling on site
Explosions	Domestic	Natural Gas explosion	Not Applicable
	Bomb		Not Applicable
	LPG		Not Applicable
	Pipeline		Not Applicable
Fires			Air Pollution
Building Collapse			Not Applicable
Hazardous substance		Accident at site	Not Applicable
		Transportation accident	Hazmat on roads
		Weapons	Not Applicable
	Biological	Leak/Weapons	Not Applicable
	Radiological	"Dirty Bomb"	Not Applicable
		Industrial Accident	Damage to Infrastructure Personal Injuries/ fatalities
		Health facilities	Not Applicable
Pollution/ Contamination	Air/Water Pollution		Fire Sediment-laden Water Run Off Fuel/hydrocarbon spill/leak
Civil Hazards			
Major Crowd Safety	(Movement, crushing etc.)	Pop Concerts Sports Events Fireworks displays Air shows	Not Applicable
Loss of Critical Infrastructure	Energy and Power Supply	Electricity	Connection to national grid
		Natural Gas	Not Applicable
		Fuel Oil	Not Applicable
		Communications	Telecom operators, mobile phone networks
Food Situation Crisis		Food Contamination Drought	Not Applicable
Water Supply		Shortage/ Contamination Freezing /Flooding	Not Applicable
Epidemics and pandemic		Communicable diseases	Not Applicable
Animal Disease		Foot & Mouth Avian Influenza	Not Applicable

Category	Type	Subtype	Relevance to the Project
Terrorism	Bombs	Car-bombs	Not Applicable
		Bombs in buildings	Not Applicable
		Fire-bombing	Not Applicable
	CBRNE		Not Applicable
	Disruption	Bomb scares	Not Applicable

The risks which are most relevant to this assessment are described in the sections that follow.

16.3.1 Meteorological

Ireland has a temperate, oceanic climate, resulting in mild winters and cool summers. The dominant influence on Ireland's climate is the Atlantic Ocean. Consequently, Ireland does not suffer from the extremes of temperature experienced by many other countries at similar latitude. The hills and mountains, many of which are near the coasts, provide shelter from strong winds and from the direct oceanic influence.

The Met Éireann weather station at Cork Airport is the nearest weather and climate monitoring station to the Project that has meteorological data recorded for the 30- year period from 1991 to 2021. The monitoring station is located approximately 48 kilometres south-east of the Project. Meteorological data recorded at Cork Airport over the 30-year period from 1991 - 2021 is shown in **Chapter 10: Air and Climate**. The wettest months are October and December, June is usually the driest. July is the warmest month with a mean daily temperature of 15.2° Celsius(C) and January is the coldest with a mean daily temperature of 5.8°C. The average annual temperature is 10.0°C.

The works programme for the construction stage of the Project will take account of weather forecasts and work will be suspended in the case of extreme weather events.

The following forecasting and weather warning systems are available and will be used on a daily basis at the site to direct proposed construction activities:

- General Forecasts: Available on a national, regional and county level from the Met Eireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates.
- Weather Warning or Advisories: Met Éireann's main suite of warnings are issued by the duty forecaster between 10am and midday and are updated as necessary as new information becomes available. In general, warnings will not be issued more than 60-

hours ahead of the expected adverse weather but advisories on potential hazards are issued up to a week in advance. The three warning categories are:
  - Yellow: Not unusual weather. Localised danger.
  - Orange: Infrequent. Dangerous/disruptive.
  - Red: Rare. Extremely dangerous/destructive.
- MeteoAlarm: Alerts to the possible occurrence of severe weather for the next 2 days. Less useful than general forecasts as only available on a provincial scale.
- 3-hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3 hours but does not account for possible heavy localised events.
- Rainfall Radar Images: Images covering the entire country are freely available from the Met Éireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3-hour record is given and is updated every 15 minutes. Radar images are not predictive.
- Consultancy Service: Met Éireann provide a 24-hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest.

16.3.2 Hydrological

As detailed in **Chapter 9: Hydrology and Hydrogeology, Appendix 9.1** Inchamore Wind Farm Site Specific Flood Risk Assessment, no recurring or historic flood incidents are recorded within the Site or along the Grid Connection Route and Turbine Delivery Route.

Inspection of Base Maps from Ordinance Survey of Ireland records, i.e. First Edition 6-inch map (1839-1842) indicate that Wind Farm Site itself, the TDR and the GCR are not susceptible to flooding. The National Flood Hazard Mapping database operated by the OPW also confirms there are no areas represented as being low, medium or high probability risk to flood areas within the Project. Furthermore, there have been no recorded flood events on the OPW Database in the immediate vicinity of the Project.

No recurring flood incidents within the Site or immediately downstream were identified from OPW's Flood Hazard Mapping. The closest mapped recurring flood event is the Sullane (030) river approximately 10 km to the southeast of the site near Ballymakeery town. This flood risk area identified extends along the Sullane (030) and continues after the Sullane (030) river and the Lee (Cork)(030) river merge in Carrigdrohid Reservoir.

Where complete, the CFRAM[2] Study OPW Flood Risk Assessment Maps are now the primary reference for flood risk planning in Ireland and supersede the PFRAM maps. No areas of the Project are within a zone mapped as being either low (0.1% AEP[3]), medium (1% AEP) or high (10% AEP) probability of fluvial flooding. There are no areas of pluvial flood extents mapped near the Site.

Based on the information gained through the flood identification process, no parts of the site are mapped within any fluvial flood zones (Flood Zones A - B).

All proposed works (except for watercourse crossings) are located at least 65 m from a watercourse.

As the associated drainage - some of which is permeant for the lifetime of the Project, will be attenuated for greenfield run-off, the Project will not increase the risk of flooding elsewhere in the catchment. Based on this information, the Project complies with the appropriate policy guidelines for the area and is at no risk of flooding.

A 1 in 100-year storm event scenario results in a net increase of surface water runoff associated with the Development, calculated to be c. 0.172 m^3/second, or 1.436% relative to the Site area (Redline Boundary). This net increase relative to the scale of the Site or the scale of the associated catchment is considered an adverse but imperceptible or negligible impact of the Development.

The Project will use the latest best practice guidance to ensure that flood risk within or downstream of the Site is not increased as a function of the Project, i.e., a neutral impact at a minimum.

The risk of the wind farm contributing to downstream flooding is also very low, as the long-term plan for the site is to retain and slow down drainage water prior to release. Robust drainage measures on the site will include swales, silt traps, check dams, settlement ponds and buffered outfalls. Please refer to the **Chapter 9** of this EIAR for further details.

[2] CFRAM is Catchment Flood Risk Assessment and Management. The national CFRAM programme commenced in Ireland in 2011, and is managed by the OPW. The CFRAM Programme is central to the medium to long-term strategy for the reduction and management of flood risk in Ireland.

[3] AEP is the annual exceedance probability.

16.3.3 Peat Stability

A comprehensive and robust Peat Stability Assessment was undertaken for the Site and used to inform the design process including the siting of all proposed main infrastructure locations and drainage control measures. A desk-stop study was undertaken for the Turbine Delivery Route and Grid Connection Route. This was considered sufficient due to the nature and scale of the works associated with these elements. The Peat Stability Assessment was informed by the Scottish Government's 2017 guidance document, Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments. Intrusive ground investigation works were carried out as part of the Peat Stability Assessment which included peat depth probing, shear strength testing, ground augering/coring and trial pitting. The extensive suite of ground investigations and the robust peat stability assessment completed ensured that the risk of such an event occurring during the construction, operation or decommissioning at the Project is minimised.

