ENVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED DERNACART WIND FARM, CO. LAOIS

VOLUME 1 - NON-TECHNICAL SUMMARY

DECEMBER 2019

Statkraft

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30 YEARS

TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

LIST OF TABLES

1 INTRODUCTION

1.1 Proposed Development

The proposed development will comprise of up to 8 no. wind turbines with a tip height of up to 185m, turbine foundations, hardstanding areas, new access tracks and upgrading of existing access tracks, 1 no. substation including control buildings, meteorological mast, electrical and grid services equipment, underground electrical and communications cabling, drainage, sediment controls, temporary site compound, tree felling, roads, hardstands and associated works. The turbine model has not been chosen but will be dictated by the energy production efficiencies of various turbines on the market at the time of the turbine procurement stage. The selected turbines will not exceed the maximum size envelope set out within the development description in this document. Throughout the Environmental Impact Assessment (EIA) process, consideration of environmental impacts of the proposed development is based on the largest possible size of development i.e. assessment of the worst-case scenario. Whilst not forming a part of the applications for consent the EIAR includes an assessment of the connection to the national electricity network to the future proposed substation at Bracklone, Co. Laois.

1.2 The Need for the Proposed Development

Carbon dioxide (CO_2) is a greenhouse gas which, if released in excessive amounts, can lead to increases in global temperatures known as 'global warming' or the 'greenhouse effect' which can influence climate change. Once the proposed wind farm is constructed there will be no negative impacts on climate change and in fact it will have a long-term positive impact by providing a sustainable energy source.

In December 2018, the revised Energy Efficiency Directive, the revised Renewable Energy Directive and the new Governance Regulation were formally adopted. The new regulatory framework includes a binding renewable energy target for the EU for 2030 of 32% with an upwards revision clause by 2023. This agreement will help the EU meet the Paris Agreement goals.

The main achievements of this agreement in terms of renewable energy production are:

- Sets a new, binding renewable energy target for the EU for 2030 of 32%, including a review clause by 2023 for an upward revision of the EU level target;
- Improves the design and stability of support schemes for renewables;
- Delivers real streamlining and reduction of administrative procedures;
- Establishes a clear and stable regulatory framework on self-consumption;
- Increases the level of ambition for the transport and heating/cooling sectors; and
- Improves the sustainability of the use of bioenergy.

Ireland is one of the most energy import-dependent countries in the European Union, importing 85% of its fuel in 2014 at an estimated cost of €5.7 billion[i]. This makes Ireland particularly vulnerable to future energy crises and price fluctuations given its location on the periphery of Europe. The Energy White Paper notes that *"There will be a substantial increase in the cost of carbon in the short and medium term, through the EU Emissions Trading Scheme".* Any steps to reduce dependence on imported fossil fuels will add to the financial autonomy and stability in Ireland.

1.3 Economic Benefits

In addition to helping Ireland avoid significant fines and reducing Irelands environmentally damaging emissions Dernacart Wind Farm would also contribute economically. To illustrate the severity of this issue, Ireland's failure to fully implement the 2009 Renewable Energy Directive suggested a penalty of €25,445.50 for each day that the Directive was not fully implemented, whilst this action was discontinued due to the enactment of legislative measures to adapt the Directive, it provides context to the severity of not meeting European Energy targets.

Work undertaken by the SEAI in 2016 indicated that the cost to Ireland of not meeting our overall renewable energy targets may be in the range of €65 million to €130 million for each percentage point Ireland falls short of the overall 16% renewable energy target.

- Significant Community Benefits Package,
- Job creation/Local Business Opportunities,
- Landowner payments,
- Development Contribution Scheme and rates (estimated at approx. €800,000 in rates to Laois County Council)

Statkraft are keen to work with communities to ensure that their projects bring value to the communities of over their project lifetime. The concept of directing benefits from wind farms to the local community is something that is promoted by the National Economic and Social Council (NESC) and Irish Wind Energy Association (IWEA) amongst others. Whilst it may be simpler and easier to put a total fund aside for a wider community area, Statkraft is endeavouring to develop new ways to direct increased gain towards the local communities and people, with particular focus on those closest to the wind farm. Statkraft is firmly of the belief that it is local people that best understand the needs and requirements of the local community. As such they have engaged proactively with local residents from an early stage in the design process in order to gain feedback on how local people feel that the most benefit can be brought to the area.

1.4 Environmental Impact Assessment Report (EIAR) Structure

The EIAR consists of the following chapters:

- Chapter 1: Introduction
- Chapter 2: Need and Alternatives
- Chapter 3: Policy
- Chapter 4: Description of the Proposed Development
- Chapter 5: EIA Scoping and Consultation
- Chapter 6: Population, Human Health and Material Assets
- Chapter 7: Shadow Flicker
- Chapter 8: Noise and Vibration
- Chapter 9: Telecommunications and Aviation
- Chapter 10: Traffic and Transportation
- Chapter 11: Landscape and Visual
- Chapter 12: Biodiversity
- Chapter 13: Land, Soils and Geology
- Chapter 14: Hydrology and Water Quality
- Chapter 15: Archaeology, Architectural and Cultural Heritage
- Chapter 16: Air Quality and Climate
- Chapter 17: Interactions of the Foregoing

The structure proposed for the EIAR is as follows:

Volume 1 – Non-Technical Summary (NTS)
Volume 2 – Main EIAR
Volume 3 – Appendices to the Main EIAR
Volume 4 – Landscape and Visual Maps and Photomontages

An Appropriate Assessment Screening and Natura Impact Statement (NIS) has also been submitted with this application.

1.5 Permission Period

A ten-year planning permission is being requested for this development. The applicant requests a grant of permission on the basis of a 30-year operational period from the date of commissioning of the wind farm.

1.6 Difficulties Encountered

In terms of difficulties encountered, the noise levels measured from noise monitoring location N5 were unexpectedly high. It has been concluded that these elevated noise levels are not representative of the baseline noise environment and as a conservative approach this information has been excluded from the analysis.

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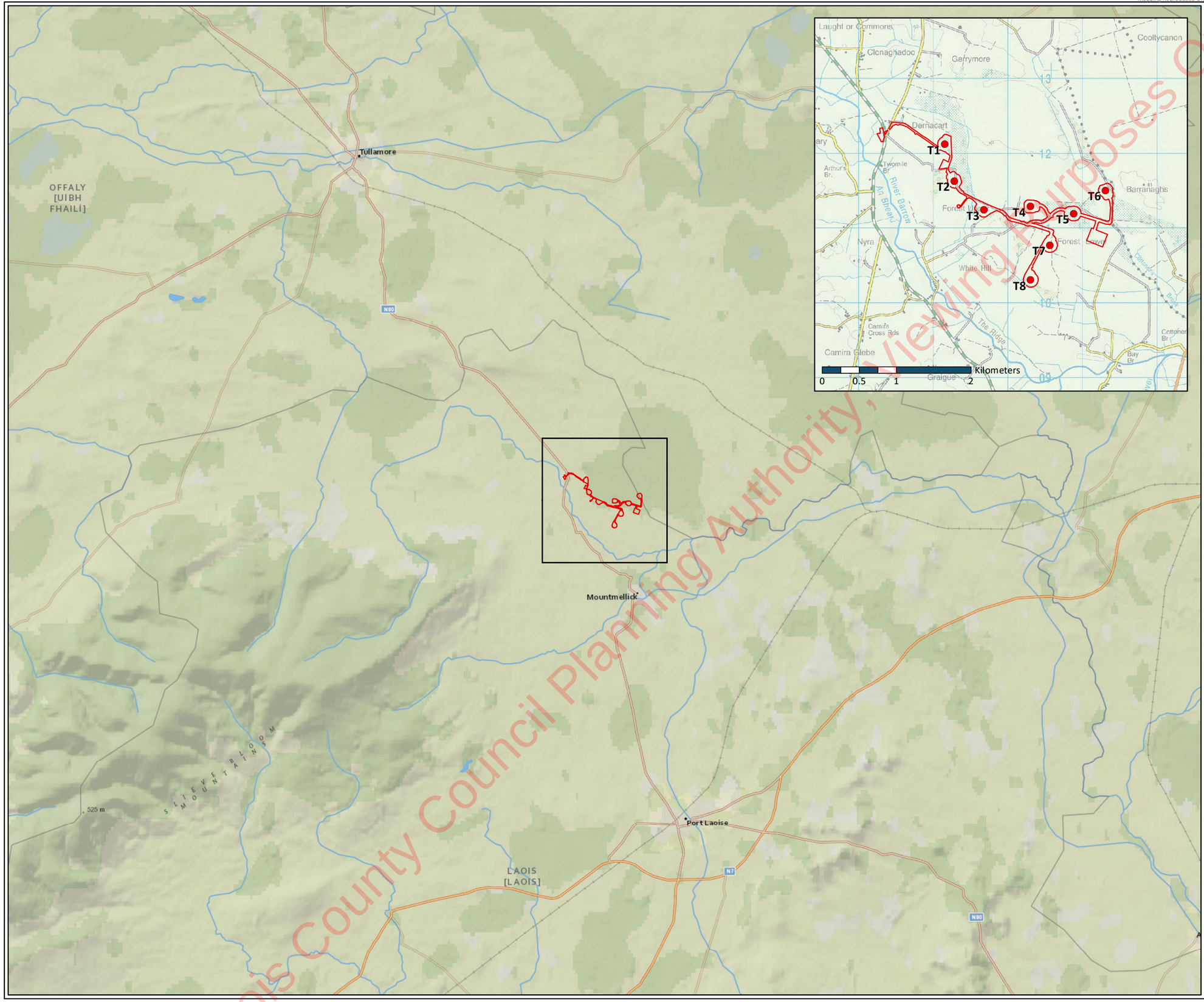

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FIGURE NO:	1.1		
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SCALE:	1:150000	**REVISION:**	0
DATE:	11/12/2019	**PAGE SIZE:**	A3

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2 NEED AND ALTERNATIVES

2.1 Need for the Development

Ireland is dependent on reliable and secure supplies of electricity. The generation of electricity accounts for about one-third of all energy use each year in Ireland. The proposed development of the Dernacart Wind Farm is necessary not only to produce electricity for the national grid, but also due to its contribution to transitioning Ireland to a low carbon economy. The proposed development will play a critical role in providing renewable electricity, accounting for up to 1.35% of the current installed wind energy capacity[ii] in the Republic of Ireland.

At a strategic level the need for the proposed wind farm development is supported by International, European, and National environmental and energy commitments and policies. In Chapter 3 of this EIAR, a detailed analysis of these commitments and policies is outlined.

The Irish Government published the Climate Action Plan in June 2019 which sets ambitious actions to ensure our 2030 targets can be achieved. This is in the context of substantial and continuing failure by Ireland in meeting climate targets to date. According to a report by Climate Action Network Europe (CAN), Ireland is:

> *"Way off track with its greenhouse gas emission reductions in sectors such as transport, buildings, waste and agriculture (non-ETS) both for 2020 and 2030"*

The Climate Action Plan recognises that Ireland must make a significant increase in the levels of renewable energy in the country.

It is estimated that the capacity of ca. 40MW of electricity from the Dernacart Wind Farm will result in the net displacement of approximately 55,188 tonnes of CO_2 per annum.

In June 2018, a political agreement was reached between negotiators for the European Commission, the European Parliament and the Council on increasing renewable energy use in the European Union. The new regulatory framework includes a binding renewable energy target for the EU for 2030 of 32%, with an upwards revision clause by 2023. The agreement is aimed at ensuring the EU, as a whole, meets the Paris Agreement Goals, a legally binding global climate deal made in 2015 by 195 countries to limit global warming.

Substantial new development will be required in Ireland to increase renewable energy production from 30% to 70%, as set out in the Climate Action Plan 2019. Most of this increase is likely to come from wind power. Moving from 2020 targets to 2030 and 2050 targets, wind energy development is required to increase substantially. This demonstrates the importance of and need for the proposed Dernacart Wind Farm development.

Ireland is one of the most energy import-dependent countries in the European Union, importing 66% of its fuel in 2017 at an estimated cost of €4 billion[iii]. Ireland's import dependency prior to 2016 varied between 85% and 90% and decreased to 69% when the Corrib Gas started production. While lower levels of oil import are being achieved as a result of the growing wind energy sector, Ireland remains vulnerable to future energy crises and price fluctuations given its location on the periphery of Europe.

The Energy White Paper, Ireland's Transition to a Low Carbon Energy Future 2015-2030 sets out a framework to guide policy and actions that the government intends to take in the energy sector. The paper notes that "There will be a substantial increase in the cost of carbon in the short and medium term, through the EU Emissions Trading Scheme". The proposed Dernacart Wind Farm aims to reduce dependence on imported fossil fuels and add to financial autonomy and energy stability in Ireland.

In addition to helping Ireland avoid significant fines and reducing Ireland's environmentally damaging emissions, the Dernacart Wind Farm will also contribute positively to the national and regional economy.

Ireland is one of the most energy import-dependent countries in the European Union, importing 66% of its fuel in 2017 at an estimated cost of €4 billion[iv]. Ireland's import dependency prior to 2016 varied between 85% and 90% and decreased to 69% when the Corrib Gas started production.

While lower levels of oil import are being achieved as a result of the growing wind energy sector, Ireland remains vulnerable to future energy crises and price fluctuations given its location on the periphery of Europe.

Additionally, a report published by Baringa[v] 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."*

2.2 Alternatives

At the outset of the project, the developers considered a range of technologies for the production and supply of renewable energy to the Irish national grid. The alternative technologies considered included:

- Bio-energy
- Off-shore Wind
- Solar Energy
- Tidal and Wave Energy

Under the "Do-Nothing" scenario, the Dernacart Wind Farm project would not go ahead, the development of wind turbines would not be pursued, and the site would remain in use for forestry and agriculture. The prospect of creating sustainable energy through County Laois'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 targets set out in the National Climate Action Plan (2019) would be reduced

The proposed development is estimated to offset 55,188 tonnes of CO_2 emissions per year, which would otherwise be released to the atmosphere through the burning of fossil fuels in the "Do-Nothing" scenario. Importation and use of fossil fuels would continue and Ireland's energy security would remain vulnerable. According to EirGrid Group's All-island Generation Capacity Statement 2018 – 2027[vi], the growth in energy demand for the next ten years will be between 15% and 47%. A 'Do-Nothing' scenario would contribute to strain existing energy infrastructure and may impact on potential economic growth if energy demand cannot be met.

Under the 'Do-Nothing' scenario, the socio-economic benefits associated with the proposed development will be lost. These benefits include up to 128 no. jobs during the construction phase of the project, and up to 20 long term jobs once operational. Furthermore, the local community will not benefit economically from the associated community benefit fund, which could be used to improve physical and social infrastructure in the area.

In the 'Do-Nothing' scenario the potential environmental impacts of the proposed development as set out throughout this EIAR will not occur and mitigation measures will not be implemented.

The site selection process for the proposed development began at a macro level. This process firstly took account of relevant international, national and regional policies, as well as the principal environmental, planning and technical criteria that determine the feasibility and suitability of the existing environment to absorb wind energy developments.

The primary macro level considerations in the identification of a broad area for wind energy development included the following:

- Identification of environmental designations on a National Scale;
- Identification of areas of built Wind Farms in Ireland;
- Identification of Grid Capacity and Electricity Infrastructure; and
- Relevant National and Regional Policies.

The micro level search criteria reflects the broad range of issues which can arise in wind farm development and allows for direct comparison across the study area to determine the relative suitability of potential wind energy development sites.

A range of sites for wind energy development were considered by the applicant. Each site was subject to consideration on a series of criteria in order to determine their wind energy feasibility. The micro level search process is described below.

The micro level search criteria included the following:

- County Development Plan Policies and Designations;
- Natura 2000 sites;
- Population Density;
- Access to major transport routes;
- Proximity to the National Electricity Grid;
- Wind Speeds;
- Land availability.

Environmental Considerations at this stage included:

- Avoidance of environmental sensitivities;
- Access to environmental capacity; and
- Level of environmental capacity.

Alternative project layouts were developed in order to avoid environmental sensitivities, minimise potential environmental impacts both on and off site and to maximise the wind potential on site. The design has been carried out in accordance with industry guidelines and best practice, namely the Department of Environment, Heritage and Local Government (DoEHLG) Wind Energy Development Guidelines (2006), and the Irish Wind Energy Association Best Practice Guidelines (2012). The layout and design was an iterative process which took account of such criteria as:

- Set back from houses;
- Set back from village and town cores;
- Set back from designated sites;
- Set back from other constraints such as watercourses and power lines;
- Suitable wind speeds;
- Landscape and visual sensitivity;
- Ecology;
- Ornithology;
- Soils and Geology;
- Hydrology;
- Noise; and
- Cultural Heritage.

