Environmental Impact Assessment Report

Ballynagare Wind Farm, Co. Kerry

Volume 1: Non-Technical Summary and Main Report

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Introduction

This Environmental Impact Assessment Report (EIAR) has been prepared by MKO on behalf of Ballynagare Wind Farm Ltd, who intends to apply to Kerry County Council for planning permission to construct a renewable energy development and all associated infrastructure in the townlands of Ballynagare, Dysert Marshes, Dysert, Curraghcroneen, Farrandeen, Monument, and adjacent townlands in County Kerry

The townlands in which the Proposed Development is located are listed in Table 1.

Table 1 Townlands within which the Proposed Development is Located

Development Works	Townland
Wind turbines and access roads, Substation, Control Building, Construction Compound & Borrow pit	Ballynagare, Dysert Marshes, Farrandeen, and Monument
Underground 38kV Grid Connection Cable Route to Clahane 110kV substation	Knockaunacurraheen, Ballintogher, Ballnageragh, Clooncolla, Ballyhorgan West, Ballyhorgan East, Lissahane, Knockburrane, Ballygarret, Banemore, and Pallas.

This EIAR complies with the EIA Directive 2011/92/EU as amended by Directive 2014/52/EU. The Environmental Impact Assessment (EIA) of the proposed project will be undertaken by Kerry County Council, as the competent authority.

Applicant

The applicant for the proposed development, Ballynagare Wind Farm Limited, is a subsidiary company of EMPower which is an Irish based international wind energy developer with over 700 MW in development in Europe and Africa. EMPower's senior management team has a combined 95 years' experience delivering projects from conception to operation across five continents. EMPower is a private limited company and is owned by GGE Ireland Limited, Wind Power Invest A/S and EMP Holdings Limited.

Brief Description of the Proposed Development

The Proposed Development will comprise the construction of 7 No. wind turbines and all associated works. The proposed turbines will have a maximum ground to blade tip height of up to 170 metres. The full description of the Proposed Development, is as follows:

- Construction of 7 no. wind turbines with the following maximum and minimum parameters:
  - Overall ground to blade tip height in the range of 170m maximum to 169.5m minimum
  - Hub height of 95m
  - Rotor diameter in the range of 150m maximum to 149m minimum
- Turbine hardstand areas;
- Provision of 1 no. permanent meteorological mast with a height of 110 metres.
- Upgrade of existing roads and access junctions
- Provision of new site entrances, roads and hardstand areas

- 2 no. peat storage areas
- 2 no. construction compounds
- 1 no. borrow pit
- All site drainage works
- 1 no. onsite 38kV substation, control building and plant, associated security fencing and wastewater holding tank
- All associated underground electrical and communication cabling connecting the turbines to the proposed on-site substation
- Connection of the proposed 38kV on-site substation via underground cable in the public road to the entrance of the existing Clahane 110kV substation in the townland of Pallas
- All ancillary site and ground works, apparatus and signage

The application is seeking a ten-year planning permission and 35 year operational life from the date of commissioning of the wind farm.

The layout of the Proposed Development has been led by consideration of constraints and facilitators , thereby avoiding the environmentally sensitive parts of the site. The roads layout for the proposed development makes use of the existing onsite access roads and tracks where possible, with approximately 1.11 kilometres of existing farm tracks and roadway requiring upgrading and approximately 8.21kilometres of new access road proposed to be constructed. All elements of the project, which includes whooper swan enhancement lands have been assessed as part of this EIAR.

Modern wind turbine generators typically have a generating capacity in the 3 to 6 MW range. For the purposes of this EIAR it is assumed that the wind turbine model installed as part of the proposed renewable energy development will have an output of 6MW. Therefore, based on 7 no. wind turbines, the proposed wind turbines will have a combined output of approximately 42MW.

Need for the Proposed Development

In March 2019, the Government announced a renewable electricity target of 70% by 2030. The Proposed Development is likely to be operational before 2030 and would therefore contribute to this 2030 target. More recently, the EPA reported that Ireland is set to fall far short of all of its carbon emissions reduction targets for 2030, despite climate action measures in the National Development Plan (EPA, June 2019). As such, the Proposed Development is critical to helping Ireland address these challenges as well as addressing the country's over-dependence on imported fossil fuels.

The Climate Action Plan 2019 (CAP) was published on the 1st of August 2019 by the Department of Communications, Climate Action and Environment (DoCCAE). The CAP sets out an ambitious course of action over the coming years to address the impacts which climate change may have on Ireland's environment, society, economic and natural resources. This Plan clearly recognises that Ireland must significantly step up its commitments to tackle climate disruption. The CAP identifies a need for 8.2GW of onshore wind generation. The CAP presents clear and unequivocal support for the provision of additional renewable energy generation and presents further policy support for increased wind energy. Further information relating to the Climate Action Plan can be found in Chapter 2, Section 2.2.3.