Peat depth across the site is generally very shallow to shallow with the exception of isolated pockets of moderately deep peat delineated by shallow subsoils and/or bedrock at or near the surface, particularly in the north west of the site. No infrastructure is proposed in the areas of moderately deep peat. There was no deep or very deep peat observed at the Site. The risk of landslides occurring on the proposed site under worst case scenario conditions has been determined to be generally very low to low.

Please see **Chapter 8: Soils and Geology** and **Appendix 8.1** for more details.

16.3.4 Traffic

The Project will utilise the existing road network during the construction phase. Construction related traffic will originate from the delivery of materials to site, removal of surplus excavated material from site and transport of employees to, from and throughout the site. The localised traffic disruptions will be mitigated through the use of industry standard traffic management measures. Please see **Chapter 15: Traffic and Transport** and **Appendix 2.1** for details.

A Traffic Management Plan (**Appendix 2.1**) is provided specifying details relating to traffic management. Prior to the commencement of the construction phase of the Project, a detailed Traffic Management Plan will be prepared by the Contractor for agreement with the relevant local authorities and An Garda Síochána. The Traffic Management Plan includes recommendations for the following:

- Traffic Management Co-ordinator;

- Delivery Programme;
- Provision of information to locals;
- A Pre and Post Construction Condition Survey;
- Liaison with the relevant local authority;
- Implementation of temporary alterations to the road network at critical locations;
- Identification of delivery routes;
- Delivery times of large turbine components;
- Travel plan for construction workers;
- Additional measures, and
- Re-instatement works.

Please see **Chapter 15: Traffic and Transportation** and Traffic Management Plan (**Appendix 2.1**) for further details.

16.3.5 Industrial Accident

The Project is not connected to or in the vicinity of any site regulated under the Control of Major Accident Hazards Involving Dangerous Substances Regulations (SEVESO sites), therefore no significant effects associated with major industrial accidents involving dangerous substances are anticipated. Gas explosions, petrochemical fires and fires from fuel emissions, leakages and spillages could occur causing personal injury, structural damage and forest fires.

16.3.6 Loss of Critical Infrastructure

EirGrid operates and develops Ireland's electricity grid. This includes interconnecting to neighbouring grids and running the wholesale electricity market. The grid safely brings power from generators such as wind farms to the ESB network that supplies homes and business in Ireland. It also brings power directly to large energy users. There are two types of electricity generation: synchronous generation and non-synchronous generation. Synchronous generation produces the same amount of electricity all the time e.g., fossil fuels. Non-synchronous generation produces varying amounts of electricity depending on the energy available. EirGrid operate the grid from National Control Centres in Dublin and Belfast, matching electricity production to customer demand, switching from synchronous to non- synchronous where required to ensure no power outages. Therefore, any technical fault at the Project would not impact the local or national energy supply.

The Project is anticipated to connect to the existing Ballyvouskill 220kV Substation.

16.3.7 Contamination

The Project has the potential to cause contamination and pollution of groundwater and surface water from potential release of hydrocarbons, earthworks and excavations on site. A Construction Environment Management Plan (CEMP) (**Appendix 2.1**) has been prepared in conjunction with the Environmental Impact Assessment Report and the Natura Impact Statement which accompanies the planning application for the Project.

Section 3 of the CEMP sets out details of the environmental controls to be implemented on site. The CEMP provides details on site drainage measures, peat stability monitoring measures, waste management and pollution prevention measures for refuelling and managing hazardous materials and cement-based products. The CEMP also sets out the Emergency Response Procedure (**Management Plan 1**) to be adopted in the event of an emergency including contamination, health and safety and environmental protection.

The CEMP provides details on all mitigation and monitoring measures to be actioned prior to construction, during the construction, operation and decommissioning phase. The CEMP will be subject to ongoing review through regular environmental auditing and site inspections during the construction phase. This will confirm the efficacy and implementation of all mitigation measures and commitments identified in the application documentation. Please see **Chapter 2: Project Description** and **Appendix 2.1 Construction Environmental Management Plan** for further details.

16.3.8 Health andSafety

During construction of the Project, all staff will be made aware of and adhere to the Health & Safety Authority's 'Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2013'. This will encompass the use of all necessary Personal Protective Equipment and adherence to the site Health and Safety Plan. An Emergency Response Plan (ERP) (**Appendix 2.1**) will be implemented and adhered to on site. The ERP provides details of procedures to be adopted in the event of an emergency in terms of site health and safety and environmental protection.

16.3.9 Turbine Safety

Turbines pose no threat to the health and safety of the general public. The Department of the Environment, Heritage and Local Government (DoEHLG)'s 'Wind Energy Development Guidelines for Planning Authorities 2006' state that there are no specific safety considerations in relation to the operation of wind turbines. Fencing or other restrictions are not necessary for safety considerations. People or animals can safely walk up to the base of the turbines. The Department of Housing, Planning and Local Government's "Draft Revised Wind Energy Guidelines, December 2019" state health and safety issues are generally covered by separate legislation and not by planning legislation however developers of wind energy developments should be aware of their requirements.

The DoEHLG Guidelines 2006 and the draft revised guidelines 2019 state that there is a very remote possibility of injury to people from flying fragments of ice or from a damaged blade. However, most blades are composite structures with no bolts or separate components and the danger is therefore minimised. The build-up of ice on turbines is unlikely to present problems. The wind turbines will be fitted with anti-vibration sensors, which will detect any imbalance caused by icing of the blades. The sensors will cause the turbine to wait until the blades have been de-iced prior to beginning operation.

Turbine blades are manufactured of glass reinforced plastic which will prevent any likelihood of an increase in lightning strikes within the Site or the local area. Lightning protection conduits will be integral to the construction of the turbines. Lightning conduction cables, encased in protection conduits, will follow the electrical cable run, from the nacelle to the base of the turbine. The conduction cables will be earthed adjacent to the turbine base. The earthing system will be installed during the construction of the turbine foundations.

16.3.10 Electromagnetic Interference

The provision of underground electric cables of the capacity proposed is common practice throughout the country and installation to the required specification does not give rise to any specific health concerns.

The extremely low frequency (ELF) electric and magnetic fields (EMF) associated with the operation of the proposed cables fully comply with the international guidelines for ELF-EMF set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP), a formal advisory agency to the World Health Organisation, as well as the EU guidelines for human exposure to EMF. Accordingly, there will be no operational impact on properties (residential or other uses), construction staff, operational & maintenance staff or recreational users of the site as the ICNIRP guidelines will not be exceeded at any distances even directly above the cables.

The ESB document 'EMF & You' (ESB, 2017)[4] provides further practical information on EMF. Further details on the potential impacts of electromagnetic interference to telecommunications and aviation are presented in the **Chapter 13: Material Assets and Other Issues.**

16.4 RISK ASSESSMENT

This section outlines the possible risks associated with the Project for the construction, operational and decommissioning phases.

These risks have been assessed in accordance with the relevant classification as outlined in **Table 16.1** and **Table 16.2**.

The consequence rating assigned to each potential risk assumes that all proposed mitigation measures and safety procedures have failed to prevent the major accident and/or disaster.