Constraints and environmental sensitivities were first identified and buffers applied in order to determine appropriate areas within the site to accommodate development.

Turbines were initially set to be 169m and would have a setback distance of 500m from houses as set out in the Wind Energy Development Guidelines (2006). The initial power output of this design iteration was expected to be 45MW or approximately 2.8MW output per turbine. This layout was established as a baseline design for public consultation and environmental assessment purposes.

In deciding to propose fewer taller turbines, a turbine model with an output of approximately 5MW was chosen as the likely option with an alternative tip height of up to 185m, increasing the proposed tip height by 16m, and reducing the overall number of turbines from 16 to 8. The increased height and diameter are expected to reach greater wind speeds and have an increased wind capture and therefore produce more energy. The expected output of these taller turbines would produce similar levels of energy production to the original layout, while greatly reducing the number of turbines. In addition, it is expected that new and more efficient turbine designs will come onto the market prior to the construction of the wind farm that will fit the proposed turbine envelope of up to 185m tip. As a result of this chosen alternative, construction traffic would be greatly reduced resulting in less impact on local roads.

In line with local concerns, the alternative design of fewer taller turbines with increased hub height and blade diameters was achieved and resulted in halving the original number of proposed turbines to 8. Through this alternative design, a minimum setback distance of 740m to dwellings was achieved.

3 POLICY

This Chapter of the EIAR outlines current EU, national, regional and where relevant local energy and planning policy and legislation relating to the proposed Dernacart Wind Farm Development.

International policies discussed include the United Nations Framework Convention on Climate Change and the Kyoto Protocol. EU Directives and Policies include:

- Directive on the Promotion of the Use of Energy from Renewable Resources
- European 2020 Strategy for Growth
- Europe 2020 Indicators – Climate Change and Energy
- 2030 Climate and Energy Framework
- A Roadmap for Moving to a Competitive Low Carbon Economy in 2050
- Recast Renewable Energy Directive (RED2)

National Policies discussed include:

- Project Ireland 2040: The National Planning Framework
- Project Ireland 2014: National Development Plan 2018 – 2027
- Climate Action Plan (2019)
- Climate Action and Low Carbon Development Act 2015
- National Mitigation Plan 2017
- Ireland's Greenhouse Gas Emissions Projections 2016 - 2035

Regional and other plans, policies and guidelines are also discussed.

It is clear that there is significant international, European, national and local policy support for a move to renewable energy resources, including onshore wind farms. Ireland is committed to meeting International and European targets and if these targets are not met fines will be imposed on the State. To illustrate the severity of this issue, Ireland's failure to fully implement the 2009 Renewable Energy Directive suggested a penalty of €25,445.50 for each day that the Directive was not fully implemented. Whilst this action was discontinued due to the enactment of legislative measures to adapt the Directive, it provides context to the severity of not meeting European Energy targets. Work undertaken by the SEAI in 2016 indicated that the cost to Ireland of not meeting our overall renewable energy targets may be in the range of €65 million to €130 million for each percentage point Ireland falls short of the overall 2020 16% renewable energy target.

While Ireland has come a long way in increasing renewable energy generation, the targets continue to increase in light of recent climate change research and predictions. From a European perspective, the 2050 EU targets effectively mean that the European Union's energy production will have to be almost carbon-free by 2050.

It is this commitment on energy and climate policy that justifies a clear need for renewable energy generation in Ireland. It is recognised that there are a range of renewable resources alternatives that could be explored to meet our International and European commitments however onshore wind energy is currently recognised as being the most economically competitive.

National energy policies have been reinforced and have amended the Laois County Development Plan 2017-2023 which applies a plan-lead approach to wind energy development. The Dernacart wind farm site is located within an area considered to have capacity and be open for consideration for wind energy development and is compatible with the existing land use on the site.

4 DESCRIPTION OF THE PROPOSED DEVELOPMENT

Statkraft proposes to develop the Dernacart Wind Farm in Co. Laois. It is proposed to supply the power from Dernacart Wind Farm to the Irish electricity network via underground cable to the future proposed substation at Bracklone, Co. Laois.

The proposed wind farm site includes lands in the townlands of Forest Upper, Forest Lower and Dernacart, and is approximately 49ha in size. The site is accessed from the N80 and the site entrance is located on the L2092.

The site of the proposed development is located in relatively low-lying lands below the 80m contour level. The landcover is classified on Corine as pastures, peat bog and coniferous forest. This is illustrated in Figure 4.1. A tributary of the River Barrow flows through the site and to the east of the site is another tributary of the River Barrow. A bog is located to the north and east of the site and to the south and west are agricultural lands.

The proposed grid connection which will connect the on-site substation to the future proposed Bracklone substation is ca. 16.5km in length and runs predominantly along existing roads.

Within 1km of the proposed turbines there are 29 no. residential receptors and 1 no. commercial receptor, - this information is based on a house survey. The closest occupied dwelling (with the exception of involved landowners) is over 740m from the nearest proposed turbine location.

Statkraft is proposing to construct an up to eight-turbine wind farm at Dernacart, Co. Laois. The wind farm will be connected by a 110kV underground cable to the proposed Bracklone substation. The proposed development will consist of the following infrastructure:

- Erection of up to 8 no. wind turbines with an overall tip height of up to 185m
- Construction of foundations and hardstanding areas in respect of each turbine
- Construction of 1 no. site entrance from the public road
- Construction of ca. 5.8km of new site access tracks and associated drainage
- Upgrade of ca.0.89km of existing access tracks and, where required, upgrade of associated drainage
- Establishment of 1no. temporary compound and associated parking areas
- Construction of drainage and sediment control systems
- Construction of 1 no. electricity substation including:
    - 2 no. control buildings containing worker welfare facilities
    - Electrical infrastructure and grid ancillary services equipment
    - Parking
    - Fencing
    - Waste water holding tank
    - Equipment storage
    - Wind farm communications equipment
    - All associated infrastructure, services and site works including landscaping
- Installation of underground electricity cables between the proposed turbines and proposed on-site substation.
- Temporary alterations to the public road at identified locations to accommodate the delivery of turbines
- Associated site works including berms and landscaping
- Tree felling
- Peat excavation
- Installation of a permanent meteorological mast of up to 110m in height
- A 10-year planning permission is sought with a 30 year operational life from the date of commissioning of the entire wind farm.

The grid connection between the on-site substation and the future proposed Bracklone substation does not form part of the planning application, however, the likely impacts of the construction and operation of this grid connection are included as part of this EIAR.

The construction period for the wind farm is estimated to be 12 months.

The proposed wind farm would be estimated to produce enough energy to power just over 34% of all households in Co. Laois.

The proposed turbines will have a tip height of up to 185m. Detailed drawings, which accompany the planning application, show a typical turbine that may be used for the proposed development, however, the exact make and model of the turbine will be dictated by a competitive tender process of the various turbines on the market at the time, but will not exceed the maximum size envelope set out within the development description (i.e. tip height up to 185m).

Turbine components deliveries are likely to be routed from Dublin Port to the M6, where they will travel to Junction 5. At Junction 5, the deliveries will exit the motorway and travel south along the N52 through the Ardan, Cappincur, Cloncollig and Clonminch roundabouts. At the Clonminch roundabout, the deliveries will travel along the N80 through Killeigh to the site entrance at Dernacart. The final turbine delivery port and delivery route will be subject to agreement with the turbine manufacturer and with the planning authority.

Within the site, approximately 890m of internal access tracks will be upgraded and c. 5.8km of new internal access tracks will be constructed as part of the development. A hardstanding area of approximately 40m x 77m with additional set down areas will be required at each turbine location.

There are no new major watercourse crossings required within the proposed development site. One existing culvert will require replacement. It is expected that all minor watercourse and drain crossings within the site will be crossed using piped culverts.

A permanent meteorological mast is to be installed within the site. It will be a free-standing mast i.e. there with no guide wires. The foundation size will be ca. 10m x 10m x 2m.

It is currently anticipated that the project will connect via underground cable to the future proposed Bracklone substation. The proposed cable route is along a local road on the eastern boundary of the site, joining the R423. The grid connection is then proposed to be laid along the R423 to Portarlington Golf Club. At Portarlington Golf Club, the grid route follows a local road to Kilbride. At Kilbride the grid route will follow local roads to the R420 and connect to the future proposed Bracklone substation. EirGrid are currently progressing a planning application for the Bracklone substation, which is detailed in the current Transmission Forecast Statement. The applicant proposes to connect into this new substation. Planning permission for the grid connection will be sought under a separate application, but the connection and associated cable facilities are included within the scope of this EIAR.

As there will be a surplus of peat due to excavations, berms have been incorporated into the design along the access tracks and turbine basis. The drainage system will be constructed alongside all turbines, internal access tracks, hardstands, substation and the temporary construction compound. The drainage system for the existing tracks and roads will largely be retained. Where the roads require widening, this will involve the slight re-location of existing roadside swales to allow for widening.

Felling of approximately 18ha of coniferous forestry is required within and around the wind farm infrastructure to accommodate the construction of some turbines, hardstands, crane pads, access tracks and the proposed onsite substation.

During the operational period, the turbines will operate automatically on a day to day basis, responding by means of anemometry equipment and control systems to changes in wind speed and direction. The turbine manufacturer or a service company will carry out regular maintenance of the turbines.

Scheduled maintenance will typically occur twice a year. The operation of the wind turbines will be monitored remotely, and a caretaker will oversee the day to day running of the proposed wind farm.

The expected physical lifetime of the turbine is approximately 30 years, and permission is sought for a 30-year operation period commencing from full operational commissioning of the wind farm.

With longer permitted operational period, the lower the cost will be, and the better the competitiveness of the wind farm with other electricity generators.

Following the end of their useful life, the wind turbines subject to planning permission may be replaced with a new set of turbines or the site may be decommissioned. On decommissioning, cranes will disassemble the above ground turbine components which would be removed off site for recycling. All the major component parts are bolted together, so this is a relatively straightforward process. The foundations will be covered over and allowed to re-vegetate naturally if required. Leaving the turbine foundations in situ is considered a more environmentally sensible option as to remove the reinforced concrete associated with each turbine would result in environmental nuisances such as noise and vibration and dust. It is proposed that the internal site access tracks may be left in place, subject to agreement with Laois County Council and the relevant landowners. The substation will remain in place as it will be under the ownership of the EirGrid.

5 EIA SCOPING AND CONSULTATION

The purpose of the EIA scoping process is to identify the key points and issues which are likely to be important during the environmental impact assessment (EIA) and to eliminate those that are not. The scoping process identifies sources or causes of potential environmental effects, the pathways by which the effects can happen, and the sensitive receptors, which are likely to be affected.

A scoping document which included a description of the proposed development, draft of the preliminary site boundary and preliminary contents was forwarded to 45 consultees on the 4th and 5th of July 2019. The recipients included the Local Authority, Government Departments, Non-Governmental Organisations (NGOs), interested parties and key stakeholders. Consultation was also undertaken with regard telecommunications.

A pre-planning meeting was held in Laois County Council on 20th June 2019. Items discussed included the layout of the wind farm, the grid connection to either Mountmellick substation or the proposed Bracklone substation. The cumulative effects with other wind farms in the wider area was discussed and Laois County Council requested two additional locations for photomontages. It was recognised that the principle of wind energy was acceptable in the area and that the area had a low density of population. Information was provided on the grid connection and it was agreed that suitable engineering solutions are available to traverse watercourses including Directional Drilling to ensure that no in-stream works take place. A pre-planning meeting was also held in Offaly County Council on 24th July 2019 to discuss the grid connection route.

Dernacart wind farm commenced the public consultation in September 2019 at an early stage in the development process. A Community Liaison Strategy (CLS) was established and set into motion with a nominated Community Liaison Officer (CLO) being appointed. Since this time, the CLO has been the main point of contact with the local community.

There are 29 houses within 1km and of these 75% engaged and met with us. Residents in all houses within 1.4km of the proposed layout were provided with information, with the consultation area extending to 1.6km and beyond in certain instances.

The core objective of this approach was to provide information on what was being considered and to receive feedback from people in the local community which would be used to inform the design process.

An important aspect of the community engagement strategy was the distribution of project information and the gathering of feedback. The CLO called to all houses within 1.6km of the design layout to provide the following information:

- A Project Booklet
- Details on the Project website
- Contact details for contacting the CLO at any time
- Newsletter distribution to coincide with planning submission

Feedback from meetings with people in this area showed that, the need to take effective climate action was well understood in the area. It was also apparent, that many people in this area are considering what changes they will need to make in their daily lives in order to play their part in combating climate change. Recent flooding events in the town of Mountmellick and across the local area were very much to the forefront of many people's minds. This said, whilst the need for the development of renewable energy was appreciated, there remained an apprehension in terms of the development of wind energy in the area which was fundamentally based on the fact that it was considered that this would lead to change in the area. In terms of this change, the most significant factors included the visual change that would occur (although many accepted that there was good screening in many locations across the local area), any changes that might happen to the hydrology system in the area and change in general terms of the whole area around transitioning to a low carbon society and what that will mean for families and individuals. It was generally accepted that the community benefit fund could deliver a significant opportunity to allow people living closest to the development to benefit from locally generated electricity and the overall transition to a low carbon society.
The main queries that were initially raised related to how this proposal would work in terms of setback, shadow flicker and noise. During these one to one meetings, it was explained that these factors had been already taken into account by the design team based on feedback commonly received from communities. A revision of the initial layout was carried out and the proposed design resulted from this review process.

The design proposal being brought forward for consultation included fewer turbines, a commitment to eliminate shadow flicker and with a setback distance of 740m and over to the nearest home in the community not connected with the wind farm. Any potential noise from the development had been reduced. This was also outlined within the project booklet. These early design changes were welcomed and were generally seen to address the initial concerns that people had.

Three houses in the area raised concerns in relation to autism. During our consultation with those who engaged with us on this, we reiterated our commitment to eliminating shadow flicker and provided contact details for a number of schools for children with special needs, including autism, that have direct and first-hand experience of both bringing these children to local wind farms and in the case of at least one of these schools, caring for children who live close to wind farms without experiencing any ill effects. A commitment was also given to provide information on the technical aspects of how the shadow flicker control system would work.

Over the course of engagement with the local community/individuals, local businesses and community groups, feedback was actively sought on ideas regarding the form that the community benefit scheme should take and how best to achieve maximum potential benefit for the local area from the community funding that would be associated with this project.

A significant community benefit fund will be available for the local area and should the project be developed under the RESS scheme, approximately €250,000 per year would be available for the local area for the duration of the scheme. The value of this fund will be directly proportional to the number of MWhs of electricity produced by the wind farm, on the project being successful in securing RESS support and the duration of that support.

During the consultation process, feedback was sought in terms of how the community benefit fund could bring real and tangible benefits to the people living in the local area. The overriding message that was received from people in the local area was that community benefit funds associated with this development should bring direct benefit to the houses in the local area. It was felt that this should be both in the form of a direct return from the wind farm whilst there was a strong appreciation for the need to take climate action and that the community benefit fund should assistance local households to reduce their carbon footprint.

Observations and issues that arose during the scoping and consultation process have informed the design, assessment and mitigation measures proposed as part of this project. There has been a reduction in the quantum of turbines from 16 no. to eight no. and there is an increase in set-back from the closest residence not involved in the project from 500m to 740m and the elimination of shadow flicker at dwellings in the local area.

6 POPULATION, HUMAN HEALTH AND MATERIAL ASSETS

6.1 Population

This section provides an overview of the population profile for the area, Laois, Offaly and the State between 2006 and 2016 in order to provide for an assessment of the potential impact of the proposed development on the demography of the area.

Within 1km of the proposed turbines there are 21 no. residential receptors and 5 no. residential and commercial receptors based on Eircode data.

Construction Impacts

The potential impacts arising from the proposed wind farm development during its construction phase which relate to the community include nuisance (such as noise and vibrations), traffic, and visual impact of the construction works.

Throughout the construction phase of the proposed development, construction workers will travel to and from the site. There is however, no indication that the construction workers will live within the study area.

Operational Impacts

Once constructed, there will be direct and indirect employment associated with the operational phase of the wind farm. There will be opportunities for mechanical-electrical contractors and craftspeople to become involved with the operation and maintenance of the wind farm, but this is not likely to impact upon the population density in the area. There will be no permanent impact on population in terms of population trends, density, household size, or age structure as a result of the operation phase.

Decommissioning Impacts

The potential impacts associated with decommissioning will be similar to those associated with construction but of a reduced magnitude.

Mitigation Measures

As there will be no adverse or significant impact on population trends, density, household size, or age structure, no mitigation measures are required.

Residual Impact

Long term the wind farm will not impact upon the population density and demographic of the study area.

6.2 Socio-Economics, Employment and Economic Activity

Construction Impacts

In terms of local impact, up to 160 staff could be employed on site at certain stages of construction. The employment of tradespeople, labourers, and specialised contractors for the construction phase will have a direct and indirect short-term, positive impact on the local economy, bringing significant benefits to local service providers and businesses with direct and indirect financial benefits to the local community.

Materials and construction workers will be sourced locally where possible, and this will assist in sustaining employment in the local construction trade. As a result, this will have a short term, positive effect on the employment profile of the area.

A Local Business Support Strategy has been developed with the view to maximising the economic benefit for the local area during the construction, operational and decommissioning phases.

Operational Impacts

According to the European Wind Energy Associated (2009), 0.4 jobs are created per MW of total installed capacity in operations and maintenance of the wind farm, as well as jobs created by other activities related to installed turbines. A study carried out by the Institute for Sustainable Futures (2015) estimates that the operational and maintenance job output is an estimated 0.3 jobs per MW based on an average of 6-7 studies. Based on this estimate, the proposed wind farm development (for the purposes of this calculation it is assumed an installed capacity of 40MW) could be expected to create between 12 and 16 long term operational jobs. This would give rise to a slight, positive impact. It should be noted however, that with rising labour productivity the figure of between 0.3 and 0.4 jobs per megawatt of total installed capacity is anticipated to fall to 0.29 jobs by 2030.

Over the lifetime of the project up to 140 jobs will be created during construction, operation and maintenance of the wind farm. This is based off the calculation provided by the Institute for Sustainable Futures (2015) of 3.2 jobs per MW during construction and 0.3 jobs per MW during operation and maintenance. People working on the construction or operation of the wind farm who live outside the area are anticipated to spend some of their income in local shops and accommodation during their time in the area. Based off the above calculations this could be up to 128 no. additional people.

There will be a slight, positive temporary impact to socio-economics, employment and economic activity in the study area associated with the employment of construction workers within the vicinity of the wind farm during the decommissioning phase.

The proposed development will provide employment opportunities for members of the local community during the construction phase and will provide ongoing employment opportunities in respect of maintenance and operation crew, and to the developer involved.

Local rates and development contributions paid by the developer will contribute significant funds to Laois County Council. This funding will be used to improve the services available to the people of the County. The Laois County Council Development Contribution Scheme (2017-2023) indicates a charge of €10,000 per MW of capacity will apply to wind turbine installations generating over 0.5 MW of energy. In addition, the Development Contribution Scheme charges €50,000 per turbine over 100m. Based on the current proposal of 8 no. turbines (185m) and an installed capacity of over 40MW, a total Development Contribution of over €800,000 would be payable by the Developer following construction. Services that will benefit from rates and development contributions include road upkeep, fire services, environmental protection, street lighting, footpath works etc., along with other local community initiatives and supports.

The proposed community benefit package will provide benefits and funding for local community projects and accordingly, may enhance the local community interaction.

Mitigation Measures

Given that the effects are predominantly positive in respect of socio-economics, employment and economic activity, no further mitigation measures are necessary.

6.3 Land Use

The site of the proposed development is located in relatively low-lying but undulating land with the majority of proposed turbines located beneath the 80m contour line. The landscape is classified as Western Boglands and North Western Lowlands according to Table 14.3 of the Laois County Development Plan 2017 – 2023.

The existing land use of the lands surrounding the wind turbines and associated infrastructure where no works are proposed will remain as existing. Land use will be changed during the construction phase of the proposed development where the development will occupy a small proportion of the development site area.

Construction Impacts

Temporary effects will arise as a result of the construction and installation of cable route which will be within the road corridor. The road will be reinstated following construction with no permanent change of use.

Given that the proposed development's footprint will occupy a small proportion of the development site area, it is anticipated that there will be minimal changes to land use from the proposed development.

The land use within the boundary of the development will change in areas where access tracks, wind turbine bases, hardstanding areas, substation associated drainage works are required.

Operational Impacts

The main land-uses of agriculture and forestry of the proposed development will continue to co-exist with the proposed wind farm. Therefore, there will be no impact on land use.

Decommissioning Impacts

There will be a slight localised change to land use associated with the removal of turbine infrastructure and reinstatement of previous land use during the decommissioning phase. Once decommissioning has ceased, no effects will remain.

Mitigation Measures

Mitigation measures for land use are primarily related to preliminary design stage, which has allowed for the prevention of unnecessary or inappropriate ground works or land use alterations to occur. The construction footprint will be kept to the minimum necessary. No further mitigation measures are required.

Residual Impacts

Once mitigation measures and appropriate design measures are incorporated, as proposed, into the proposed wind farm development, there will be minimal change to land use with no significant adverse negative residual effects arising from the project on land use.

6.4 Recreation, Tourism and Amenity

In 2017 Overseas visitors totalled 43,000 for Co. Laois and accounted for €14 million in revenue. Domestic visitors totalled 280,000 for both Laois and Offaly and accounted for €30 million in revenue. Individual domestic figures were not available for Co. Laois and Co. Offaly as both had been assessed together.

The Slieve Bloom Mountains are located approximately 8 km to the south west of the Dernacart wind farm and are split between Laois and Offaly. The mountains are popular with visitors including: hikers, recreational walks and eco trails. The Clamphole waterfall and Glenbarrow trailhead are one of the most popular visitor locations in the Slieve Bloom Mountains. The Calmphole waterfall is located c. 8.2km to the south west of the Dernacart Wind Farm.

The Rock of Dunamase is located 15.2 km to the south east of the Dernacart Wind Farm and is one of the main tourist attractions in County Laois. The ruins of the Rock which are one of eight National Monuments in Co. Laois are managed by the State and it is part of the Laois Heritage Trail and Irelands Ancient East.

The Round Tower Timahoe is located c. 22.4 km south east of the Dernacart Wind Farm and is an example of a 12th century round tower. The St. Mochua Monastery ruins lie within the grounds of the round tower and the ruins and Tower are one of eight National Monuments within County Laois. As with the Rock of Dunamase the Tower forms part of the Laois Heritage Trail and Irelands Ancient East.

Aghaboe Abbey is located c. 27.5 km south west of the Dernacart Wind Farm. The Abbey was founded by St Canice in the 6th century and rebuilt as an Augustinian prior in the 13th century[1] The Abbey also forms part of the Laois Heritage Trail and Irelands Ancient East Tourism Area..

The Grand Canal, Way is a National Waymarked Trail and is managed by Waterways Ireland. It is 117km in length and connects Dublin to the River Shannon. The route of the Grand Canal Way passes c. 15km to the north of the Dernacart Wind Farm.

Angling is the premier recreational activity on the Grand Canal with multiple hotspots and competitive stretches along its length. Similarly, boating, canoeing, cycling and walking are popular recreational activities throughout the Grand Canal Way (c 15km from the nearest turbine).

Construction Impacts

During the construction phase of the proposed wind farm development, there is potential for impacts on recreation, tourism and amenity users in the vicinity of the site from increased construction traffic, and dust and noise nuisance. However, given there are no recognised visitor attractions or amenities within the study area there will be no negative effect on recreation, tourism and amenities.

Potential construction impacts along the cable route may occur as the cable is c. 16km in length with 14km installed in public roadways. Any disruption will be mitigated where possible by maintaining access for people throughout, and where this is not possible, by minimising the impact through the provision of clear and timely information on the timing and scope of planed works to the local community.

Operational Impacts

According to the Department of the Environment, Heritage and Local Government's document: Wind Energy Development Guidelines for Planning Authorities, 2006, tourism and wind energy developments can co-exist happily.

During the operational phase of the wind farm there will be a slight to imperceptible impact on tourism with views of the wind farm from the Slieve Bloom Mountains. This impact is not deemed significant due to the distance of the mountains and that wind farms are an already existing feature within the Irish landscape, of which those have set precedent for the proposed development's assimilation into the receiving environment.

It is not considered that the operation of the proposed wind farm development will have an significant adverse effect on tourism within the vicinity of the proposed development.

Decommissioning Impacts

There will be no impact on recreation, tourism and amenity in the study area associated with the wind farm during the decommissioning phase of the wind farm.

Residual Impacts

While there may be a temporary - short-term negative impact to recreation, amenity and tourism during the construction phase of the development, there will be no significant, adverse impacts in the surrounding area. During the operational phase of the wind farm there will be a slight to imperceptible impact on tourism with views of the wind farm from the Slieve Bloom Mountains. It is not considered that the operation of the proposed wind farm development will have any significant adverse effect on tourism within the vicinity of the proposed development.

[1] https://laois.ie/departments/heritage/laois-heritage-trail/aghaboe-abbey/

6.5 Human Health

As part of the human health impact assessment of the proposed wind farm development, an analysis of peer-reviewed health literature on potential effects arising from wind farm projects was undertaken. This demonstrated that there are generally no merits behind perceptions of negative health effects on people, living in proximity to wind turbines. The review of literature did not find any published, credible scientific sources that link wind turbines to adverse health effects.

Construction Impacts

Construction of the proposed development and associated roads will entail the establishment of a construction site, as is the case for wind farm developments of this scale. The construction site and materials utilised on site may give rise to potential health and safety hazards on construction workers and on the general public, if site safety rules are not properly implemented.

The proposed wind energy development will be designed, constructed, operated and decommissioned in accordance with the following:

- Safety, Health & Welfare at Work (Construction) Regulations 2013
- Safety, Health & Welfare at Work Act 2005
- Safety, Health & Welfare at Work (General Applications) Regulations 2007

Operational Impacts

Under normal conditions, presence at the site including the area of the turbines is safe for people and animals. There will be no fences or barriers restricting access other than normal livestock fencing, and livestock can continue to graze on the land during operation as normal. The proposed development is expected to have minimal impact on agricultural practices on the lands due to a small area of land being lost. This loss is not expected to have an adverse impact on livestock (cows or sheep) and horses in the surrounding area. There are numerous examples of wind farms where livestock coexist and graze routinely in fields hosting wind turbines. Existing land use, such as grazing livestock or crops can continue on the site as normal, therefore, there will be no adverse effect on farmers or other local residents who normally use the land as a result of the proposed development.

The rigorous statutory and engineering safety checks imposed on the turbines during design, construction, commissioning, operation and decommissioning will ensure that any associated the risks to humans are negligible. 24-hour remote monitoring and fault notifications are included as standard in the Turbine Operations and Maintenance Contracts. 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.

The health and safety record of the wind energy industry worldwide is exceptionally good. Wind energy has a better safety record than any form of power generation.

In terms of perceived effects from shadow flicker and noise, a shadow flicker assessment has been conducted and is included in Chapter 7 of this EIAR and a noise impact assessment is included in Chapter 8. In relation to shadow flicker, there will be no exceedances of the guideline limits as the Developer has committed to zero shadow flicker. In term of noise, operational wind farm noise levels will meet the derived night and daytime noise limits at all residential properties surrounding the wind farm. The impact under this criterion, is not considered to be of a significant magnitude.

Wind turbines, like all electrical equipment, produce electro-magnetic radiation. Underground electricity cables with capacities similar to those proposed are however common throughout Ireland and the installation to the required specification does not give rise to health concerns. The magnetic fields associated with underground cables decrease rapidly with distance, and decrease with the square of distance. The electric field emissions from underground cables are negligible as the ground absorbs the field. Due to the characteristics of the proposed development, there will be no impact on residential properties at any distance from the proposed development as the ICNIRP guidelines are not exceeded at any of the relevant distances including the ground directly above the cables.

Decommissioning Impacts

There will be no negative impact on human health arising from the decommissioning phase.

Mitigation Measures

A site-specific Safety and Health Management Plan has been prepared on a preliminary basis for the project in accordance with the requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2013 and is included in the Outline CEMP contained in Appendix 4.2 of Volume 3 EIAR Appendices.

The Safety and Health Management Plan will be finalised in accordance with this outline plan following the appointment of the contractor for the main construction works.

All hazards will be identified, and risks assessed. Where elimination of the risk is not feasible, appropriate mitigation and/or control measures will be established. The contractor will be obliged both under the construction contract and in accordance with all relevant health and safety legislation to adequately identify all hazards and eliminate them, or if this is not possible to minimise the risks associated with the construction phase of the project.

Safe Pass is a safety awareness training programme for construction workers. FÁS Safe Pass registration cards, which is a record of this training, are required for all construction, delivery and security staff on the site. 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 Plan.

Public safety will be addressed by providing appropriate information through local consultation and by restricting site access during construction. Appropriate warning signs will be posted, directing all visitors to the site manager.

No mitigation measures are required in relation to people and animals during the operational phase of the development.

For security purposes, access points to the towers and the substation compound are secured by locks and access will not be obtained without the corresponding keys. The substation will be enclosed by palisade fencing and equipped with intruder and fire alarms in line with ESB and EirGrid standards.

Fall protection in the form of a safety harness will be provided to allow personnel access to the nacelle. This refers to the part of the turbine which covers the generating components at the top of the turbine tower. Personnel will be connected to a central line running behind the ladder from the safety harness. This will prevent personnel from freefalling more than a few centimetres, hence reducing the potential for injury.

Adequate clearance of structures from overhead lines will be provided. In this case, all on-site electrical connections are carried by underground cable.

There will be lightning conductors on each turbine as all structures standing tall in the sky require protection and turbines in particular to allow surge protection to electrical components.

As no impacts from ELF-EMF have been identified, mitigation measures are not included.

Residual Impacts

Once construction mitigation measures are put in place, health and safety risks associated with the development are considered to be similar to those of a typical construction site.

There are no operational risks associated with the operation of the wind turbines and cables and once normal safety mitigation measures are implemented, the substation will not have impact on human health and/or safety.

6.6 Vulnerability of the Project to Natural Disasters

Should a major accident or natural disaster occur, the potential sources of pollution onsite during the construction, operational and decommissioning phases of the Dernacart Wind Farm development are limited. The primary sources of pollution with potential to cause significant environmental pollution and associated negative impacts on human health include the bulk storage of fuel for machinery and generators, hydrocarbons, chemicals and wastes. In the case of the proposed wind farm development site, bulk liquid storage of fuel or chemicals are very limited.

Ireland does not suffer from extreme temperatures like that of many countries at a similar latitude due to the dominant influence of the Gulf Stream. This provides Ireland with a mild temperate climate. However, Global climate change and rising temperatures are likely to increase frequency of storms. Impacts upon the Dernacart wind farm from such storms include high winds and lightning strikes. Wind turbines are designed with safety features which active in certain storm conditions. Examples of such safety features include automatic shutdown speeds or prolonged wind speed above a certain threshold. The turbines will also be equipped with lightning protection to protect against any potential lightning strikes. Potential natural disasters that may occur at the site are therefore limited to:

- Flooding;
- Fire; and
- Major incidents involving dangerous substances.

In respect of flooding the turbines are sited on elevated land to capture wind speeds and in any case wind turbines are not considered to be vulnerable infrastructure with regard to flooding. Fire hazards exist around the proposed wind farm development, in particular, given that part of the site is adjacent to forestry. While fire plans are not a requirement for private forestry they represent best practice and help in the prevention of forest fires. The proposed wind farm site is not close to any site regulated under the Control of Major Accident Hazards Involving Dangerous Substances Regulations i.e. SEVESO site, that would fall within the consultation radius distance from a SEVESO site as per Development Plan policy.

6.7 Material Assets

It is proposed to haul construction materials, from quarries and pits within the vicinity of the proposed development. The quarries and pits within the vicinity of the proposed development, provide sources of aggregates, hardcore, fill materials; washed sand and gravel, pebble sand aggregates, ready mix concrete, and mortar.

In terms of other non-renewable resources within the site area, there is peat beneath areas of forestry in the northern part of the site.

Construction Impacts

The construction of the wind farm will impact on natural resources such as aggregates which will be sourced from quarries and pits within the area. Existing tracks will be used where possible and the layout has been designed to minimise the length of new track required. This will contribute to minimising the requirement for such stone material. Peat will be excavated in areas of forestry where tree felling is required to facilitate development works relating to the wind farm. Surplus peat will be used to form berms along the access roads within the site.

The proposed development is intended to capture the renewable wind resource at the site and is located within an area determined by SEAI as having excellent wind resources for wind farm development. There will be no negative effects on the renewable energy resource of the receiving environment.

It is considered that the proposed development will have an overall positive impact in terms of carbon reduction and climate change. Any trees felled for wind farm purposes will be compensated for by planting a tree at another unplanted location as set out in Irish Forest Service Guidelines.