16.4.1 Likely Significant Effects

16.4.1.1 *Do-Nothing Scenario*

If the Project was not to proceed it would not be able to supply the electricity generated to the national grid. The opportunity to generate renewable energy and electrical supply to the national grid would be lost. Commercial forestry operations, existing land-use practices and recreational amenities would continue at the Site.

16.4.1.2 Assessment of Effects During Construction

A risk register has been developed which contains all potentially relevant risks identified during the construction phase of the Project. Six risks specific to the construction of the Project have been identified and are presented in **Table 16.5**.

Table 16.5: Risk Register - Construction Phase

Risk ID	Potential Risk	Possible Cause
Potential vulnerability to disaster risks		
A	**Severe Weather** Risk to construction activity on site	Extreme weather- periods of heavy rainfall, taking into account climate change and strong winds
B	**Flooding**	

[4] EMF & You: Information about Electric & Magnetic Fields and the electricity network in Ireland Available at: https://esb.ie/docs/default-source/default-document-library/emf-public-information_booklet_v9.pdf?sfvrsn=0.

Risk ID	Potential Risk	Possible Cause
	High levels of surface water on site	Extreme weather- periods of heavy rainfall, taking into account climate change and strong winds
C	**Peat Stability** Movement of peat within the site during construction	Mismanagement of excavated material on site Severe weather conditions- storm, flooding
Potential to cause accidents and / or disasters		
D	**Traffic Incident** Collisions onsite and offsite with vehicles involved in construction of the Project	Driver negligence or failure of vehicular operations on site roads. Traffic Management Plan not implemented
E	**Contamination** Discharge or spillage of fuel, chemical solvents into watercourse or percolated to groundwater	Fuel spillage during delivery to site. Failure of fuel storage tank or tanks in plant and machinery and vehicles. Drainage and seepage water resulting from infrastructure excavation; Stockpiled excavated material providing a point source of exposed sediment; Construction of the Project cable trench resulting in entrainment of sediment from the excavations during construction; and, Erosion of sediment from emplaced site drainage channels.
F	Industrial Accident- Fire, gas explosion	Equipment or infrastructure failure; Electrical problems; and Employee negligence.

16.4.1.3 Assessment of Effect During Operation

Six risks specific to the operation of the Project have been identified and are presented in **Table 16.6**.

Table 16.6: Risk Register – Operational Phase

Risk ID	Potential Risk	Possible Cause
Potential vulnerability to disaster risks		
G	**Contamination**	

Risk ID	Potential Risk	Possible Cause
	Discharge or spillage of fuel, chemical solvents, sewage or wastewater into watercourse or percolated to groundwater	A vehicular incident on the public road involving fuel, wastewater or sewage transportation in the operational phase.
Potential to cause accidents and / or disasters		
H	**Industrial Accident – Fire / Gas Explosion**	Equipment or infrastructure failure; Electrical problems; and Employee negligence.
I	**Collapse/ damage to structures**	Earthquakes; and Vehicular collisions due to driver negligence on public roads.
J	**Traffic Incident** Collisions onsite and offsite with vehicles involved in operation of the Project.	Driver negligence or failure of vehicular operations on site roads. Traffic Management not implemented
K	**Industrial Accident Fire/ Gas explosion**	Petrochemical Fires causing personal injury, structural damage and forest fires.
L	**Loss of Critical Infrastructure**	Electrical fault at substation bay

16.4.1.4 Assessment of Effect During Decommissioning

Six risks specific to the decommissioning of the Project have been identified and are presented in **Table 16.7**.

Table 16.7: Risk Register – Decommissioning Phase

Risk ID	Potential Risk	Possible Cause
Potential vulnerability to disaster risks		
M	**Severe Weather** Risk to decommissioning activity on site	Extreme weather- periods of heavy rainfall, taking into account climate change and strong winds
N	**Flooding of site** High levels of surface water on site	Extreme weather- periods of heavy rainfall, taking into account climate change and strong winds
Potential to cause accidents and / or disasters		
O	**Traffic Incident**	

Risk ID	Potential Risk	Possible Cause
	Collisions onsite and offsite with vehicles involved in construction of the Project	Driver negligence or failure of vehicular operations on site roads. Traffic Management not implemented
P	**Contamination** Discharge or spillage of fuel, chemical solvents into watercourse or percolated to groundwater	Fuel spillage during delivery to site. Failure of fuel storage tank or tanks in plant and machinery and vehicles. Drainage and seepage water resulting from infrastructure excavation. Erosion of sediment from emplaced site drainage channels.
Q	**Industrial Accident - Fire/Gas explosion**	Petrochemical Fires causing personal injury, structural damage and forest fires.
R	**Loss of Critical Infrastructure**	Electrical fault at substation bay

These risks have been assessed in accordance with the relevant classification (Refer to **Table 16.1** and **Table 16.2**) and the resulting risk analysis is given in **Table 16.6**.

The risk register is based upon possible risks associated with the Project. As outlined in **Section 16.3**, the consequence rating assigned to each potential risk assumes that all proposed mitigation measures and safety procedures have failed to prevent the major accident and/or disaster.

16.4.1.5 Assessment of Effect – Summary

Table 16.8: Risk Assessment

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
Construction Phase								
A	Severe Weather	Extreme weather-periods of heavy rainfall, taking into account climate change and strong winds	Illness or loss of life; Sedimentation of nearby watercourse Damage to, or depletion of aquatic habitats and species;	3	The risk of severe weather is unlikely when considering the assessment in **Chapter 10: Air and Climate** and weather conditions recorded over the last 30 years within the area.	1	The risk of severe weather conditions during the construction phase will result in a minor consequence in that a small number of people would be affected' should a severe weather occur, with 'no fatalities and a small number of minor injuries with first aid treatment'. No contamination, localised effects.	3
B	Flooding	Extreme weather-periods of heavy rainfall, taking into account climate	Illness or loss of life; Sedimentation of nearby watercourse;	2	The risk of flooding is considered very unlikely when taking into account the	1	The risk of flooding during the construction phase will result in a minor consequence in	2

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
		change and strong winds	Damage to, or depletion of aquatic habitats and species;		baseline assessment in **Chapter 9: Hydrology and Hydrogeology** and due to no recurring or historic flood incidents being recorded within the Wind Farm site or along the Grid Connection route.		that a small number of people would be affected' should a severe weather occur, with no fatalities and a small number of minor injuries with first aid treatment'. No contamination of environment (e.g., watercourses), localised effects.	
C	Peat Stability	Mismanagement of excavated material on site Extreme weather conditions	Movement of peat within the Project; Sedimentation of nearby watercourse; Damage to, or depletion of aquatic habitats and species;	2	The Project has been designed to minimise the potential for peat instability and failure. Refer to **Appendix 8.1**: **Geotechnical and Peat Stability Assessment Report**	2	The risk of peat instability during the construction phase will result in a limited consequence in that there would be a limited number of people affected' with 'localised effects of short duration.	4