Utilities such as overhead power lines, telephone lines or underground services may require diversion or be temporarily disrupted during the construction of the wind farm development. The construction of the cable trenches, along c. 16km public roads, will have a negative temporary impact on the roads concerned during construction, with some roads likely to require re-surfacing. Importation of materials and equipment for Dernacart Wind Farm will also increase shipping traffic at the ports being used and increase freight on the motorway, national primary route and regional road network along the designated haulage routes.

Operational Impacts

Once Dernacart Wind Farm development is operational, the potential for negative effects on material assets is minimal.

It is likely that a small amount of aggregate / granular material is required to maintain access tracks throughout the operational phase.

The direct effect of electricity generated by the proposed wind farm development will give rise to a reduction in the quantity of fossil fuels required for electricity generation across the State. This will give rise to a positive impact and will contribute to reducing Ireland's dependency on imported fuel resources.

Decommissioning Impacts

There will be no negative impact on material assets arising from the decommissioning phase.

Mitigation Measures

During construction, it is proposed to undertake slit trenching to identify existing underground services along the proposed cable routes. This will minimise the likelihood of disruption or damage to existing utilities. It is not intended to divert existing services but instead where possible the cable will be laid above or below existing services. Communication with the relevant services providers will be maintained for the duration of the construction works.

Non-renewable resources will be sourced locally, insofar as possible to minimise transportation distances and indirect impacts on climate change.

Residual Impacts

While limited quantities of non-renewable resources such as aggregates and cement will be used to construct the wind farm, the proposed development will result in a positive residual impact on non-renewable resources by offsetting the use of fossil fuel power generation.

7 SHADOW FLICKER

Under certain combinations of geographical position, wind direction and times of day and year, the sun may pass behind the rotors of a wind turbine and cast a shadow over the windows of nearby buildings. When the blades rotate and the shadow passes a window, to a person within that room the shadow appears to 'flick' on and off; this effect is known as 'shadow flicker'. The phenomenon occurs only within buildings where shadows are cast across a window aperture, and the effects are typically considered up to a maximum distance of 10 times the rotor diameter from each wind turbine; at greater distances the effects are generally considered to be negligible.

A study area of 1,700 m from each of the eight wind turbines was selected for this assessment. This is based upon ten times the maximum rotor diameter (170 m) that would be used within the proposed development, in order to present a worst-case scenario and define the largest possible study area. The assessment considers all identified potential shadow flicker sensitive receptors within and on the edge of the study area.

It is possible to predict the total theoretical number of hours per year that shadow flicker may occur in a building from the relative position of the turbines to the building, the geometry of the wind turbines, the latitude of the wind turbine site and the size & orientation of the windows potentially affected.

These predictions can then be used to determine the times necessary to apply curtailment to each turbine in order to mitigate the effects of shadow flicker.

The potential for shadow flicker to occur and the intensity and duration of any effects depend upon the following factors:

- the location of the window relative to the turbines;
- the distance of the building from the turbines;
- the turbine geometry;
- the time of year (which impacts the sun's trajectory across the sky);
- the frequency of cloudless skies (particularly at low elevations above the horizon); and,
- the wind direction (which impacts on turbine orientation).

The shadow flicker model calculates the total theoretical occurrence of shadow flicker at all receptors per year based on a worst-case scenario that 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 and the turbines (except where this is prevented due to topography). In reality this will not occur and for some of the time, turbines will not be orientated as described, whilst clouds will obscure the sun and line of sight may be obscured, for example, from leaves on trees.

In order to provide a more realistic prediction of shadow flicker effects, historical weather data can be used to apply a correction factor, which considers the frequency of clear skies when shadows may be cast.

In total, 109 properties have been identified within 10 rotor diameters of the turbines, and of these 98 have been identified as either dwellings or commercial premises (or could not be ruled out as either) and are therefore considered potential shadow flicker receptors. There are no receptors within 500 m of the wind turbines.

The remaining 11 buildings have been classified as uninhabited, derelict or otherwise insensitive to shadow flicker; these have not been considered as part of the shadow flicker assessment.

Operational Impacts

With due consideration of the annual average sunshine hours, the predicted likely levels of shadow flicker exceed the WEDG recommended 30 hours per year at 7 receptors within the 10 rotor diameter study area. At the remaining 71 receptors where shadow flicker may occur, annual shadow flicker is likely to be less than 30 hours per year.

Predicted likely levels of shadow flicker at the most affected receptor are approximately 39.9 hours per year; this is a conservative estimate and actual levels would likely be lower.

The predicted maximum theoretical hours per day of shadow flicker exceeds 30 minutes at 59 receptors within the overall study area. The maximum amount of shadow flicker per day predicted at any receptor is 1 hour 13.8 minutes (1.23 hours), however the average duration of shadow flicker effects at this receptor is likely to be lower, at 53.4 minutes (0.89 hours).

It is possible to ensure the complete elimination of shadow flicker at all receptors within 10 rotor diameters by ensuring that the turbines do not operate during the times and conditions that shadow flicker may occur. This will result in energy yield losses, which can be estimated based on the total theoretical predictions of shadow flicker as well as considering the 'likely' levels.

The assessment found that for shadow flicker levels to be reduced to zero at all sensitive receptors within the study area the turbines would need to be shut down for approximately 2.6% of the maximum potential operating time (assuming worst-case conditions). However, considering the 'likely' levels of shadow flicker this may be reduced to 0.68% of the maximum potential operating time. Given that the 'likely' levels are still a conservative estimate, the actual impact upon energy yield would be lower.

Mitigation Measures

Shadow flicker control modules, consisting of light sensors and specialised software, can be installed on the turbines to prevent operation during periods when shadow flicker may occur. The calculated shadow flicker periods can be input into the turbine control software and when the correct conditions are met i.e. the light intensity is sufficient and during a potential period of shadow flicker, individual turbines will cease operation until the conditions for shadow flicker are no longer present. This method of mitigation is typically used in the event of adverse shadow flicker effects occurring to prevent any further instances of shadow flicker at nearby receptors, rather than merely reduce shadow flicker to acceptable levels. For Dernacart Wind Farm, the applicant is committing to zero shadow flicker for all receptors within 1.7km (10 times the rotor diameter) of the turbines.

Residual Impacts

The results of the shadow flicker assessment predict that Dernacart Wind Farm has the potential to introduce shadow flicker at a number of buildings surrounding the site. The implementation of a scheme of mitigation to cease operation of the turbines during periods of potential shadow flicker will ensure that no shadow flicker effects are experienced within any sensitive building within 10 rotor diameters of a turbine.

8 NOISE AND VIBRATION

The proposed Dernacart Wind Farm is located within a rural environment, just south of an existing bog in an area comprising forestry and agricultural activities.

Baseline noise monitoring has been carried out at five receptor locations mainly to the south and west of the proposed wind farm to establish existing levels of background noise in the vicinity of the proposed wind farm, to enable appropriate noise limits for the site to be derived. One monitoring location was omitted from the further analysis as noise levels were elevated and were not considered to be representative of the wider noise environment in the vicinity of the proposed wind farm. The standard approach to derivation of noise limits is to carry out baseline measurements at several locations around the proposed site. Noise limits are then derived for the properties at which the measurements were carried out based on the results of these measurements. As it is not usually possible to carry out measurements at every property, properties near to the measurement property are then assigned the same limits as the measurement property. The operational impact at each of the measurement properties was appraised in accordance with the Institute of Acoustic's Good Practice Guidelines. As a conservative exercise, a worst-case envelope based on the lowest average noise levels at all measurement properties was used to derive a site wide noise limit and the operational impact from the wind farm was assessed.

The chosen noise monitoring locations were representative of the different noise environments in the vicinity of the proposed Dernacart Wind Farm development in addition to being located at some of the closest dwellings to the proposed wind farm development. The baseline noise monitoring was used to derive appropriate noise limits according to the Department of the Environment, Heritage and Local Government DoEHLG *Wind Energy Planning Guidelines*.[i]

Potential noise and vibration impacts during the operational phase and construction phase were assessed.

The predicted on-site construction noise is predicted to be greatest from works associated with the preparation of access tracks at dwellings near to the site entrance. With mitigation measures, construction phase noise and vibration levels will be below the relevant limits. These works are expected to have a moderate impact and temporary in duration. All other on-site construction works are slight impact and temporary in duration. There is potential for temporary elevated noise levels due to the grid connection works but these will be limited to a small number of dwellings (one dwelling within 10m and a further 53 dwellings located 10-25m from the works). However, elevated noise levels from these works will be for a temporary duration at a particular property (i.e. less than 3 days). The works are expected to have a significant temporary impact.

Operational noise from the proposed turbines are predicted to meet the derived daytime and night-time noise limit at all occupied dwellings and planning applications for dwellings surrounding the wind farm and no mitigation will be required. However, new sources of noise will be introduced into the soundscape and it is expected that there will be a long-term slight to moderate significance of impact for dwellings within the 35 dB L_{A90} study area with a moderate significance of impact on the closest dwellings to the proposed wind farm. Operational noise from the substation is within derived noise limits. The significance of impact from the substation at the nearest noise sensitive location is expected to be not significant.

Operational noise from the proposed development including the cumulative impact from other nearby wind energy developments were considered. There are three wind farms within 20 km of the site but are sufficiently distant (between 12km and 20km) so that they do not contribute to the operational noise from the Dernacart Windfarm. Therefore, there is no significant noise or vibration effect associated with the day to day operation of the site.

9 TELECOMMUNICATIONS AND AVIATION

The telecommunications impact study comprised of four primary stages:

- Telcom Operator Consultations
- Field Surveys
- Desktop Survey Network Modelling and Analysis
- Mitigation Measure Proposals
- Report Generation

Aviation interests in the vicinity of the development site have also been assessed within this chapter to determine if any implications would occur on the operations of communications, navigation and surveillance systems used for air traffic control.

Ai Bridges was commissioned to evaluate the possible effects that the proposed wind farm could have on existing telecommunications networks. Consultation was carried out by AI Bridges with all known Telecommunications Operators (TOs) that could potentially be affected by the proposed wind farm.

Operational Impacts - Telecommunications

In line with the Wind Energy Development Planning Guidelines and Best Practice Guidelines for Irish Wind Energy, consultation was undertaken by Ai Bridges to provide information on the proposed development to all relevant telecommunications service providers, and to discuss concerns as well as the potential for benefits of the proposed wind farm. The service providers were provided with an indicative turbine layout and asked to advise whether any impact could occur to their networks. Eir/Meteor, OpenEir and Vodafone raised concerns with regard to microwave links. However, OpenEir have stated that they expect this link to be decommissioned in the next few months.

There are two telecoms mast sites within 10km to the southwest of the proposed wind farm. These sites are at Capard (Site A and Site B).

No license exempt infrastructure was identified by operators during the consultation process. However, during the field survey a number of unlicensed radio antennas were observed with bearings in the general direction of the proposed wind farm.

None of the telecom operators contacted during consultation have stated any concerns regarding their GSM Access Networks.

None of the telecom operators contacted during consultation have stated any concerns regarding their 3G/4G Access Networks.

TETRA Ireland raised no concerns in relation to the proposed wind farm development.

The nearest airport/airfield to Dernacart Wind Farm is Ridge Aviation which is located ca. 9km to the southeast of the proposed wind farm. There are no PSR or SSR radar systems at this airfield. The nearest PSR/SSR system is located at Dublin airport which is in excess of 75km from the proposed wind farm. This is categorised as Zone 4 and therefore no assessment is required. As there are no aviation radar navigational equipment in close proximity to the proposed wind far, there should be no impact to the IAA telecommunications network.

Mitigation Measures - Telecommunications

In relation to the Eir link between Capard and Cooltycannon, the proposed mitigation is to re-route the link for Cooltycannon (OY_4718) to another Eir site away from the wind farm area.

In relation to the Vodafone link between Capard and Clonyquin, it is proposed to mitigate this by re-routing the link to Clonyquin from another Vodafone site (at Portarlington), away from the wind farm area.

Consultation with RTE indicates that there will be no impact to any of their microwave telecoms links but there is low to moderate risk of interference to TV reception to any households to the west and north west of the windfarm development. Mitigation of this potential interference could require some remedial measures in relation to television reception. In practice, such measures are not difficult to implement, are relatively inexpensive and if necessary will be undertaken by the developer in conjunction with 2rn/RTÉ. A 2rn Protocol Agreement has been signed by the applicant and 2rn in relation to interference on viewers television sets and broadcast radio receivers.

Residual Impacts - Telecommunications

The implementation of a suitable mitigation strategy will ensure that local telecommunications are not adversely affected by the development of the Dernacart Wind Farm. The telecommunications mitigation strategy shall be carefully implemented to ensure there are no unintended consequential effects, such as:

(a) Introducing any new impacts to existing telecommunications services.

(b) The cumulative effects of additional turbines, or additional wind farms.

(c) Cumulative effects of any mitigation methods.

(d) Any interaction with regard to other existing or proposed wind farms, or telecommunications facilities, in the area.

Aviation

Limetree Airfield is located ca. 6.1km south-east of the proposed Dernacart Wind Farm. Ridge Aviation is situated ca.10km south-east of the proposed development site. Other airfields in the vicinity include Kilrush Airfield and Birr Airfield, however both are located more that 30km away from the site location

With regards to aviation telecommunication systems, the nearest PSR/SSR system is located at Dublin airport which is in excess of 75km from the proposed wind farm (i.e. EUROCONTROL Assessment Zone 4 – No assessment required.)

FT has undertaken a specific aviation consultation with the various aviation stakeholders to establish whether any services or infrastructure in the vicinity of the proposed Dernacart Wind Farm can be affected by it. During a phone call with Limetree Airfield, concerns were raised about the distance of the proposed site to the existing airfield. A follow up email was requested with details about tip heights and turbine locations. Subsequently the airfield confirmed that they have no observation to make. Ridge Aviation expressed no concerns about the development. No response was received from Kilrush or Birr airfields.

Construction Impacts - Aviation

The IAA have no specific observations or requests with regard to the proposed development. During the construction phase there is potential for cranes to affect overflying aircraft if not properly lit.

Operational Impacts - Aviation

During the operational phase of the development it is not anticipated that there will be any impacts on the surrounding environment.

As there are no aviation radar navigational equipment (PSR or SSR) in close proximity to the proposed development there should be no impact to the IAA telecommunications network.

Mitigation Measures – Aviation

In the event of planning consent being granted, the applicant should be conditioned to contact the IAA to; (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 and (3) notify the IAA of intention to commence crane operations with a minimum of 30 days prior notification of their erection. All other requirements can be clarified when the applicant consults with the IAA to agree the aeronautical obstacle warning light scheme, should planning be granted.

The Department of Defence requirements will be implemented as follows:

- Single turbines or turbines delineating corners of a wind farm should be illuminated by high intensity obstacle strobe lights (Red);
- Obstruction lighting elsewhere in a windfarm will be of a pattern that will allow the hazard to be identified and avoided by aircraft in flight;
- Obstruction 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 850 nanometres (nm) of wavelength. Light intensity to be of similar value to that emitted in the visible spectrum of light Obstruction lights used should be incandescent or of a type visible to Night Vision Equipment.

Residual Impacts

No residual impacts are expected following the implementation of the above measures.

10 TRAFFIC AND TRANSPORTATION

It is estimated that the construction of the development will take approximately 12 months. There are a number of items which will be conducted in parallel, but the basis construction programme would involve site establishment, site access road construction, hardstanding construction and substation works, the grid connection works are likely to be done in parallel with the site works. The turbine installation works will be completed before commissioning, reinstatement, and landscaping.

The proposed site entrance is at the local road (L2092) between the N80 and Kilcavan. The site entrance has been designed to accommodate the turbine component deliveries but also to achieve adequate sight lines in both directions. The site entrance is located on a straight section of road which has good visibility in both directions. Sightlines of 160m are achieved in both directions at a setback distance of 3m and is designed in accordance with TII guidelines.

The grid connection is proposed to route from the on-site substation to the future proposed substation at Bracklone in Portarlington. The cable will follow the route along a local road on the eastern boundary of the site, joining the R423. The grid connection is then proposed to be laid in the R423 to Portarlington Golf Club. At Portarlington Golf Club, the grid route follows a local road to Kilbride. At Kilbride the grid route will follow local roads to the R420 and connect to the future proposed Bracklone substation. The grid connection to the future substation at Bracklone will also involve crossings at the railway.

In constructing the new wind farm project, materials and plant will need to be delivered to site. The material haul routes will include some of the surrounding road network and will need to cater for the additional traffic associated with the development.

Turbine deliveries will likely be from Dublin Port to the M6, where the turbine components would travel to Junction 5. At Junction 5 of the M6, the turbine component deliveries would exit the motorway and travel along the N52 traveling through the Ardan, Cappincur, Cloncollig and Clonminch roundabouts. At the Clonminch roundabout, the deliveries would travel along the N80 through Killeigh to the site entrance at Dernacart. The turbine delivery route is displayed in Figure 4.3 in Chapter 4. At the junction of the N80 and the local road leading to the site entrance, a turning area is required for the delivery truck. It is proposed to use a blade adaptor to minimise the land required at this location. The blade adaptor is capable of raising the blade from its horizontal position to a vertical position thus reducing the swept path/length of the load and reducing the requirements for hedge trimming/land takes etc. The blade is connected to a specially adapted motorised unit and tilted up to 60 degrees into the air and transported through the restricted area. The tilting of the blade reduces the length and thus a reduced area of land is required for the transportation of the blade.

Construction Impacts

The wind farm construction activities associated with the wind farm will lead to additional construction related traffic on the existing public road network over the duration of the construction works. These impacts will include:

- HGVs transporting materials to and from the site, including road making materials, concrete, building materials, drainage/ducting materials, cabling, electrical components and excavated material;
- HGVs transporting conventional earthworks machinery such as excavators, dumper trucks and rollers;
- Fuel trucks transporting fuel for plant to each site compound during the construction phase;
- LGVs such as cars, 4x4s and vans used by the workers and supervisory staff involved in the construction works;
- Abnormal loads including turbine components.

Based on exiting AADT volumes and capacity of the N80, the proposed temporary increase in traffic due to the development during the construction phase will be low. The associated adverse impact is considered to be temporary in duration and slight in significance.

The grid connection construction works will require a combination of temporary traffic diversions and temporary lane closures along the proposed route.

The impact of the traffic diversions and lane closures on a section of road will depend on the location of the grid connection works and active traffic at the time of installation. The negative impact of the grid connection works is anticipated to be temporary and 'slight' to 'moderate' in significance without appropriate mitigation (i.e. traffic management).

The delivery of turbine components including blades, tower sections and nacelles is a specialist transport operation owing to the oversized loads involved. The blades are the longest component and have been considered for the purpose of this assessment. The impact of the turbine deliveries is anticipated to be temporary in duration and 'imperceptible' in significance.

It is estimated that the construction phase for the wind Farm will lead to 14,516 additional HGV trips (two-way) over the duration of the construction works. The combined HGV and LGV average daily increase is 97 trips per day.

Operational Impacts

The wind farm will be monitored remotely once operational. The only associated traffic with the operational phase of the wind farm will be from the wind farm owner/operator, ESBN and EirGrid personnel visiting the substation, and maintenance staff. There will also be a limited infrequent attendance by routing environmental monitoring/compliance staff.

Routing turbine maintenance is generally conducted by personnel climbing inside the tower. However, there may be circumstances where a crane may need to be mobilised to site to conduct non-routine maintenance.

The adverse impact associated with the estimated number of vehicles visiting the site is deemed to be imperceptible in significance.

Decommissioning Impacts

During the decommissioning phase, the dismantled turbine components will be removed from site and are likely to be broken up before removing from site.

Cables installed in ducts are likely to be removed and areas of hardstanding and access roads no longer required will be reinstated or covered in topsoil.

Negative or adverse effects on the receiving environment associated with decommissioning works considered to be temporary in duration and slight in significance without appropriate mitigation.

Infrastructure associated with the grid connection will form part of the national transmission network and will be left in-situ. Therefore, no impacts are envisaged upon decommissioning of the wind farm development and no mitigation is required.

Mitigation Measures

Mitigation measures include the following:

- A Traffic Management Plan to be implemented
- A Traffic Management Coordinator to be appointed
- Road pre-condition survey to be carried out
- Road reinstatement on completion of the works
- Site inductions – all workers will receive an induction
- 24-hour emergency contact
- Traffic management guidance – all temporary traffic management will be planned and executed in accordance with best practice
- Letter drops will be carried out
- Signage – clear signage will be provided
- Road sweeper – if necessary a road sweeper will be used

- Site entrance – the entrance will be secured when not in use and when necessary a flagman will be used

For the grid connection a road opening licence will be required. In advance of the works route proofing will be conducted. Local access will be maintained and measures will be taken to prevent soil/dirt on the road. Trenches will be backfilled and reinstated to the satisfaction of the roads authority.

For the turbine deliveries, a programme will be submitted to the roads authority. Any areas affected by the works will be reinstated to its original condition. Consultation will be conducted with the local authority.

Mitigation measures adopted for project decommissioning shall be in line with those identified for the construction phase of the development.

Residual Impacts

Negative or adverse effects on the receiving environment associated with the construction works within the main wind farm site are considered to be short-term in duration and slight in significance following mitigation.

Negative or adverse effects on the receiving environment associated with the turbine delivery route are considered to be temporary and imperceptible following mitigation.

Negative or adverse effects on the receiving environment associated with the grid connection route are considered to be temporary and slight following mitigation.

The trip generation for the development once operational is anticipated to be minimal. Effects on the receiving environment associated with the operation phase of the development are considered to be neutral in terms of quality, long-term in duration and imperceptible in significance.

11 LANDSCAPE AND VISUAL

Landscape Impact Assessment (LIA) relates to assessing the effects of a development on the landscape as a resource in its own right and is concerned with how the proposal will affect the elements that make up the landscape, the aesthetic and perceptual aspects of the landscape and its distinctive character.

Visual Impact Assessment (VIA) relates to assessing effects of a development 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).

The Wind Energy Development Guidelines published by the Department of the Environment, Heritage and Local Government (2006) specify different radii for examining the zone of theoretical visibility of proposed wind farm projects (ZTV). The extent of this search area is influenced by turbine height as follows:

- 15 km radius for blade tips up to 100m;
- 20 km radius for blade tips greater than 100m and;
- 25 km radius where landscapes of national and international importance exist.

In the case of this project, the blade tips are up to 185m high, and, thus, the minimum ZTV radius recommended is 20km from the outermost turbines of the scheme.

There are not considered to be any sites of national or international importance between 20 – 25km and thus, the radius of the study area will remain at 20km. Notwithstanding the full 20k 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 impact to occur. When referenced within this assessment, the central study area is the landscape within 5km of the site.

The landscape of the study area is predominantly flat to gently undulating, particularly in the central study area, with isolated hills in the south/southeast and the north/northeast, as well as the Slieve Bloom Mountains in the southwest, which exceed 500m AOD in height. A subtle elevated area also emerges northwest of the central study area, and plateaus at approx. 130m AOD. Most of the central study area, as well as large swathes of the north-eastern section of the study area, remain below 90m AOD. The site of the proposed development is located in relatively low-lying lands below the 80m contour level. A small tributary of the River Barrow flows through the site and to the east of the site is another tributary of that river.

The proposed Dernacart Wind Farm site is located along peatland fringe farmland and forestry at the southwestern and southern periphery of a substantial cutaway peatland area. Landcover on the site of the proposed development entails peat bog, coniferous forest and pasture. A large cutaway bog is located to the north and east of the site, while to the south and west are agricultural lands.

Given the highly visible nature of commercial wind energy developments, it is not generally feasible to screen them from view using on-site measures as would be the primary form of mitigation for many other types of development. Instead, landscape and visual mitigation for wind farms must be incorporated into the early stage site selection and design phases.

In this instance the two main forms of landscape and visual mitigation employed are:

- The use of fewer taller turbines rather than a greater number of shorter turbines (height versus density relationship);
- Consolidation of the turbine layout;
- The buffering of residential receptors;
- The positioning of turbines within, between and in the direct vicinity to existing mature/semi-mature woodland.

Overall, it is considered that the central study area is a robust, highly-modified and productive rural area without a high degree of distinction or uniqueness. The land use pattern is broad and only marginally productive in some areas and yet there is little sense of the naturalistic. Landscape value tends to relate to supporting the local rural economy rather than scenic, recreational or naturalistic values. Other than the town of Mountmelllick in the south of the study area, land uses tend to be of a relatively low level of intensity, and this is complimented by a similarly low level of large scale built development beyond that town, and the small village of Clonygowan in the far north of the central study area. For these reasons the sensitivity of the central study area is generally considered to be Medium-low.

The wider study area, however, is less homogenous than the central study area, in terms of landscape character. While it is predominantly an ostensibly flat or slightly undulating productive rural area contained in pastoral farmland and interspersed by peat bogs with peripheral forest plantations, this is diversified by the presence of the Slieve Blooms in the south-west quadrant of the study area, as well as occasional low hills or promontories rising from the plains in the southeast quadrant (e.g. the Rock of Dunamaise). In summary, it is considered that aside from some isolated landscape features, which are considered to be in the higher ranges of sensitivity, the vast majority of the outer study area has a landscape sensitivity that is no greater than that of the central study area – Medium low.

In summary, there will be physical impacts on the land cover of the site as a result of this development, but these will be relatively minor in the context of the already modified context of cutaway peatland, conifer plantations and pastoral farmland. Effects on landscape character will be most noticeable within the central study area (<5km) due to the perceived scale, intensity and extent of the proposed development in this immediate context. The proposed wind farm will be a new and defining feature of the landscape character in the central study area, but it is not considered to be an incongruous feature within this robust and anthropogenic landscape setting. On balance, the magnitude of landscape effect in the central study area is deemed to be Medium-low in the nearest 2-3km. This is likely to reduce to a Low magnitude beyond this threshold.

Within the wider study area, beyond 5km, the effects on landscape character are considerably lower and will reduce further as separation distance increases. The proposed wind farm will be perceived as one form of development within a pattern of other broad scale anthropogenic land uses. Even if visible from landscape areas/features beyond 5km, the proposed wind farm will be perceived as a discrete background feature of another landscape area.

Consequently, the magnitude of landscape effect for the wider study area is judged to be no greater than Low-negligible out to approximately 10km and only when clear indivisibility exists. Beyond this distance threshold the magnitude of landscape impact is considered to reduce to Negligible.

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 used in combination with professional judgement. The significance of landscape impacts is considered to be Moderate-slight within the immediate context of the site (nearest 2-3km). Thereafter, significance will reduce to Slight and Imperceptible at increasing distances, as the development becomes a progressively smaller component of the wider landscape fabric.

As part of the visual impact assessment, 21 no. viewpoints were selected and photomontages prepared to illustrate and assess the visual impact of the proposed wind farm. The significance of the visual impact varies from imperceptible to moderate. The visual impacts of the proposed development were assessed across 21 different representative viewpoints from a wide range of angles, elevations and distances within the study area. Of the 21 viewpoints assessed, the proposed development will have an 'Imperceptible' impact upon visual amenity in the majority of instances (i.e. 11 viewpoints: VP1, VP3, VP4, VP10a, VP12, VP13, VP15, VP16, VP17, VP18 and VP20). As the proposed development includes eight turbines with a tip height of 185m, there is a distinctively high number of receptors that will not experience any material impact to their visual amenity as a result of the proposed development. Indeed, in the vast majority of these 11 viewpoints, no aspect or element of the proposed development will be seen from these locations, which are generally within the wider landscape of the study area.

In terms of designated views, for the County Laois designated views, that from the Rock of Dunamaise (i.e. VP2) was deemed to have a 'Slight' significance of visual impact, while that from the Slieve Bloom Mountains (i.e. VP19) was deemed to have a 'Moderate-slight' significance of visual impact. For the two relevant designated views/prospects in County Offaly and the one in County Kildare, the significance of visual impact was deemed to be 'Imperceptible' in all three cases.

Local Community views are considered to be those experienced by those people who live, work and move around the area within approximately 5km of the site. These are generally the people that are most likely to have their visual amenity affected by a wind energy proposal due to proximity to the turbines, a greater potential to be surrounded by turbines or having turbines as a familiar feature of their daily views. These local community VP locations are all selected on the basis of the most open views available in order to represent a worst-case scenario. It is important to note that open views are not necessarily typical views of the scheme from within the local landscape.

In this instance, the viewpoint selection set well represents views from local roads and residences, as well as the small and sometimes dispersed rural settlements that occur within the near vicinity of the proposed Dernacart Wind Farm. These selected viewpoints are not a reflection of a high population density in this rural area, or the relative proximity of the population to the proposed turbines, as both are fairly typical scenarios in the Irish context. Instead, it reflects a desire to focus the assessment on those receptors with the most potential to be impacted by the proposed development. Consequently, one third (i.e. 7) of the 21 VPs were specifically selected as Local Community views. Of these, the highest level of visual impact significance is considered to be 'Moderate,' and this occurs at three of the VP locations (VP8, VP9 and VP10b). VP8 and VP9 are located within 1.2km of the nearest turbine and share a general absence of foreground screening (e.g. mature roadside trees), resulting in open and relatively close views of the proposed turbines.

Seven viewpoints were selected to represent '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. Of the seven viewpoints, the highest level of impact is deemed to be 'Moderate-slight' at VP7, located within the northern outskirts of Mountmellick town, less than 2.5km from the nearest proposed turbine. In this instance, three proposed wind turbines will be visible, with a fourth partially discernible, along the blade tip of a fifth turbine, but will not be spatially dominant within that complex and highly-modified vista.

The second highest level of impact was from VP5 on the outskirts of Portarlington ('Moderate Slight'), which will reveal a partial blade set of one proposed turbine and the blade tip of another proposed turbine will be seen rising above a treeline to the west. However, being located on an elevated bridge over the Dublin-Cork rail line was largely responsible for attaining such a view of the proposed development.

Of the remaining five viewpoints that were selected to represent 'Centres of Population', these covered the towns of Portlaoise, Tullamore and Mountrath, as well as the villages of Clonygowan and Clonasee. In all five cases, the resulting visual impact significance was deemed to be 'Imperceptible.'

In terms of cumulative impacts, overall, it is considered that the proposed wind farm represents a minor and suitably located addition to the wind energy development that is gradually becoming a more characteristic landscape feature throughout the lowland, midlands landscape, particularly within marginal peatland areas. There are few opportunities for indivisibility of the proposed wind farm in-combination with other wind energy developments from within the lowland plains fabric of Laois, Offaly and Kildare. Where such rare elevated vantage points allow for indivisibility, one of the developments is a distant background feature in the view of the other. Consequently, these are deemed to be Low.

12 BIODIVERSITY

12.1 Introduction

The ecological appraisal for the project was carried out by Fehily Timoney & Company (FT) between July and December 2019. A series of ecological surveys were carried out at the site of the turbines, onsite substation and the route of the proposed underground grid connection running to the proposed Bracklone Sub-station east of Portarlington in Co. Laois. FT completed habitat and botanical surveys, bird surveys, and mammal surveys. Ecofact Environmental Consultants Ltd. carried out aquatic surveys and evaluation. Bird and Bat surveys were carried out during summer 2018, winter 2018/19 and summer 2019 by Natural Power Consultants. Kilnahown Bridge (along proposed cable route) was surveyed for bats in September 2019.

12.2 Existing Environment

The site does not overlap any designated nature conservation site but is upstream of the River Barrow and River Nore SAC (002162); a number of small streams drain the proposed site and surrounding lands towards the Barrow. In total there are five European Sites within 15km of the proposed development. The Natura Impact Statement contained in Appendix 12 assesses the effects of the proposed wind farm development on European Sites. In terms of Nationally designated sites, there is one Natural Heritage Area (NHA) and four proposed Natural Heritage Areas (pNHAs) within 10 km of the proposed wind farm, while a further three pNHAs are present within 10 km of the proposed grid connection route.

12.2.1 Habitats and Flora

Habitats present within and adjacent to the site include the following:

- Depositing/Lowland Rivers
- Improved Agricultural Grassland
- (Mixed) Broadleaved Woodland
- Mixed Broadleaved/Conifer Woodland
- Conifer Plantation
- Treelines
- Hedgerows
- Scrub
- Bog Woodland
- Buildings and Artificial Surfaces
- Dense Bracken
- Cutover Bog
- Wet Grassland
- Artificial Lakes and Ponds

The cable route from the on-site substation to Bracklone substation along the road corridor (buildings and artificial surfaces, grassy verges, hedgerows, treelines and amenity grassland). These habitats are also present along the turbine delivery route.

No rare or protected flora species were recorded during the site surveys. Giant hogweed, an invasive species, is present nearby, but outside the proposed site boundary.

12.2.2 Ornithological Surveys

Ornithological surveys were carried out over two years for the proposed wind farm development. Flight activity (vantage point) surveys undertaken during both winter and breeding seasons covered the proposed wind farm site and surrounding area. Breeding bird surveys including common bird census, moorland breeding bird survey and breeding wader surveys were undertaken in 2018 and 2019, while a monthly wader census, winter walkover surveys and hen harrier winter roost checks were carried out during winter 2018/2019.