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
							Contamination of environment (e.g., watercourses), localised effects of short duration.	
D	Traffic Incident	Driver negligence or failure of vehicular operations on Site Access Roads. Traffic Management not implemented or not adhered	Injury or loss of life.	3	A limited number of vehicles will be permitted on the Site as part of the construction phase. As such, it can be determined that there is some 'opportunity, reason or means' for a vehicle collision to occur on site, 'at some time.' An unlikely risk is therefore predicted.	1	A minor consequence is predicted. Having regard to on-site speed limits and vehicular movements, a small number of people would be affected' should a vehicular collision occur, with no fatalities and small number of minor injuries with first aid treatment.'	3
E	Contamination	Fuel spillage during delivery to site.	Damage to, or depletion of aquatic habitats and species	2	As outlined in **Chapter 2: Project Description** and the **Appendix 2.1 Construction**	2	The risk of a fuel spillage or impact on surround drainage during the construction phase will	4

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
		Failure of fuel storage tank or tanks in plant and machinery and vehicles. Drainage and seepage water resulting from infrastructure excavation; Stockpiled excavated material providing a point source of exposed sediment; Construction of the Project resulting in entrainment of sediment from the	Release of suspended solids to surface watercourses and could result in an increase in the suspended sediment load, resulting in increased turbidity which in turn could affect the water quality and fish stocks of downstream water bodies		**Environmental Management Plan**, fuel will be stored on-site but in a bunded area to ensure containment and prevent spillages of fuel. No fuels, chemicals or solvents will be stored outside of the confines of the site. Setback distances from sensitive hydrological features means that adequate room is maintained for the proposed drainage mitigation measures as detailed in **Chapter 9: Hydrology and Hydrogeology.**		result in a limited consequence in that there would be a limited number of people affected' with 'localised effects of short duration through the use of bunded containment areas and proposed drainage mitigation measures during construction. Contamination of environment (e.g., watercourses), localised effects of short duration.	

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
		excavations during construction; and, Erosion of sediment from emplaced site drainage channels						
F	Industrial Accident - Fire/Gas explosion	Equipment or infrastructure failure; Fuel spillage/storage Electrical problems; and Employee negligence	Illness or loss of life; Damage to, or depletion of habitats and species; and Impacts on ambient air quality.	2	As outlined in **Chapter 2 Project Description** and **Appendix 2.1: Construction Environmental Management Plan**, fuel will not be stored on-site post construction, therefore fuel is not considered to be a significant fire risk. There are no Gas Networks within the vicinity of the Project.	2	Should a fire/explosion occur at the site, it will be of a limited consequence in that there would be a limited number of people affected' with localised effects of short duration due to the nature of the project and the lack of infrastructure or fuel storage during operation that would result in any such incident. There will be normal community functioning in the area	4

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
					Therefore, there is low risk of explosion. In accordance with Chapter 19 of the Safety, Health and Welfare at Work Act 2005 (the 2005 Act), the Project will be subject to a fire safety risk assessment which would assist in the confirmation of any major risks of fire on site e.g., wind turbines, substation, vandalism.		with some inconvenience. Simple contamination of environment (e.g., watercourses), localised effects of short duration.	
Operational Phase								
G	Contamination	A vehicular incident, refuelling incident, wastewater or sewage transportation in	Damage to, or depletion of aquatic habitats and species.	2	As outlined in **Chapter 2: Project Description** and **Appendix 2.1 Construction Environmental**	2	The risk of a fuel spillage or impact on surrounding drainage during the operational stage will result in a limited	4

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
		the operational phase.	Release of suspended solids to surface watercourses could result in an increase in the suspended sediment load. Increased turbidity which in turn could affect the water quality and fish stocks of downstream water bodies		**Management Plan**, fuel will be stored on-site but in a bunded area to ensure containment and prevent spillages of fuel. No fuels, chemicals or solvents will be stored outside of the confines of the site. Setback distances from sensitive hydrological features means that adequate room is maintained for the proposed drainage measures as detailed in **Chapter 9: Hydrology and Hydrogeology**.		consequence in that there would be a limited number of people affected with localised effects of short duration through the use of bunded containment areas during operation. Simple contamination of environment (e.g., watercourses), localised effects of short duration.	

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
H	Industrial Accident - Fire/Gas explosion	Equipment or infrastructure failure; Fuel spillage/storage Electrical problems; and Employee negligence	Illness or loss of life; Damage to, or depletion of habitats and species; and Impacts on ambient air quality.	2	As outlined in **Chapter 2: Project Description**, fuel will not be stored on-site post construction therefore fuel is not considered to be a significant fire risk. Gas will not be used onsite; therefore it is not considered a fire/explosion risk. In accordance with Chapter 19 of the Safety, Health and Welfare at Work Act 2005 (the 2005 Act), the Project will be subject to a fire safety risk assessment which would assist in the	2	Should a fire/explosion occur at the site, it will be of limited consequence in that there would be a limited number of people affected with localised effects of short duration due to the nature of the project and the lack of infrastructure or fuel storage during operation that would result in any such incident. There will be normal community functioning in the area with some inconvenience. Simple contamination of environment (e.g., watercourses), localised effects of short duration.	4

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
					identification of any major risks of fire on site e.g. wind turbines, substation, vandalism			
I	Collapse/ damage to structures	Landslide/ Earthquake; and Extreme weather conditions such as flooding and storms. Vehicular collisions due to driver negligence Mismanagement of excavated material on site	Injury or loss of life. Movement of peat within the site; Sedimentation of nearby watercourse; Damage to, or depletion of aquatic habitats and species;	2	According to the Irish National Seismic Network, earthquakes measuring ~2 on the Richter Scale are "normal" in terms of seismicity in Ireland. These are known as microearthquakes; they are not commonly felt by people and are generally recorded only on local seismographs. As such, buildings in Ireland are extremely unlikely to be damaged or collapse due to seismic activity.	1	The risk of infrastructure collapse or damage to structures during the construction phase will result in a minor consequence in that a small number of people would be affected, with no fatalities and a small number of minor injuries with first aid treatment. No contamination of environment (e.g., watercourses), localised effects.	2

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
					Having regard to public speed limits within the site, it is not predicted that any collision of vehicles and any infrastructure would result in significant damage/collapse. The Project has been designed to take into account any issues on peat or spoil stability			
J	Traffic Incident	Driver negligence or failure of vehicular operations on Site Access Roads. Traffic Management not implemented	Injury or loss of life.	3	A limited number of vehicles will be permitted on the Site as part of the operation phase. As such, it can be determined that there is some 'opportunity, reason or means for a	1	A minor consequence is predicted. Having regard to on-site speed limits and vehicular movements, a small number of people would be affected should a vehicular collision occur, with no fatalities and small number of minor	3

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
					vehicle collision to occur on site, 'at some time.'		injuries with first aid treatment.	
K	Loss of Critical Infrastructure	Equipment or infrastructure failure; Electrical problems; Employee negligence Landslide/ Earthquake; Extreme weather conditions such as flooding and storms.	Injury or loss of life	1	EirGrid operate the grid from National Control Centres matching electricity production to customer demand, switching from synchronous to non-synchronous where required to ensure no power outages. The Project will be connected to a single bay at Ballyvouskill 220kV substation and any shortages or failures will not impact other connections to the same substation	2	Should a power failure occur at the Ballyvouskill 220kV substation, it will result in a limited number of people affected- localised effects of short duration	2