A total of 43 bird species were recorded during breeding season surveys, while 24 species were recorded on-site during winter walkover surveys.

Target bird species present within and in the environs of the site included:

- Grey Heron
- Lapwing
- Golden Plover
- Woodcock
- Snipe
- Jack Snipe
- Sparrowhawk
- Merlin
- Kestrel
- Peregrine Falcon
- Black-headed Gull
- Herring Gull
- Lesser Black-backed Gull

12.2.3 Mammal Surveys

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

In 2018 (activity season), preliminary roost assessments, activity (transect) surveys, emergence surveys and static detector surveys were undertaken. A total of three species (common and soprano pipistrelle, Leisler's bat) were recorded within the study area, while *Myotis* sp. and *Pipistrellus* sp. (identified to genus level) were also recorded. A derelict building c. 600m from the nearest proposed turbine was confirmed to contain a single soprano pipistrelle.

A hibernation roost survey was carried out in winter 2018/2019, comprised of potential roost inspections and deployment of static detectors at potential roost locations. No evidence of wintering bats was recorded.

Static detector surveys were undertaken again in 2019 (activity season) common and soprano pipistrelle, Leisler's bat, *Myotis* sp. and *Pipistrellus* sp. were recorded, while an additional species, brown long-eared bat was also recorded. The online analysis too *Ecobat* was used to analyse data from static detector surveys.

A daytime torch inspection of Kilnahown Bridge along the proposed cable route in late September 2019 recorded 2 no. Daubenton's bats roosting in the stonework of the dry arch on the southern bank.

12.2.4 Aquatic Ecology

The proposed Dernacart wind farm is located within the River Barrow catchment. The watercourses surveyed are the Barrow River, Clonygowan Stream, Cottoners Brook, White Hill (E) Stream, Forest Upper Stream and White Hill (W) Stream. All of the sites are located within the Barrow catchment. No Annex I habitats were noted at any of the survey sites. The non-native invasive species Jenkin's spire snail was recorded at survey sites 1 and 5 on the Barrow. No interaction with this species will occur as a result of proposed works.

No signs of otter *Lutra lutra* were found during the current surveys of the study area, although it is noted that the species has been recorded in the vicinity. Common frog *Rana temporaria* was recorded in bog woodland north-east of T6; the drains and ponds within the study area offer potential breeding habitat for frogs. It is noted that the minor watercourses draining the proposed wind farm site, cable route and surrounding areas are in poor condition and are not of ecological or fisheries significance.

12.3 Construction Effects

An evaluation of all habitats, bird species, mammal and other fauna, and aquatic species was conducted. Effects on biodiversity were then assessed. The findings are presented in Chapter 12.

The NIS submitted with this planning application addresses potential effects on European Sites resulting from the proposed development. There are no downstream hydrological links between the proposed development and the national sites located within 10 km.

Construction of the wind farm will lead to some permanent loss of habitat.

The habitat loss will be the total area covered by the roads plus the footprint of each of the proposed turbines, all other wind farm infrastructure, and turbulence/bat mitigation felling buffers. The total predicted habitat loss as a result of the proposed development is 22.4 ha or ca. 7.6% of the study area; of this, 78% of the land take is from coniferous forestry plantation.

Without mitigation in place the following effects during construction include:

- Badgers - a short-term significant effect is predicted for badgers due to the proximity of setts to the development.
- Red squirrel – short term significant effect
- Irish hare – short term imperceptible effect
- Pine marten – possible short-term significant effect
- Otter – no direct effects
- Irish stoat – short term imperceptible effect
- Hedgehog – short term imperceptible effect
- Pygmy shrew – short term imperceptible effect
- Bats – removal of linear features: long-term slight-moderate effect

Indirect effects could arise due to disturbance to fauna; however, this will be temporary in nature and affected mammals will be able to move to other locations in the wider area until the disturbance has ceased.

Indirect effects to otter through a reduction in water quality in and around the proposed development reducing prey availability are unlikely to occur since the streams draining the proposed development are of poor ecological status.

The potential likely significant effects of wind turbines on birds are considered as:

- Possible loss or deterioration of habitats; and
- Disturbance or displacement of birds.

For target species, the effect of habitat loss was assessed and its significance without mitigation assigned. Indirect effects due to disturbance displacement was also assessed.

Access tracks will be built to access proposed turbine locations where no access tracks currently exist. The internal tracks will cross the Forest Upper stream via an existing crossing point (to be upgraded) and also run parallel to a section of access track and section of proposed grid connection.

There is potential for releases of suspended solids and other substances associated with upgrading, realigning and construction of access roads within the site. Installation, upgrading and/or extension of an internal road network on a wind farm site and excavations can result in increased silt runoff, which may have a serious effect on the spawning sites of salmonids.

Engineering works in the vicinity of streams and stream crossings can also effect directly on physical habitat, for example nursery areas for fish. Permanent loss of aquatic habitats can also occur where access roads are constructed over or in close proximity to streams/rivers. Obstruction to upstream movement of fish, particularly salmon and trout, due to construction of culverts can also potentially occur.

Due to the low ecological and fisheries value of watercourse within and near the proposed site, no direct effects in this category are predicted. Potential direct construction phase effects on aquatic ecology, in the absence of mitigation, are assessed as being slight, negative, short-term and in the local context.

Aquatic species listed on Annex II of the EU Habitats Directive (1992) potentially occurring within the study area include the white-clawed crayfish, Atlantic salmon, brook lamprey and river lamprey. There is the potential for short-term moderate *indirect* effects to these protected aquatic species within the wider catchment. Potential effects affecting these species could occur as a result of water quality effects arising through accidental pollution events including the increased erosion which may give rise to elevated suspended solids and siltation effects.

There is also a risk that machinery or materials imported onto the site could act as a vector for introducing or dispersing non-native invasive species.

12.4 Operational Effects

The operational phase will have a lower potential to effect local habitats and fauna than the construction phase. The main potential operational effects arise from rotation of the blades of the wind turbines and, to a lesser extent, from vehicular movement through the site associated with wind turbine maintenance. The rotation of the blades may result in displacement due to the avoidance by birds of the area around the turbines. In addition, the rotating blades present a potential collision hazard to local bird and bat species. The rotation of the blades of the turbines may also result in increased noise levels which may also cause disturbance to local wildlife.

The NIS submitted with this planning application addresses potential effects on European Sites resulting from the proposed development. There are no downstream hydrological links between the proposed development and the national sites located within 10 km; as such no operational-phase effects linked to water quality are predicted in this category.

There is a potential effect (without mitigation) on water quality within the site, due to sediment erosion and runoff during the operational phase, which would be deemed to be short term, probable and slight until soils are re-vegetated. No further effects to habitats should occur during the operational phase of the wind farm.

Human activity associated with the maintenance of the operational windfarm will be infrequent and minimal. The proposed windfarm is located within a commercial forestry and agricultural area, so there is already disturbance caused by human activity associated with forestry and agricultural management. As a result, any negative effect to mammals during the operational phase of the windfarm is deemed to be a Long-term Imperceptible Effect.

Collision risk is a potential issue in relation to bats, particularly in relation to Leisler's bat, soprano pipistrelle, and common pipistrelle which are classified as at high risk of collision due to their hunting habits and flight patterns (SNH, 2019). *Myotis* spp. May also be at risk due to their tendency to swarm. During 2019, Common pipistrelle was the most frequent species on site accounting for 45% of recordings, followed by soprano pipistrelle (33%), Pipistrellus sp. (13%), Leisler's (5%) Myotis sp. (3%) and brown long-eared bat (1%)

In terms of avifauna, a collision risk model analysis was undertaken for the proposed wind farm. This modelling used data from vantage point surveys carried out in winter surveys of 2018/19 and summer surveys during 2018 and 2019. The species that were selected for collision risk modelling were: Black-Headed Gull, Curlew, Golden Plover, Grey Heron, Herring Gull, Jack Snipe, Kestrel, Lapwing, Lesser Black-Backed Gull, Merlin, Peregrine, Sparrowhawk, Snipe and Woodcock. These species have been selected because they were recorded within the 500 m buffers, and are of conservation concern: i.e., they are red or amber-listed in Birds of Conservation Concern Ireland 2014-2019 (Colhoun and Cummins, 2013), and/or are listed on Annex I of the Birds Directive (79/409/EEC). For each species, the collision risk was calculated, and the significance of the effect assessed.

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

Operational wind farms are not normally considered to have the potential to significantly effect on the aquatic environment. The main risk to watercourses is when oils and lubricants are used on site. If these leaked from the turbines or maintenance areas or were disposed of inappropriately, there is a risk of water pollution. However, the likelihood of this occurring is very low, and the potential significance of this effect can be mitigated through proper management. Spills of any oil or fuels from site vehicles onto the access roads may find its way to the local stream network. However, this is unlikely to be a significant effect considering the low numbers of vehicles involved and the high quality standards that are implemented on a well-managed site.

Upgrading of the site track/road network could allow increased public access to the site. This could potentially result in illegal dumping of domestic rubbish which could affect the watercourses in the area by causing a deterioration in water quality. Potential operational phase effects on aquatic ecology are assessed as being ***short-term moderate*** *and in the local context.*

Cumulative effects with other wind farms were assessed; since these wind farms are not within the same catchment, there is no potential for cumulative effects on water quality. There are several solar farms and one large housing development permitted in the vicinity of Dernacart Wind Farm. No significant cumulative effects to habitats of county or international importance, are likely. Similarly, no significant cumulative effects are likely to mammals or to aquatic ecology. In terms of cumulative operational effects on avifauna, no significant cumulative collision risks are foreseen due to the distance between the proposed development and other permitted wind farms. Similarly, no significant cumulative effect is foreseen in terms of barrier effect or displacement.

12.5 Mitigation Measures

12.5.1 Construction

The following mitigation is specified for construction stage:

- Appointment of Project Ecologist/Ecological Clerk of Works (ECoW) for duration of construction phase
- Minimise works footprint; habitat & species management plan
- Ecological supervision of vegetation clearance including scrub, hedgerow and woodland
- Construction operations limited to daytime to minimise disturbance to nocturnal fauna
- Felling operations to avoid combined pine marten/red squirrel breeding period (January-April inclusive) where possible
- Pre-construction mammal survey to confirm existing environment as described in EIAR
- Badger derogation/disturbance licence to be obtained to enact mitigation measures as informed by pre-construction survey
- Tree/vegetation clearance to be carried out outside the bird breeding season (March-August inclusive) where possible
- Felling to create vegetation-free buffer around turbines to reduce collision risk for bats (50m buffer between blade tip and top of surrounding trees
- Toolbox talks with construction staff on disturbance to key species during construction
- Re-survey of snipe breeding areas prior to construction to confirm findings surveys carried out pre-consent remain accurate. If construction works commence in these areas of the site during the breeding season, an exclusion zone of 500m will be placed around any recorded nest sites April to June
- Pre-construction Merlin survey at turbine locations; if Merlin present, restriction of works to outside breeding season (April-July)
- Placement of Merlin nest-baskets >500m from turbines
- Re-instatement of hedgerows with locally sourced native species
- Measures to protect water quality as detailed in Chapter 12 Biodiversity, Chapter 14 Hydrology and Appendix 4.2 CEMP
- Pre-construction amphibian surveys

12.5.2 Operation

- Measures to protect water quality as detailed in Chapter 12 Biodiversity, Chapter 14 Hydrology and Appendix 4.2 CEMP

- Post construction bird monitoring programme to be implemented at subject site to confirm the efficacy of the mitigation measures; surveys to be carried out and results submitted to the competent authority and NPWS during years 1, 2, 3, 5, 10 and 15 post construction (Fatality monitoring, flight activity surveys, monthly wildfowl census, breeding bird surveys and breeding wader surveys)
- Wheel washes draining to silt traps at site entrance to prevent possible spread of invasive species.
- The vegetation-free (bat mitigation) buffer zones around turbines will be managed and maintained during the operational life of the development.
- Bat monitoring for first 3 years of operation to determine activity levels post construction
- Bat mortality searches (years 1, 2, 3, 5, 10 and 15 post construction- to be carried out in conjunction with bird mortality searches)
- Implementation of feathering/increased cut-in speeds during conditions correlating with high bat activity pending outcome of post-construction monitoring and fatality searches

12.6 Residual Effects

There will be no residual effects to nationally designated sites (NHAs and pNHAs). European sites are considered separately in the NIS.

Construction of the wind farm will lead to some permanent loss of habitat (the total area covered by the roads plus the footprint of each of the proposed turbines and all other wind farm infrastructure and associated felling buffers). No interaction with invasive plant species is anticipated. No residual effects are anticipated.

Following mitigation, residual effects to badger, Irish stoat and red squirrel will be reduced to ***imperceptible negative effects***.

It is considered that overall the proposed wind farm will have an ***imperceptible residual effect*** on golden plover at an all-Ireland level. With the implementation of mitigation, the proposed wind farm will have an ***imperceptible-slight residual effect*** on birds.

In terms of aquatic ecology, residual effects are evaluated to be limited to a local context and will not affect the conservation status of key aquatic ecology receptors in the receiving waters.

Following implementation of mitigation measures, an ***imperceptible-slight residual negative effect*** on bats is anticipated, with the favourable conservation status (FCS) of bat species being unaffected and all species confirmed or expected on or near the study areas are anticipated to persist.

Residual effects are assessed as ***not significant*** for 'Other Taxa'.

13 LAND, SOILS AND GEOLOGY

The Quaternary Geology underlying the proposed wind farm site, as taken from the GSI online mapping, comprise Cut over raised peat (Cut), TILL derived from Limestones (TLs) and Gravels derived from Limestones (GLs).

The proposed wind farm site is predominantly underlain by cut over raised peat deposits. Areas of TILL derived from Limestones and pockets of deposits of Gravels derived from Limestone are located distributed through the central and southern portions of the proposed wind farm site.

The Quaternary Geology underlying the proposed grid connection, as taken from the GSI online mapping, comprise Cut over raised peat (Cut), TILL derived from Limestones (TLs), Gravels derived from Limestones (GLs), Alluvium and Urban sediments.

The future proposed Bracklone 110 kV cable route is predominately underlain by cut over raised peat, TILL derived from limestones, and gravels derived from limestones. The urban sediments are found at the eastern section of the grid connection at the town of Portarlington. There are small sections of alluvium located adjacent to the River Barrow.

The Geological Survey of Ireland (GSI) 1:100,000 scale bedrock geology map shows that the proposed wind farm site and associated access tracks are underlain by the Carboniferous Ballysteen Formation. The Ballysteen Formation is described as comprising bioclastic argillaceous limestone with oolitic limestones occurring through the formation.

The future proposed Bracklone 110 kV cable route is predominately underlain by Carboniferous formations including the Ballysteen Formation, Waulsortian Formation, Allenwood Formation and Lucan Formation.

The GSI Online Irish Geological Heritage database indicates that the proposed wind farm study area is not located in an area of specific geological heritage interest. The closest area of Geological Heritage is Glenbarrow located approximately 7 km south-west of the site.

The GSI Online Minerals Database accessed via the Public Data Viewer shows a number of active and historic quarries and mineral occurrences surrounding the study area. These consist of rock and sand and gravel quarries none of which are located within the proposed development site boundary. The nearest active quarries are 2 No. sand and gravel workings identified as Seamus Gorman Sand & Gravel quarries situated south of the proposed development site.

The Groundwater Vulnerability is classified by the GSI as being 'Moderate' across the majority of the proposed wind farm site becoming 'High' at the extreme east, west and south of the wind farm site. The extreme portion of the site is classified as being of 'Low' Groundwater Vulnerability.

All proposed turbine locations and the proposed temporary compound are located within areas mapped as at being 'Moderate' vulnerability to groundwater pollution. The proposed substation at the eastern extent of the proposed wind farm site is located within an area of 'High' vulnerability to groundwater pollution.

The proposed grid connection route traverses' areas of 'Moderate' to 'High' vulnerability along the majority of the proposed route. An area of 'Extreme' vulnerability is recorded at the eastern extent of the grid connection where overburden deposits are <3m in thickness.

The study area site is located within 3 No. groundwater bodies (GWBs). The proposed wind farm site is located within the Portlaoise GWB while the proposed grid connection traverses the Portlaoise, Bagnelstown Upper and the Cushina GWBs.

There are however 4 No. Source Protection Areas in the wider study area, and these are:

- Portlaoise, 8km south of the proposed wind farm site;
- Clonaslee, 6km west of the proposed wind farm site;
- Danganbeg / Meelaghans, 5.7km north-west of the proposed wind farm site; and
- Lough, 9km east of the proposed wind farm site.

There are no Group Water Schemes (GWS) in the immediate vicinity of the proposed development. The nearest recorded GWS held within the GSI database is the Killenard GWS which are located approximately 0.75km east of the proposed grid connection route.

Based on a review of the GSI Groundwater Wells and Springs database there are 28 No. Groundwater Wells and 1 No. spring recorded (10m to 1km accuracy) within 1km of the proposed development site. There are no groundwater wells or springs recorded by the GSI within the proposed wind farm site.

The slopes of the site are characterised by gentle slopes of between 1° and 3°. No evidence of slope instability was observed at the site and there are no historical records of landslide activity within or close to the site, on the GSI (n.d) database.

Construction Impacts

Impacts to land, soils and geology were found to be short term, slight to moderate in significance. Potential impacts include soil compaction, spills and leaks of fuels and oils, concrete pours, silt run off and soil erosion.

Impact to hydrogeology were found to be short-term, moderate/slight to moderate significance. Potential impacts include groundwater pollution due to the removal of overburden, silt infiltration, soil erosion affecting groundwater, contamination of groundwater from spills/leaks of fuels/oils, reduction in groundwater levels due to dewatering.

Indirect impacts include an increase in the demand for local aggregate and disposal of unusable backfill to waste facilities.

Operational Impacts

Some construction traffic may be necessary for the maintenance of turbines which could result in minor accidental leaks or spills of fuel/oils and the grid transformer in the substation and transformers in each turbine may be oil cooled and so there is potential for spills / leaks of oils from this equipment resulting in contamination of soils and groundwater. Also, there may be a small amount of granular material required to maintain access tracks which will place an intermittent minor demand on local quarries. These impacts are of slight significance.

Decommissioning Impacts

The potential impacts associated with decommissioning will be similar to those associated with construction but of reduced magnitude. During decommissioning, it may be possible to reverse or at least reduce some of the impacts caused during construction by rehabilitating construction areas such as turbine bases, hardstanding areas, the substation and site compound. This will be done by covering with topsoil to encourage vegetation growth and reduce run-off and sedimentation. Other impacts such as possible soil compaction and contamination by fuel leaks will remain but will be of reduced magnitude.

Mitigation Measures

A Construction Environmental Management Plan (CEMP) has been prepared for the proposed development. The CEMP defines the work practices, environmental management procedures and management responsibilities relating to the construction phase of the proposed development. The CEMP will be updated prior to construction to take account of any amendments arising during the consenting process and relevant conditions attached to the planning permission and will be implemented for the duration of the construction phase of the project. The CEMP will be a live document and will be reviewed and updated as required.

The development will be constructed in a phased manner to reduce the potential impacts of the development on the Land, Soils and Geology at the site. Phased construction reduces the amount of open, exposed excavations at any one time.

One of the primary mitigation measures employed at the preliminary design stage is the minimisation of volumes of excavated Peat and Glacial TILL deposits to be exported off site. Such material can be used to construct access tracks, hardstands and reinstatement around turbine foundations. Material can also be used for landscaping and berms.

To mitigate against the compaction of soil at the site, prior to the commencement of any earthworks, the work corridor will be pegged, and machinery will stay within this corridor so that peatland / soils outside the work area is not damaged.

To mitigate against erosion of the exposed soil or rock, all excavations will be constructed and backfilled as quickly as possible. Excavations will stop during or prior to heavy rainfall events. To mitigate against possible contamination of the exposed soils and bedrock, refueling of machinery and plant will only occur at designated refueling areas.

To minimise the impact to surface water quality, existing peat bog drainage will be maintained outside the immediate site area, and where appropriate additional site drainage and settlement ponds will be installed as required prior to construction activities. Silt fencing will be installed in new and existing drainage and monitoring of water quality undertaken during the construction phase.

Storage tanks, used to store fuel for the various items of machinery, will be self-contained and double-walled. Refuelling of construction vehicles will be carried out from these tanks or from delivery vehicles at designated refuelling areas.

With regard to slope stability issues, detailed design best practice will be implemented as follows:

- The works will be designed and supervised by a suitably qualified and experienced geotechnical engineer or engineering geologist, and hydrologist or drainage engineer;
- Peat stability monitoring program and appropriate instrumentation may be required where deeper in-situ peat deposits occur. The requirement and proposed location of monitoring instrumentation will be identified prior to construction works commencing on site. Excavation works will be monitored by suitably qualified and experienced geotechnical engineer;
- The programming of the works (by the Contractor) will be such that earthworks are not scheduled to be carried out during severe weather conditions. Where such weather is forecast, suitable measures will be taken to secure the works;
- Prior to the placement of peat in the proposed berms the existing ground conditions will be inspected by a suitably qualified and experienced geotechnical engineer or engineering geologist to ensure there is no potential for ground instability from the peat placement activities; and
- All temporary cuts/excavations will be carried out such that they are stable or adequately supported. Gravel fill will be used to provide additional support to drains where appropriate. Unstable temporary cuts/excavations will not be left unsupported. Where appropriate and necessary, temporary cuts and excavations will be protected against the ingress of water or erosion.

To mitigate against the increased vulnerability of the underlying aquifer to groundwater pollution, all excavations will be constructed and backfilled as quickly as possible. Excavations will stop during or prior to heavy rainfall events. To mitigate against possible contamination of the underlying, refueling of machinery and plant will only occur at designated refueling areas.

It is not envisaged that the operation of the proposed development will result in significant impacts on the geological and hydrogeological regimes within the study area, as there will be no further disturbance of overburden post-construction.

The main potential residual impact during the operation phase would be the risk to groundwater from contamination from spills. Due to the reduced magnitude of the impacts, no additional mitigation measures are required for the maintenance and operation of the wind farm, over and above those incorporated into the design of the substation transformer, which will be bunded to protect soils against accidental leakages of oil.

Residual Impacts

Following the implementation of mitigation measures, the residual impact significance to the receiving environment would be imperceptible during the construction period and imperceptible during the operation of the proposed development. Mitigation measures will be monitored throughout the construction and operational phases. The proposed development is not expected to contribute to any significant, negative cumulative effects of other existing developments in the vicinity. Slight residual cumulative effects from the excavation of fill material from local quarries and disposal of material deemed unsuitable for reuse are considered result from the proposed development by placing demand on existing quarries and available void space at licensed facilities during the construction phase of the development.

14 HYDROLOGY AND WATER QUALITY

Surface water runoff from the site drains to Forrest Upper stream, White hill (W) stream and Cottoner's Brook stream. These streams are tributaries of the River Barrow. In terms of the grid connection, drainage from the route is to the Forrest Lower Stream, White(W) Hill stream, Cottoner's Brook stream, Clonygowan stream, Rathmore stream, the River Barrow and an unnamed stream which is a tributary of the River Barrow.

Surface runoff from turbines T1 and T2 drains to the east to the Forrest upper stream. From there it flows for approximately 1.3 km to the south where it turns south westly towards the River Barrow. This stream rises at an elevation of 80 m OD approximately 310 m east of the turbine T1. Surface runoff from T3 drains to an unnamed tributary of Forrest upper, approximately 55 m north of the turbine. Surface runoff from turbines T4, T5, T7 and T8 drains to White hill (W) stream. From there it flows south-eastly for approximately 2.4 km before it joins the River Barrow. Surface runoff from turbine T6 drains to Cottoner's Brook stream which rises to an elevation of c. 74 m OD at the eastern boundary of the site and flows in south-easterly direction for approximately 2.6 km where it meets the River Barrow.

The national flood hazard mapping (available at www.floodmaps.ie) does not indicate any record of historical flooding on the wind farm. There are no areas defined as 'benefitting lands within the Dernacart Wind Fam in the OPW flood hazard mapping.

The water quality status of the Barrow River and its tributaries is 'Moderate'. River waterbody risk for Cottoner's Brook river is under Review. The Barrow Rivers and its tributaries are classified as 'At Risk'.

The site is not situated within any environmentally designated areas; however, surface water runoff drains into the River Barrow and River Nore SAC (002162).

Construction Impacts

Tree felling, new access tracks and upgrade of existing tracks, turbine hard-standing areas, the on-site substation and other new, hard surfaces have the potential to contribute to an increase in runoff.

The hydrological environment of the Dernacart Wind Farm is considered to be of 'high' sensitivity for receptors draining to the River Barrow. The effects of the increase in runoff has negligible magnitude on receiving waters because estimated increase in runoff is low compared to the flows of receiving waters. The runoff increase of 0.387 m^3/s (or 0.12 %) due to Dernacart Wind Farm is not significant.

The relatively low increase in runoff has however, the potential to cause soil erosion and consequent sediment release into the receiving watercourses. Possible potential indirect impacts on surface water quality during tree felling and construction activities include increased sediment in watercourses, increase in nutrients from tree felling, blockages in cross drains could lead to flooding, suspended solids could affect aquatic fauna and habitats, fuel leaks or spills could affect watercourses, wet concrete could affect receiving waters.

Operational Impacts

The main hydrological impact of the development is estimated increased runoff. Due to the insignificance of the increase in runoff from the development, the grassing over the drainage swales, and the non-intrusive nature of site operations, there is a negligible risk of sediment release to the watercourses during the operational phase.

Decommissioning Impacts

The potential impacts associated with decommissioning will be similar to those associated with construction but of reduced magnitude.

There would be increased trafficking and an increased risk of disturbance to underlying soils at the Dernacart Wind Farm, during the decommissioning phase, in this instance, leading to the potential for silt laden runoff entering receiving watercourses from the wheels of vehicles.

During decommissioning, it may be possible to reverse or at least reduce some of the impacts caused during construction by rehabilitating construction areas such as turbine bases, hardstanding areas, the substation and site compound. This will be done by covering with topsoil to encourage vegetation growth and reduce runoff and sedimentation.

Other impacts such as possible soil compaction and contamination by fuel leaks will remain but will be of reduced magnitude. However, as noted in the Scottish Natural Heritage guidance on restoration and decommissioning of onshore wind farms (SNH, 2013) reinstatement proposals for a wind farm are made approximately 30 years in advance, so within the lifespan of the wind farm, technological advances and preferred approaches to reinstatement are likely to change. It is therefore '*best practice not to limit options too far in advance of actual decommissioning but to maintain informed flexibility until close to the end-of-life of the wind farm*'.

Grid connection cables will be left in the ground, therefore no potential impacts during decommissioning stage are likely to occur.

Flood Risk Assessment

A flood risk assessment has been undertaken for this development. Recurring flooding is expected at the confluences of the White (W) hill stream, Cottoner's Brook stream and the River Barrow.

The flooding of area adjacent to the confluences of the River Barrow might occur due to the high-water elevation in the River Barrow which might cause backups at Forrest Upper stream, White (W) hill stream and the Cottoner's Brook stream.

The increased surface water runoff due to development is negligible and these flows are further reduced with the proposed drainage system. Increase in the water elevation at the locations of crossing is also negligible. Therefore, the proposed development has a minimal impact on flooding risk in the surrounding area.

The increase in runoff due to grid cable installation is not expected because the finished surfaces are not changed. Therefore, no impacts on the flood risk is expected.

Mitigation Measures

Proposed drainage measures to reduce and protect the receiving waters from the potential impacts during the construction of the proposed development are as outlined in the chapter These include measures to prevent runoff erosion from vulnerable areas and consequent sediment release into the nearby watercourses to which the proposed development site drains. The main mitigation measures are the use of stilling ponds, silt fencing, monitoring of works by a suitably qualified person, silt traps, use of cross drains, swales, proper storage of fuels and oils and designated refueling areas.

Trees will be felled away from aquatic zones where possible. Brash mats will be used as necessary on any off-road harvesting routes, removed and replenished if they become worn. Branches, logs or debris will not be allowed to accumulate in aquatic zones and will be removed as soon as possible.

When operational, the development will have a negligible effect on surface water quality as there will be no further disturbance of soils post-construction.

During the operation phase, small quantities of oil will be used in cooling the transformers associated with the facility. There is therefore a potential for small oil spills. Risks of potential oil leakage and pollutions draining to the watercourse from the installed transformer is mitigated with transformer interceptor bund wall.

It is not envisaged that the maintenance period will involve any significant impacts on the hydrological regime of the area. The maintenance of the development will incorporate effective maintenance of the drainage system.

Residual Impacts

Increased runoff and sedimentation to watercourses once mitigated will ensure that the residual impacts of the construction stage are imperceptible.

15 ARCHAEOLOGY, ARCHITECTURAL AND CULTURAL HERITAGE

There are no recorded archaeological sites within the proposed development site. There are 3 no. recorded sites within 1.5km of the site boundary and within 100m of the underground cable route – two enclosures and a metal working site.

Monument Ref.	Class	Townland	ITM	Distance from proposed development
OF033-012----	Enclosure	Barranaghs	646057, 710258	1,100m SE of north-eastern planning boundary and 830m SE of UGC route
LA003-006----	Enclosure	Garrymore	642899, 713471	1,095m N of north-western planning boundary
LA004-003----	Metalworking site	Townparks	645960, 709261	1,920m SE of southern planning boundary and 130m S of UGC route

There are entries into the excavations database within townlands that form part of the study area, however, none of the licenced investigations revealed anything of archaeological significance.

The cartographic sources examined for the study area comprised the first edition 6-inch OS map (1842) and the 25-inch second edition OS map (surveyed and published 1888-1913). Upon review it was noted that the proposed windfarm development site largely comprised extensive tracts of low-lying unenclosed marshy/bogland terrain; whilst areas to the west and south, adjacent the River Barrow riverbanks were improved and enclosed with several rural dwellings dispersed throughout. No unrecorded cultural heritage assets were noted within the proposed windfarm site.

The proposed route of the UGC extends along a portion of the (now infilled) Mountmellick branch of the Grand Canal (located at present-day Canal Rd) south/south east of the urban extents of Portarlington, for c. 1.5km. The canal was infilled in 1970. The Mountmellick branch was built between 1827 and 1831, extending from the Barrow Line at Monasterevin via Portarlington to Mount Mellick, and closed in 1960. Approximately 58% of the Mountmellick branch has been infilled since its closure.

Various online aerial images of the proposed development site, including those published by OS Ireland, Google and Bing, were consulted as part of the assessment. These provide overviews of the site from the 1990s onwards. There were no traces of differential soil-marks or earthworks that may indicate the presence of sub-surface archaeological sites such as burnt spreads or levelled enclosures identified during a review of the aerial images of the proposed windfarm development site.

There are 9 no. recorded architectural heritage structures (recorded on the NIAH/RPS); located within the study area.

As a result of the land improvement works which were evidently undertaken across much of the proposed windfarm site where proposed infrastructure (i.e. design footprint) is located, as well as the disturbances which would have occurred during the planting and possible rotation of forestry, the proposed windfarm site is considered to be of low archaeological potential. Areas of increased archaeological potential include more localised areas of marginal land which were not subject to land improvement or forestry works such as the northern portion of the area for a portion of the proposed access road between Turbines 2 and 3. Notwithstanding same, there still remains a possibility that subsurface archaeological artefacts, features or deposits survive across the overall windfarm site.

The UGC route extends along a network of farm/forestry tracks, local rural road networks, regional roads and suburban roads (southern outskirts of Portarlington). The surface of the public road and trackways is generally level with, or slightly above, the level of the adjacent verge/fields.

The upper subsoil levels along the road verges are likely to have been truncated during the construction of same and as such the archaeological potential of these is considered low. The forestry/farm tracks are often slightly raised above the surrounding landscape and are likely to have had less of an impact on the underlying subsoil strata. Given the presence of recorded sites and findspot within the wider environs of the western end of the UGC route, including the land-based area of Cottoner's Bridge (and Bornass/Cottoner's Brook banks), there remains potential to encounter archaeological finds/features, albeit of a low-level risk.

There are a number of designated built heritage features located within 100m of the UGC route: Bay Bridge (RPS 823), post-box, (RPS 52-02 & NIAH 14933009) COI church (RPS 52-01 & NIAH 14933007), Tudor Lodge (NIAH 14933008), Kilnahown Bridge (RPS 825 & 52-05; NIAH 14933012) and Ballymorris House (RPS 674 & NIAH 12800554).