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
Decommissioning Phase								
L	Severe Weather	Extreme weather-periods of heavy rainfall, taking into account climate change and strong winds	Illness or loss of life; Sedimentation of nearby watercourse Damage to, or depletion of aquatic habitats and species.	2	The risk of severe weather is unlikely when considering the assessment in **Chapter 10: Air and Climate** and weather conditions recorded over the last 30 years within the area.	1	The risk of severe weather conditions during the decommissioning phase will result in a minor consequence in that small number of people would be affected should a severe weather occur, with no fatalities and a small number of minor injuries with first aid treatment. No contamination of environment (e.g., watercourses), localised effects.	2
M	Flooding	Extreme weather-periods of heavy rainfall, taking into account climate	Illness or loss of life; Sedimentation of nearby watercourse	1	The risk of flooding is considered very unlikely when taking into account the	1	The risk of flooding during the decommissioning phase will result in a minor	1

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
		change and strong winds	Damage to, or depletion of aquatic habitats and species;		baseline assessment in **Chapter 9: Hydrology and Hydrogeology** and due to no recurring or historic flood incidents recorded within the Site or along the Grid Connection route.		consequence in that 'small number of people would be affected should a severe weather event occur, with no fatalities and a small number of minor injuries with first aid treatment. No contamination of environment (e.g., watercourses), localised effects.	
N	Traffic Incident	Driver negligence or failure of vehicular operations on Site Access Roads. Traffic Management not implemented	Injury or loss of life.	3	A limited number of vehicles will be permitted on the Site as part of the decommissioning phase. As such, it can be determined that there is some 'opportunity,	1	A minor consequence is predicted. Having regard to on-site speed limits and vehicular movements, a small number of people would be affected should a vehicular collision occur, with no fatalities and small number of minor	3

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
					reason or means for a vehicle collision to occur on site, 'at some time.' An unlikely risk is therefore predicted.		injuries with first aid treatment.	
O	Contamination	Fuel spillage during delivery to site. Failure of fuel storage tank or tanks in plant and machinery and vehicles. Drainage and seepage water resulting from infrastructure removal. Erosion of sediment from site drainage channels.	Damage to, or depletion of aquatic habitats and species Release of suspended solids to surface watercourses and could result in an increase in the suspended sediment load, resulting in increased turbidity which in turn could affect the water quality and fish	2	As outlined in **Chapter 2: Project Description** and **Appendix 2.1 Construction Environmental Management Plan**, fuel will be stored on-site but in a bunded area to ensure containment and prevent spillages of fuel. No fuels, chemicals or solvents will be stored outside of the confines of the Site. Setback distances from sensitive hydrological	2	The risk of a fuel spillage or impact on surrounding drainage during the decommissioning phase will result in a limited consequence in that there would be a limited number of people affected with localised effects of short duration through the use of bunded containment areas during operation. Simple contamination of environment (e.g., watercourses), localised effects of short duration.	4

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
			stocks of downstream water bodies.		features means that adequate room is maintained for the proposed drainage measures as detailed in **Chapter 9: Hydrology and Hydrogeology**.			
P	Industrial Accident- Fire/gas explosion	Equipment or infrastructure failure; Fuel spillage/storage Electrical problems; and Employee negligence	Injury or loss of life Structural damage Forest fires Air Pollution Damage to, or depletion of habitats and species Contamination	2	As outlined in **Chapter 2: Project Description** and **Appendix 2.1 Construction Environmental Management Plan**, fuel will not be stored on-site post construction therefore fuel is not considered to be a significant fire risk. In accordance with Chapter 19 of the	2	Should a fire/explosion occur at the site, a limited consequence in that there would be a limited number of people affected with localised effects of short duration due to the nature of the project and the lack of infrastructure or fuel storage during decommissioning that would result in any such incident. There will be normal community	4

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
					Safety, Health and Welfare at Work Act 2005 (the 2005 Act), the Project will be subject to a fire safety risk assessment which would assist in the identification of any major risks of fire on site.		functioning in the area with some inconvenience. Simple contamination of environment (e.g., watercourses), localised effects of short duration.	
Q	Loss of Critical Infrastructure	Equipment or infrastructure failure; Electrical problems; and Employee negligence Landslide/ Earthquake; and	Injury or loss of life	1	EirGrid operate the grid from National Control Centres matching electricity production to customer demand, switching from synchronous to non-synchronous where required to ensure no power outages. The Project will be connected to	2	Should a power failure occur at the Ballyvouskill 220kV substation, it will result in a limited number of people affected- localised effects of short duration	2

Risk ID	Potential Risk	Possible Cause	Environmental Effect	Likelihood Rating	Basis of Likelihood	Consequence Rating	Basis of Consequence	Risk Score (Consequence x Likelihood)
		Extreme weather conditions such as flooding and storms.			Ballyvouskill 220kV substation and any shortages or failures will not impact other connections to the same substation			

The risk assessment for each of the potential risks identified are consolidated in **Table 16.9** which provides their 'risk score.' A corresponding risk matrix is provided in **Table 16.10**, which is colour coded to provide an indication of the critical nature of each risk. As outlined in **Table 16.3**, the red zone represents 'high risk' scenarios', the amber zone represents 'medium risk scenarios and the green zone represents 'low risk scenarios.

Table 16.9: Risk Scores

Risk ID	Potential Risk	Likelihood Rating	Consequence Rating	Risk Score
Construction Phase				
A	Severe Weather	3	1	3
B	Flooding	1	1	1
C	Peat Stability	2	2	4
D	Traffic Incident	3	1	3
E	Contamination	2	2	4
F	Industrial Accident - Fire/Gas explosion	2	2	4
Operational Phase				
G	Contamination	2	2	4
H	Industrial Accident - Fire/Gas explosion	2	2	4
I	Collapse/ damage to structures	2	1	2
J	Traffic Incident	3	1	3
K	Loss of Critical Infrastructure	1	2	2
Decommissioning Phase				
L	Severe Weather	2	1	2
M	Flooding	1	1	1
N	Traffic Incident	3	1	3
O	Contamination	2	2	4
P	Industrial Accident- Fire/gas explosion	2	2	4
Q	Loss of Critical Infrastructure	1	2	2

Table 16.10: Risk Matrix

		Consequence Rating				
		1.Minor	2.Limited	3. Serious	4.Very Serious	5.Catastrophic
Likelihood Rating	5.Very Likely					
	4. Likely					
	3. Unlikely	D,N				
	2. Very Unlikely	A,C,I,L,J,M	B,E,F,G,H,O,P			
	1. Extremely Unlikely		K,Q			

Table 16.10, presents the potential risks identified during the construction, operation and decommissioning of the Project all or which can be classified as 'low risk scenarios.'

The scenario with the highest risk score in terms of a major accident and/or natural disaster during the construction, operation and decommissioning phase of the Project is identified below:

Peat Stability During Construction

The likelihood of peat instability during the construction of the Project is considered very unlikely as the soil stability risk assessment classified the site as low risk. The risk of peat instability has been minimised through the careful design of the Project and will be further limited through the implementation of the best practice construction control measures outlined in **Appendix 8.1**.

The risk of peat instability is 'very unlikely' to occur and will have 'limited' consequences should it do so, representing a 'low-risk scenario' during the construction phase.