In addition, there are 6 no. undesignated cultural heritage features within the study area pertaining to the UGC route:

- Cottoner's Bridge 19th century low parapet remains, Forest Lower/Barranaghs townlands (ITM 646564, 709675)
- Derelict 19th century farm cottage, Forest Lower townland (ITM 645735, 709508)
- Possible gate-lodge associated with the former Garryhinch House (ITM 649321, 710974)
- 2 no. derelict 19th cottages at Ballymorris townland (ITM 653694, 709982 & ITM 653717, 709989)
- Mountmellick Branch of the Grand Canal, at Canal Road, Portarlington (ITM 655048, 711448)

Construction Impacts

There are no recorded archaeological sites within the proposed construction areas, and, due to intensive land improvement works throughout the windfarm area and road carriageway construction (often with deep drainage ditches) along the UGC route, the overall archaeological potential to reveal sub-surface archaeological features is low. However, there is still a possibility of encountering archaeological finds/remains throughout the area during the construction phase. Such potential features shall be subject to direct negative impact, of high magnitude, although the value/sensitivity potential of the sub-surface archaeological resource is unknown, it is considered to be of potential slight/moderate significance of effect. It should be noted that a programme of licenced archaeological testing at pre-planning stage is, in this case, not deemed beneficial to facilitating impact assessment (or formulating an appropriate mitigation strategy) on the unknown archaeological resource. The proposed site has been significantly improved (indicating extensive ground disturbance) and is of low archaeological potential; and there are several large areas currently forested and inaccessible, thereby inhibiting a conclusive overall site-based test.

There are 3 no. designated architectural heritage assets located on, or in close proximity to, the proposed UGC route which if affected would result in slight effects. There are 6 no. undesignated cultural heritage features located within the defined study area for the proposed windfarm development and UGC route which may be negatively impacted by same. Five of the undesignated sites are low value assets with indirect negative impact, of low magnitude, resulting in a not significant significance of effect and one asset which if affected would result in slight/moderate effects.

Operational Impacts

Following the construction phase for the proposed windfarm development, including the UGC route; the operational phase is considered to have **no likely or significant effects** on the archaeological heritage resource. Any identified construction phase impacts shall be fully mitigated in advance and/or during on-site works.

Following the construction phase for the proposed windfarm development, including the UGC route; the operational phase is considered to have **no likely or significant effects** on the architectural heritage resource. Any identified construction phase impacts shall be fully mitigated in advance and/or during on-site works.

Mitigation Measures

A programme of archaeological monitoring shall be undertaken by a suitably qualified archaeologist, during all ground reduction works/topsoil stripping associated with the proposed windfarm hardstands/turbine locations, turbine delivery haul routes, access tracks, temporary compound and sub-station, and specifically including the north-eastern land-based area (adjacent Turbine 6 and associated access track) which is sited adjacent the minor watercourse of Bornass/Cottoner's Brook. It is noted that there are no other riverine environments present within the proposed windfarm site. Such an archaeological monitoring programme, given both the low archaeological potential and presence of heavily forested areas within the proposed windfarm site, is considered an appropriate archaeological mitigation strategy in this regard.

The proposed UGC route shall traverse predominantly along the verge of the existing road network throughout the study area. These areas are often bounded by heavy hedge/tree growth and deep ditches. The western extent of the UGC route exits the windfarm site and traverses past a junction with Bay Bridge and onwards to Cottoner's Bridge. This area is within the wider environs of a recorded findspot (saddle quern), a recorded metalworking site and an enclosure site, as well as the River Barrow itself. In addition, direction drilling is proposed for bridge crossing points (under the riverbed(s)), at Cottoner's Bridge (minor watercourse – Bornass/Cottoner's Brook) and at Kilnahown Bridge (River Barrow). Riverbanks are considered locations that have higher potential for sub-surface archaeological finds or features; however, the entry and exit points for the directional drilling shall be located within the road surfaces immediately before and after the river crossings (and adequately beyond any bridge structures themselves), with no ground disturbance on the riverbanks. As such, the area at the western extent of the UGC, from the exit point at the windfarm to Cottoner's Bridge, shall be subject to archaeological monitoring during the construction phase. There shall not be a requirement for archaeological mitigation at the in-road directional drilling entry/exit points for the river crossings.

Given the construction method of in-road directional drilling beneath riverbed(s), where applicable, there is no underwater archaeological impact associated with the proposed windfarm development (including UGC route), and as such, no mitigation measures are deemed necessary.

In the event of an archaeological find or feature being discovered during the construction phase works, the archaeologist shall evaluate, characterise and determine the extent of the remains. Thereafter an agreed mitigation framework including a Method Statement and Programme of Works shall be required in order to adequately preserve and/or record the archaeological resource, with consultation from the National Monuments Service (NMS). Whilst determination is being sought to mitigate the find/feature, the area shall be appropriately buffered with temporary fencing and an adequate works exclusion zone created in order to minimize any potential indirect damage during the site works.

There are identified impacts on the architectural heritage resource that shall require specific mitigation measures in advance of the commencement of the construction phase. Measures include the preparation of method statements and management plans and liaison with Laois County Council's Conservation Officer.

Residual Impacts

The presence and/or extent of the potential sub-surface archaeological resource within the proposed windfarm site/UGC is currently unknown, and as such any measurable impact is largely indeterminable at this stage and can only be postulated as *potential* impacts and *potential* significance of effects. Should archaeological remains be encountered during the construction stage, these direct impacts shall be mitigated by either preservation *in situ* (avoided) or preservation by record (fully archaeologically excavated), per consultations and agreements with NMS.

Preservation *in situ* shall allow for a negligible magnitude of impact albeit on a hitherto unknown value/sensitivity asset, resulting in a potential not significant/imperceptible significance of effect in the context of residual impact on the 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 significance of effect in the context of residual impact on the overall archaeological resource.

There are no identified residual impacts on the architectural heritage resource.

16 AIR QUALITY AND CLIMATE

European air quality legislation requires that each member state be defined in terms of Zones and Agglomerations for air quality, with Ireland divided into four zones. Dublin Conurbation is one zone – Zone A and Cork Conurbation is defined as Zone B. Zone C consists of 24 cities and towns (such as Galway, Limerick and Waterford cities and towns such as Naas, Newbridge, Celbridge, Leixlip) with a population of greater than 15,000 while Zone D covers the remainder of the country. The proposed wind farm is located in Zone D.

The dominant influence on Ireland's climate is the Gulf Stream. Consequently, Ireland does not suffer from the extremes of temperature experienced by many other countries at similar latitude. The climatic conditions for the wider geographical area have been derived from historical meteorological measurements compiled by Met Éireann at Oak Park synoptic station which is approximately 44km south east of the proposed wind farm and associated infrastructure.

Construction Impacts

The principal source of potential air emissions during the construction of the proposed wind farm will be dust arising from earthworks, tree felling activities, trench excavation along cable routes, construction of the new access tracks, the temporary storage of excavated materials, the movement of construction vehicles, loading and unloading of aggregates/materials and the movement of material around the site.

Dust emissions arise when particulate matter becomes airborne making it available to be carried downwind from the source. Dust emissions can lead to elevated PM_{10} and $PM_{2.5}$ concentrations and may also cause dust soiling. The amount of dust generated and emitted from a working site and the potential impact on the surrounding areas varies according to:

- The type and quantity of material and working methods
- Distance between site activities and sensitive receptors
- Climate/local meteorology and topography

It is not predicted that an air quality impact will occur due to traffic at the proposed development as the impacts will fall below the screening criteria set out in the UK DMRB guidance (UK Highways Agency 2007), on which the TII guidance is based.

Operational Impacts

Once the proposed wind farm development is constructed there will be no significant direct emissions to atmosphere. A diesel generator will be located at the substation; however, this will only be operated as a back-up/emergency power supply. The operational phase of the wind farm will result in positive impacts on air quality due to the displacement of fossil fuels as an energy source.

It is estimated that Dernacart Wind Farm will result in the net displacement of approximately 55,188 tonnes of CO_2 per annum or 1,655,640 tonnes of CO_2 over its lifespan (30 year period assumed). From an operational perspective, the proposed development will displace CO_2 emissions from fossil fuel based forms of energy generation and will assist Ireland in meeting its renewable energy targets and obligations. The burning of fossil fuels for energy creates greenhouse gases, which contributes significantly to climate change. These and other emissions also create acid rain and air pollution.

Decommissioning Impacts

In terms of decommissioning, there will be truck movements associated with removing the turbines from the wind farm resulting in vehicular emissions and also dust. However, the number of truck movements would be significantly less than the construction phase and would potentially result in a slight temporary impact.

Mitigation Measures

The following mitigation measures during the construction phase of the proposed wind farm relevant to air quality:

- The internal access roads will be constructed prior to the commencement of other major construction activities. These roads will be finished with graded aggregate;
- A water bowser will be available to spray work areas (wind farm and grid connection route) and haul roads, especially during periods of excavations works coinciding with dry periods of weather, in order to suppress dust migration from the site;
- All loads which could cause a dust nuisance will be covered to minimise the potential for fugitive emissions during transport;
- Gravel will be used at the site exit point to remove any dirt from tyres and tracks before travelling along public roads;
- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
- The access and egress of construction vehicles will be controlled to designated locations, along defined routes, with all vehicles required to comply with onsite speed limits;
- Construction vehicles and machinery will be serviced and in good working order;
- Wheel washing facilities will be provided at the entrance/exit point of the proposed development site;
- The developer in association with the contractor will be required to develop and implement a dust control plan as part of the CEMP (the outline CEMP contained in Appendix 4.2 will be updated by the Contractor). This plan will address aspects such as excavations, haul roads, temporary stockpiling and restoration works. The plan will be prepared prior to any construction activities and will be established and maintained through the construction period.
- Sensitive receptors within 100m of the proposed development and along haulage routes entering the site; and dwellings directly adjacent to the cable route construction that experience dust soiling, where appropriate, and with the agreement of the landowner, will have the facades of their dwelling cleaned if required should soiling have taken place;
- Ensure all vehicles switch off engines when stationary – no idling vehicles; and
- 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.

Residual Impacts

Following the implementation of the above mitigation measures, the proposed development may result in slight to moderate residual impacts arising from fugitive dust emissions during particular construction activities. These will be localised in nature and as they will be associated with particular elements of the construction phase, they will be temporary in nature and will not result in any permanent residual impacts. Slight Impacts related to vehicle emissions will cease following construction and no significant impacts are anticipated.

There will be residual positive impacts from the operation of the proposed development in terms of the displacement of fossil fuel energy generation with renewable energy. It is estimated that an output of up to 40MW for the proposed Dernacart Wind Farm will result in the net displacement of 55,188 (from Calculator Tool) tonnes of CO_2 per annum.

17 INTERACTIONS OF THE FOREGOING

This Chapter considers the potential for interactions and inter-relationships between one aspect of the environment and another which can result in an impact being either positive or negative, as well as having varying levels of significance.

Direct, indirect, cumulative, and interactive impacts were considered during the siting of turbines to minimise impacts on landscape and visual, the population and human health, geology and slope stability, biodiversity, hydrology, water quality, material assets, shadow flicker and archaeological, architectural and cultural heritage.

Interactions and inter-relationships after the optimisation of the layout design with respect to the various aspects of the environment are discussed, where relevant in each section and in this chapter. Table 17.1 herein provides a matrix showing the key interactions and inter-relationships between the key environmental aspects of the proposed development.

Table 17-1: Description of Interactions Between Key Environmental Aspects

INTERACTION	DESCRIPTION
Air Quality, Noise & Vibration, Traffic & Transportation, Population & Human Health, Biodiversity, Land, Soils & Geology	Dust and noise nuisance arising from the construction phase of the proposed development (earthworks etc.) in combination with increased construction related traffic could cause negative impacts to residential amenity and local fauna in close proximity to the development site and the proposed cable route. Dust, vibration and noise will occur both at the site and along haul routes associated with the proposed development as well as associated exhaust emissions from construction traffic. Dust emissions can also affect biodiversity by affecting photosynthesis, respiration and transpiration in plants. The combination of environmental impacts may also affect tourism, but it is likely that this impact will be imperceptible following the implementation of mitigation measures during the construction and operational phase. This interaction of effects will also occur at the decommissioning phase of the development. The impacts are considered to be temporary and measures are set out throughout the EIAR to mitigate against these effects on residential amenity and biodiversity. The indirect impacts on climate from traffic emissions was also considered during the assessment. Once operational, the wind farm will result in positive impacts due to the reduction in use of fossil fuels for energy and the lack of emissions.
Noise & Vibration, Landscape & Visuals, Shadow Flicker, Population and Human Health	It is possible that a combination of noise, shadow flicker and visual intrusion caused by the proposed wind turbines may impact on residential amenity of nearby residential receptors. It is not likely that an interaction of the above would negatively impact on nearby residential receptors following adherence to relevant guidance and the implementation of mitigation measures.
Land, Soils & Geology, Hydrology & Water Quality, Population & Human Health, Biodiversity	Potential alteration to drainage patterns caused by the construction of the proposed turbines may affect peat stability and cause slope failure. This could have on-site and off-site effects and could cause potential impacts on human safety and destruction of ecological habitat. Appropriate mitigation measures have been set out to ensure drainage patterns are controlled so as to not affect slope stability. Compacting of soil caused by construction plant and machinery may impact on soil infiltration. This has potential to cause flooding and saturated ground which is a potential danger to human safety and possible destruction of ecological habitat. A Construction Environmental Management Plan will be produced by the appointed contractors which will address on-site safety and the CEMP will detail the full suite of mitigation measures to be adhered to during the works.

INTERACTION	DESCRIPTION
Land, Soils & Geology, Hydrology & Water Quality, Biodiversity	During the construction phase, excavation and tree felling will expose soil. This could cause potential sedimentation of watercourses. Silt may migrate causing the sediment loading of nearby streams, impacting on water quality. This could have a negative impact on aquatic biodiversity downstream of the site. Mitigation measures have been proposed to assure that sedimentation of streams will not occur. On-site refuelling also has potential to harm aquatic biodiversity in the case of spillage of hydrocarbons. These have potential to migrate to nearby streams significantly impacting on water quality. Appropriate measures will be put in place to assure hydrocarbon storage and refuelling will occur within bunded areas.
Hydrology & Water Quality, Traffic & Transportation	There is potential for an increase in run-off due to haulage trucks to enter watercourses. However, following the implementation of mitigation measures and drainage design measures, this will not result in a significant effect.
Land, Soils & Geology, Population & Human Health, Traffic and Transportation	Increased traffic during the construction phase may have a negative impact on the public road. Migration of soil from the construction areas on wheels of vehicles exiting the construction site may cause the soiling of public roads. This can affect skid resistance and cause potential impacts on human safety on the public road. Appropriate wheel washing facilities will be employed on site to ensure migration of soils will not take place between the construction site and public road.
Telecommunication & Aviation, Population and Human Health	The proposed development may cause impacts on communication, navigation and surveillance for air traffic control which could affect separation and safety of aircraft which may impact on human safety, however this is unlikely to occur. The siting of the turbines has been informed by best practice and consultation and mitigation measures and further consultations prior to construction with telecommunications providers and IAA will ensure no impacts occur.
Landscape and Visual, Biodiversity, Population and Human Health	In terms of landscape and visual impacts, the loss of hedgerows and trees due to construction will have a local impact, however, mitigation planting will ameliorate this. The change in the landscape, from the erection of turbines, and the associated visual impact of this change, has the potential to impact on local residents, tourists and the general public. The interactions between these environmental aspects was 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.
Archaeology, Architectural and Cultural Heritage, Traffic & Transportation	There is potential for an indirect impact from the windfarm and the UGC route on the Kilnahown bridge (a protected structure on both Laois and Offaly RPS Refs. 825 and 52-05 respectively); and a cast-iron post box at Garryhinch crossroads (a protected structure Offaly RPS Ref. 52-02). However, a baseline condition survey will be carried out prior to construction and the bridge will be monitored during the construction phase.
Archaeology, Architectural and Cultural Heritage, Population and Human Health	Impacts on the archaeological, architectural and cultural heritage of the surrounding environment, both during construction and operation, has the potential to impact on the population through the excavation of previously unknown features, or, during operation of the wind farm, in a change in the setting of the feature, due to changes in landscape. These interactions were considered in EIAR, both in the design of the turbine layout and in the design of suitable mitigation to protect the archaeological, architectural and cultural heritage during construction and operation.

[i] Sustainable Energy Authority of Ireland, Energy Security in Ireland – A Statistical Overview 2016 Report.
[ii] IWEA Facts & Stats: https://www.iwea.com/about-wind/facts-stats

[iii] SEAI. Energy in Ireland 2018 Report

[iv] SEAI. Energy in Ireland 2018 Report

[v] Cost-benefit analysis of wind energy in Ireland 2000-2020, Barringa, January 2019

[vi] Eirgrid (2018), All-island Generation Capacity Statement 2018-2027. Available at: http://www.eirgridgroup.com/site-files/library/EirGrid/Generation_Capacity_Statement_2018.pdf

[i] Department of the Environment, Heritage, and Local Government, Wind Energy Planning guidelines, 2006