Contamination During Construction, Operation and Decommissioning

There is a potential risk of contamination from site activities during the construction, operational and decommissioning phases from potential release of hydrocarbons. The risk of contamination was given a risk score of 4. However, as outlined in **Chapter 2: Project Description**, **Appendix 2.1**: Construction Environmental Management Plan (CEMP) and **Chapter 9: Hydrology and Hydrogeology**, measures are proposed and will be put in place to reduce the risk of accidental spillage and contamination of pollution risk to groundwater, surface water and associated ecosystems, and to terrestrial ecology.

The risk of contamination is 'very unlikely' to occur as adherence to the CEMP mitigation measures will be required and will have 'limited' consequences should it do so, representing a 'low-risk scenario' during the construction, operation and decommissioning phases.

Industrial Accident-Fire/Gas Explosion During Construction, Operation and Decommissioning

There is a potential risk of fire/explosion at the Project. However, as outlined in **Section 16.2.1**, the scope of this assessment has been based on the understanding that the Project will be designed, built and operated in line with current best practice. Further, in accordance with Chapter 19 of the Safety, Health and Welfare at Work Acts 2005 to 2014, the Project will be subject to a fire safety risk assessment which will assist in the identification of any major risks of fire on site e.g., wind turbines, substation, vandalism.

Therefore, the risk of fire/explosion occurring at the Project resulting in a major accident and/or disaster was given a risk score of 4. This indicates a scenario that is 'very unlikely' to occur and having 'limited' consequences should it do so, representing a 'low-risk scenario' during the operational phase.

16.4.2 Mitigation Measures

As outlined in **Section 16.4.1**, the scenarios with the highest risk score in terms of the occurrence of major accident and/or disaster were identified as 'Contamination' of the Project and risk of 'Industrial Accident- Fire/Gas Explosion' during the construction, operation and decommissioning phases.

The Project has been designed in accordance with the best practice measures described in detail in this EIAR and, as such, mitigation against the risk of major accidents and/or disasters is embedded through the design.

As discussed, the application for the Project is accompanied by a CEMP (**Appendix 2.1**) which sets out details of the environmental controls to be implemented on site. The CEMP sets out the Emergency Response Procedure to be adopted in the event of an emergency including contamination, health and safety and environmental protection. The CEMP provides details on all mitigation and monitoring measures to be actioned prior to construction, during the construction, operation and decommissioning phase. The CEMP will be subject to ongoing review through regular environmental auditing and site inspections. This will confirm the efficacy and implementation of all mitigation measures and commitments identified in the application documentation.

The CEMP includes an Emergency Response Plan (**Management Plan 1**). It provides details of procedures to be adopted in the event of an emergency relating to health & safety or environmental protection. The Emergency Response Plan includes details on the response required and the responsibilities of all personnel in the event of an emergency. Please see **Appendix 2.1** for details.

16.4.3 Residual Effects

The risk of a major accident and/or disaster during the construction of the Project is considered 'low' in accordance with the 'Guide to Risk Assessment in Major Emergency Management' (DoEHLG, 2010).

It is considered that when the mitigation and monitoring measures outlined in the CEMP are implemented and adhered to, there will not be significant residual effect(s) associated with the construction, operation and decommissioning of the Project.

16.4.4 Assessment of Cumulative Effects

16.4.4.1 Cumulative Impact Assessment

A search in relation to developments that may have the potential to result in a cumulative impact with the Project on the environment was carried out as part of the EIAR (Please see **Appendix 2.4**). The Project has been considered, cumulatively with these developments. The closest developments to the Site that are not yet constructed are a solar farm (Cork CoCo Planning Ref. No. 174167) located 3.1 km south-east of the Site and Gortnakilla, Clonkeen, Killarney Wind Farm located 1.87 km west of the Site. The closest operational project is Coomagearlahy Kilgarvan Wind Farm located 2.70 km south-west of the Site. Due to the separation distance of the projects, the Project being located at a higher elevation than the other developments, lack of connectivity of forestry parcels and the implementation of proposed mitigation measures, there is no potential for significant cumulative increase in the vulnerability of the Project to risks such as peat stability, flooding, contamination, fire or traffic or loss of critical infrastructure.

17 INTERACTIONS OF THE FOREGOING AND A SUMMARY OF MITIGATION MEASURES

17.1 INTERACTIONS OF THE FOREGOING

17.1.1 Introduction

The foregoing topics in earlier chapters do not exist in isolation from each other and consequently, any impact on one element of the environment may also impact on another. The Irish Environmental Protection Agency have developed a simple matrix to show the key interactions and interrelationships between the environmental aspects of a Development (**Table 17.1**). The interactions between impacts on different factors have been addressed as relevant throughout the EIAR (**Table 17.2**). The cumulative slight impact on a number of topics may result in a significant impact on another topic.

17.1.2 Impact Interactions

Where any potential negative impacts have been identified during the assessment process, these impacts have been avoided by embedded design mitigation or at a minimum, reduced by the proposed mitigation measures.

17.2 SUMMARY OF MITIGATION MEASURES

This Chapter summarises mitigation measures proposed elsewhere in the EIAR. Chapters 4 to 16 of the EIAR outline the findings of the assessment of the predicted effects of the Project on a topic by topic basis. The significance of these effects have been assessed using criteria defined in the topic chapters. In the context of The EPA Guidelines (2022), the significance of effects is categorised from imperceptible through to not significant, significant and profound with varying sub-categories.

17.2.1 Embedded Mitigation

Embedded mitigation includes design changes that were made to reduce or eliminate adverse effects, as well as normal good practice measures; these have avoided the majority of potentially significant effects. **Appendix 17.1** summarises mitigation measures for all technical assessment chapters.

The process of applying the embedded mitigation is set out in **Chapter 2: Project Description**. The key design aspects comprising embedded mitigation include:

- Avoiding inconsistent turbine spacing, outliers and excessive turbine overlapping to minimise visual confusion and ensure a balanced/compact array of key views;
- Achieving an appropriate scale of turbine, taking account of the landscape context;

- Upgrading existing forestry tracks to be used as Site Access Roads at the Site;
- Respecting and understanding the ground conditions and topography of the Site; including avoiding effects on active peat where possible;
- Maximising the separation from residential dwellings, and
- Respecting other environmental constraints and associated buffer separations.

17.2.2 Specific Mitigation Measures

In addition to mitigation proposed to address significant adverse effects (**Appendix 17.1**), certain chapters have also proposed further measures to reduce effects that were assessed as 'Not Significant' before mitigation.

Table 17.2 outlines interactions between environmental aspects. Technical assessments have assessed pathways, both direct and indirect that can magnify effects through the interaction or accumulation of effects. Effects have been cross-referenced between chapter topics. An outline of potential interactions between chapters/topics is presented in **Table 17.1**.

Table 17.1: Summary matrix of Interactions of Impacts during Construction, Operational and Decommissioning Phases (Source: Adapted from EIAR Guidelines, 2022)

	Population & Human Health		Biodiversity		Ornithology		Soils & Geology		Hydrology and Hydrogeology		Noise		Landscape & Visual		Material Assets		Cultural Heritage		Traffic & Transportation		Major Accidents and Natural Disasters	
	Const & Decom	Oper	Const & Decom	Oper	Const & Decom	Oper	Const & Decom	Oper	Const & Decom	Oper	Const & Decom	Oper	Const & Decom	Oper	Const & Decom	Oper	Const & Decom	Oper	Const & Decom	Oper	Const & Decom	Oper
Population & Human Health																						
Biodiversity																						
Ornithology																						
Soils & Geology																						
Hydrology and Hydrogeology																						
Noise																						
Landscape & Visual																						
Material Assets																						
Archaeology and Cultural Heritage																						
Traffic & Transportation																						
Major Accidents & Natural Disasters																						

Note: Const. = Construction phase; Oper = Operational phase Decom. = Decommissioning

Interaction or inter-relationship

No interaction or inter-relationship

Table 17.2: Interactions & Inter-relationships between Environmental Aspects of the Development

Interaction	Description
Population and Human Health & Hydrology and Hydrogeology	Impacts could be observed through flood risk polluting waters supply and also recreational fisheries; **Chapter 9: Hydrology and Hydrogeology** considers these aspects and concludes that there are there are no impacts.
Population and Human Health & Noise	The noise assessment inherently covers any interaction as the methodology used and limits applied are designed to protect health and amenity.
Population and Human Health & Landscape and Visual	The construction phase of the Project will see a temporary introduction of machinery and the erection of five turbines into a natural but already modified landscape. **Chapter 12: Landscape and Visual Amenity** assessed the landscape effects, the visual effects and the cumulative effects of the Project, including assessment from recreational scenic viewpoints, and was also informed by the findings of the Assessment. The interactions between the environmental aspects were carefully considered in the EIAR, particularly in the design of the turbine layout. Detailed zone of theoretical visibility maps (ZTVs), route screening analysis and photomontages were prepared to assess the level of impact. Based on the findings of the collective assessments it is considered that the Project will not give rise to any significant effects, either singly or in combination. Tourists to Ireland have become accustomed to the vision of turbines on the landscape and given the scenario where more windfarms will be built in Ireland in the future, the most widely held view is that this will not impact their likelihood to visit the area again.
Population and Human Health & Material Assets: 1. Shadow Flicker 2. Air Navigation 3. Telecommunications 4. Socio-economic	1. The shadow flicker assessment identified the potential for shadow flicker to affect between 20 No. out of 39 No. receptors within the shadow flicker study area. The assessment identified no significant effects, given that shadow flicker is unlikely to cause a nuisance to nearby inhabited dwellings. It also notes that the function to stop the turbine if required to do so, is available. The potential effects of the Project from shadow flicker are considered to be **Not Significant**. 1. Operating windfarms have the potential to cause a variety of adverse effects on aviation. Rotating wind turbine blades may have an impact on certain aviation operations, particularly those involving radar. The physical height of turbines can cause obstruction to aviation and the overall performance of communications, navigation and surveillance equipment. All structures over 150 m in height are required to have lighting to warn aviation traffic. No significant impacts are predicted in terms of human beings and air navigation. In adherence to IAA Safety Regulations and ICAO Annex 15, aeronautical obstacle warning light schemes will be installed as requested by IAA, co-ordinates of ground and tip height elevations at each wind turbine location. 2. During operation, wind turbines have the potential to interfere with electromagnetic signals passing above the ground due to the nature and size of the windfarm. During the construction and decommissioning phase activity, signals may be passed below ground via existing infrastructure. Impacts may include overground or underground communication cables, microwave links, telecommunication links, business radio and television reception. Mitigation measures were implemented in the design phase through mitigation by avoidance i.e., the known routes of the telecommunication links were plotted and a buffer was applied to them, outside of which the proposed turbines were located. In the operational phase, all electrical components, equipment, apparatus and systems will be required by Irish and European law to comply with the EMC

Interaction	Description
	Directive 2014/30/EU. Compliance with this Directive will mean that the electromagnetic emissions from these devices will not cause interference to other equipment. Turbine and substation control electronics will be typical of any circuits used by industry or a conventional generating station. There is no potential for interference with the links from other windfarms in combination with the Project. Based on the remote location of the Project and a distance of 753 metres to the nearest residential dwelling, no significant impacts are predicted on telecommunications or radio reception as a result of the Project. 3. The Project will provide opportunities for local suppliers to be engaged in the construction phase. This will be a minor beneficial impact. The developer will seek to secure positive benefits for the local/regional economy by encouraging the use of local labour, manufacture and suppliers where possible. They will hold 'Meet the Developer' days prior to construction to allow local contractors to engage with the process and maximise opportunities.
Population and Human Health & Air and Climate	Impacts on air quality during the construction and decommissioning phase may occur due to dust emissions from construction activities onsite and through increased traffic and associated exhaust emissions from construction traffic. These interactions have been considered as part of the EIAR, without significant effects being predicted and suitable mitigation measures provided to further reduce potential impacts. During the operational phase, the energy generated by the Project will offset energy and the associated emission of greenhouse gases from electricity-generating stations dependent on fossil fuels, thereby having a net positive effect on climate. In doing so, there will likely be reduced effects from climate change on human beings. The cumulative effect of the Project with other Irish renewable generation is considered to be a fundamental change in the climate effects of Ireland's energy supply, which is a **major, positive effect,** that is **Significant** (beneficial) under the EIA Regulations and will contribute to Ireland's binding emission reduction targets.
Population and Human Health & Cultural Heritage	Damaging a cultural asset could affect tourism; this has been considered in **Chapter 14: Cultural Heritage** and will not to be an issue.
Population and Human Health & Traffic and Transport	The construction and decommissioning phase will give rise to traffic movements of abnormal loads and is likely to create some short-term inconvenience for road users. A **Traffic Management Plan** (TMP) will be in place and minimise disruption insofar as possible. Suitable mitigation measures to reduce dust emissions have been outlined in **Chapter 15: Traffic and Transportation.**
Population and Human Health & Major Accidents and Natural Disasters	A wind farm is not a recognised source of chemical pollution. Should a major accident or natural disaster occur, the potential sources of pollution onsite during both the construction and operational phases are limited. There is limited potential for significant natural disasters to occur at the Site. Ireland is a geologically stable country with a mild temperate climate. The potential natural disasters that may occur are therefore limited to peat-slide, flooding and fire. In the highly unlikely event that the stability of peat is compromised, an Emergency Response Plan has been prepared and can be found in **Appendix 2.1: Construction Environmental Management Plan, Management Plan 1**.
Biodiversity & Ornithology	All interactions for any habitat or species including those associated with Special Protection Areas (SPA) or Special Areas of Conservation (SAC) are considered in the Natura Impact Statement and not considered further here.
Biodiversity & Hydrology and Hydrogeology	Contamination of surface water and groundwater could occur from many elements including wastewater sanitation contamination, hydrocarbon contamination, watercourse crossings construction, entrainment of suspended solids during earth works, increased entrainment of contaminants and other impacts arising due to

Interaction	Description
	localised stability issues, amongst other potential sources. Contamination of water quality could impact both flora and fauna including fisheries, otter, lizards and amphibians (loss of breeding ponds) amongst others. Lagoon-type sediment traps and plant filtration beds will be installed in watercourses to maintain water quality and prevent potential impacts on protected species located downstream such as the freshwater pearl mussel. These interactions have been considered as part of the EIAR, with suitable mitigation measures provided to minimise potential impacts.
Biodiversity & Soils and Geology	Potential impacts on biodiversity during the construction and decommissioning phase could include disturbance to birds and mammals from loss / changes in habitat. The Project has been designed to avoid impacts on Annex I peatland, wet heath, dry heath, and siliceous rock habitat as much as practicably possible. . Restoration will be undertaken in line with the **Habitat Enhancement Plan** (**Appendix 5.5**).
Biodiversity & Major Accidents & Natural Disasters	Potential impacts on biodiversity during the construction and decommissioning phase could include disturbance to birds and mammals from loss / changes in habitat. The Project has been designed in accordance with the best practice measures described in detail in this EIAR and, as such, mitigation against the risk of major accidents and/or disasters is embedded through the design.
Ornithology & Noise	The ornithology assessment considers general disturbance to sensitive bird species, including that caused by the sources likely to occur during the construction and decommissioning of the Project. The potential effects on birds from noise will not be significant and temporary in nature.
Ornithology & Major Accidents and Natural Disasters	Potential impacts on biodiversity during the construction and decommissioning phase could include disturbance to birds from loss/ changes in habitat. The Project has been designed in accordance with the best practice measures described in detail in this EIAR and, as such, mitigation against the risk of major accidents and/or disasters is embedded through the design to ensure no such impacts will occur.
Soils and Geology & Hydrology and Hydrogeology and Landscape and Visual	The hydrogeological balance of the Site could be impacted by the amount of earth materials excavated. Adopting good practices, planning ahead and real time monitoring in more sensitive (>1 m peat depth) areas will ensure that any excavations associated with the Project will have minimal impact. These interactions have been considered as part of the EIAR, with suitable mitigation measures provided to minimise potential impacts. Application of the mitigation measures will reduce the risk of stability issues and impacts on hydrology and hydrogeology arising at a localised scale.
Soils and Geology & Landscape and Visual & Major Accidents and Natural Disasters	The unavoidable residual impacts on the soils and geology environment as a function of the Project is that there will be a change in ground conditions at the Site with the replacement of natural materials such as peat, subsoil and bedrock by concrete, subgrade and surfacing materials. Stability issues and slope failure arising from vehicular movement could cause significant local or at worst-case scenario landslide issues. Where suitable mitigation measures are applied and proper precautions and planning are executed effectively, the risk of such potential impacts will be significantly reduced and considered avoidable.
Soils and Geology, Landscape and Visual & Archaeology and Cultural Heritage	The construction and decommissioning phase pertaining to the Project will involve significant ground reduction and topsoil removal throughout the design layout footprint. While there are two recorded archaeological sites within the Redline Boundary, none are located on the footprint of any proposed construction areas. There is a possibility of encountering unrecorded archaeological finds/features throughout these areas, during the construction and decommissioning phase and increasing the area of disturbed soil. If any sub-surface archaeological features are identified during

Interaction	Description
	archaeological monitoring they will be securely cordoned off, cleaned and recorded *in situ*. The National Monuments Service will then be notified and consulted to determine further appropriate mitigation measures, which may include preservation *in situ* (by avoidance) or preservation by record (archaeological excavation). These interactions were considered in the EIAR, both in the design of turbine layout and in the design of mitigation measures. Monitoring, including a watching brief in undisturbed portions of the footprint will be carried out. All records will be preserved where found. The operational phase will result in a range of indirect negative impacts of a visual nature on the wider setting of a number of recorded archaeological sites within the study area and the surrounding landscape which will range from not significant to moderate in significance. The one predicted indirect negative impact of moderate significance will arise from the presence of three turbines (T1, T2 and T3) and associated access routes within a 500 m area extending to the south, northwest and northeast of an extant archaeological site (Enclosure CO057-007----) (Figure 14.1). This is predicted to result in a medium magnitude of impact on the historic landscape setting of this recorded archaeological monument, which is of potential medium-high value and, based on the EPA impact assessment criteria presented in Table 14.4 (Section 14.2.8), this will result in a predicted reversible, negative, indirect, moderate significance of impact.
Soil and Geology & Major Accidents and Natural Disasters	The Project has been designed in accordance with the best practice measures described in detail in this EIAR and, as such, mitigation against the risk of major accidents and/or disasters is embedded through the design. The Project has been designed in accordance with the best practice measures described in detail in this EIAR and, as such, mitigation against the risk of major accidents and/or disasters is embedded through the design.
Hydrology & Biodiversity	There is a potential for Fisheries to be impacted by a disturbance or contamination of watercourses during the construction period if the stated mitigation measures are not adhered to. However, the mitigation measures to protect watercourses outlined in Aquatic Ecology, Soils and Geology and Hydrology and Hydrogeology chapters will be strictly adhered to which includes monitoring of Site water run-off during all phases of the Project.
Hydrology and Major Accidents & Natural Disasters	The Project will use the latest best practice guidance to ensure that flood risk within or downstream of the Site is not increased as a function of the Project, i.e., a neutral impact at a minimum. The risk of the wind farm contributing to downstream flooding is very low, as the long-term plan for the site is to retain and slow down drainage water prior to release. Robust drainage measures on the site will include swales, silt traps, check dams, settlement ponds and buffered outfalls. This has been addressed **in Chapter 9: Hydrology and Hydrogeology.**
Noise & Traffic and Transportation	Traffic and Transportation will create noise onsite and along the Site Access Roads. Site contractors will be required to employ the best practicable means of reducing noise emissions from plant, machinery and activities, as advocated in BS 5228. Such potential effects are considered to be not significant.

Interaction	Description
Noise & Major Accidents and Natural Disasters	Alarms (e.g., for security, fire) will be sounded in cases of emergency. The maintenance of these alarms is essential and any faulty alarm causing nuisance alerts will be replaced accordingly. Incidents such as explosions in the substation buildings will have a noise impact. However, proper maintenance and operation will make this risk unlikely.
Landscape and Visual & Material Assets	The Irish Aviation Authority (IAA) has outlined criteria regarding tall structures and the installation of an aeronautical obstacle warning light scheme for the Project. This has been addressed in **Chapter 13: Material Assets and Other Issues**.
Material Assets & Major Accidents and Natural Disasters	TheProject is not connected to or in the vicinity of any site regulated under the Control of Major Accident Hazards Involving Dangerous Substances Regulations (SEVESO sites), therefore no significant effects associated with major industrial accidents involving dangerous substances are anticipated. Any technical fault at the Project would not impact the local or national energy supply. The extremely low frequency (ELF) electric and magnetic fields (EMF) associated with the operation of the proposed cables fully comply with the international guidelines for ELF-EMF set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP), a formal advisory agency to the World Health Organisation, as well as the EU guidelines for human exposure to EMF. Accordingly, there will be no operational impact on properties (residential or other uses), construction staff, operational & maintenance staff or recreational users of the site as the ICNIRP guidelines will not be exceeded at any distances even directly above the cables.
Traffic and Transport & Biodiversity: Fisheries	During the construction phase, increased traffic could lead to increased sedimentation/pollution of watercourses as moving vehicles disrupt soil and emit pollutants. The interactions between these aspects were considered in the EIAR and mitigation has been embedded in the design of the Project. This assessment has identified no potentially significant residual effects on Fisheries from Traffic & Transportation from the Project.
Traffic and Transport & Major Accidents & Natural Disasters	The Project will utilise the existing road network during the construction phase.. Construction related traffic will originate from the delivery of materials to site, removal of surplus excavated material from site and transport of employees to, from and throughout the Site. The localised traffic disruptions will be mitigated through the use of industry standard traffic management measures. Please see **Chapter 15: Traffic and Transport** and **Appendix 2.1** for details.