Section 2.2 in Chapter 2 of this EIAR on Background to the Proposed Development, presents a full description of the international, national and regional renewable energy policy context for the proposed project. Section 2.2 also addresses climate change, including Ireland's current status with regard to meeting greenhouse gas emission reduction targets.

Economic Benefits

The Proposed Development will have several significant long-term and short-term benefits for the local economy including job creation, local authority commercial rate payments and a Community Benefit Scheme.

The annual commercial rate payments from the Proposed Development to Kerry County Council, will be redirected to the provision of public services within Co. Kerry. These services include items such as road upkeep, fire services, environmental protection, street lighting, footpath maintenance etc. along with other community and cultural support initiatives.

It is estimated that the proposed project will create approximately up to 88 jobs during the construction, operational and maintenance phases of the Proposed Development. During construction, additional employment will be created in the region through the supply of services and materials to the development. In addition to this, there will also be income generated by local employment from the purchase of local services i.e. travel and lodgings.

Should the Proposed Development receive planning permission, there are substantial opportunities available for the local area in the form of Community Benefit Funds. Based on the current proposal, a Community Benefit Fund in the region of €3.1 million will be made available over the lifetime of the project. The value of this fund will be directly proportional to the level of installed MWs at the site and will support and facilitate projects and initiatives including youth, sport and community facilities, schools, educational and training initiatives, and wider amenity, heritage, and environmental projects. Further details on the proposed Community Gain proposals are presented in Section 4.5 of this EIAR.

Purpose and Structure of this EIAR

The purpose of this EIAR is to document the current state of the environment in the vicinity of the Proposed Development site and to quantify the likely significant effects of the Proposed Development on the environment. This EIAR submitted by the applicant provides the relevant environmental information to enable the Environmental Impact Assessment (EIA) to be carried out by the competent authority, in this case Clare County Council.

The EIAR project team comprises a multidisciplinary team of experts with extensive experience in the assessment of wind energy developments and in their relevant area of expertise. Each chapter of this EIAR has been prepared by a competent expert in the subject matter. The chapters of this EIAR are as follows:

1. *Introduction*
2. *Background to the Proposed Development*
3. *Consideration of Reasonable Alternatives*
4. *Description of the Proposed Development*
5. *Population and Human Health*
6. *Biodiversity*
7. *Ornithology*
8. *Land, Soils and Geology*
9. *Hydrology and Hydrogeology*
10. *Air and Climate*
11. *Noise and Vibration*
12. *Archaeological and Cultural Heritage*
13. *Landscape and Visual*
14. *Material Assets (including Traffic and Transport, Telecommunications and Aviation)*
15. *Interactions of the Foregoing*
16. *Schedule of Mitigation*

A Natura Impact Statement has also been prepared in line with the requirements of the Habitats Directive and has been submitted to the Planning Authority as part of the planning application documentation.

Background to the Proposed Development

This section of the EIAR presents policy information on Energy and Climate Change policy and targets, the strategic, regional, and local planning context for the Proposed Development, scoping and consultation, and the cumulative impact assessment process. A description of reasonable alternatives studied by the developer, relevant to the project including renewable energy technologies, turbine numbers, layout and design is included at Chapter 3 of this EIAR.

The policies and targets which have been put in place at the various levels of Government in relation to renewable energy and climate change illustrate the need for the Proposed Development to assist Ireland in meeting its national targets and European commitments in relation to climate change and decarbonisation.

The Proposed Development comprises the provision of wind turbines which will generate renewable energy and provide it for use onto the national grid. Ireland's mandatory target under EU Directive 2009/28/EC is for renewable resources to account for 16% of total energy consumption by 2020. At national level, the targets within the Government's 2007 White Paper, Delivering a Sustainable Energy Future for Ireland: The Energy Policy Framework 2007 – 2020, set a target of 33% electricity from renewable sources by 2020, a target that was subsequently increased to 40%.

The need to decarbonise the economy and reduce emissions has always been imperative, however in recent years the urgency involved has become clearer to all stakeholders. The Climate Action Plan published by the Government in 2019 has clearly identified the need for and urgency of change, it states:

> *"The accelerating impact of greenhouse gas emissions on climate disruption must be arrested. The window of opportunity to act is fast closing, but Ireland is way off course.... The shift in climate is bringing profound shifts of desertification, rising sea levels, displaced population, profound challenges to the natural world, and economic and social disruption. We are close to a tipping point where these impacts will sharply worsen. Decarbonisation is now a must if the world is to contain the damage and build resilience in the face of such a profound challenge."*

Furthermore, the Programme for Government released in June 2020 also highlights the need for a clean and reliable supply of energy:

> *"Energy will play a central role in the creation of a strong and sustainable economy over the next decade. The reliable supply of safe, secure and clean energy is essential in order to deliver a phase-out of fossil fuels. We need to facilitate the increased electrification of heat and transport. This will create rapid growth in demand for electricity which must be planned and delivered in a cost-effective way."*

The primary driver behind the Proposed Development is the need to provide additional renewable energy to offset the use of fossil fuels within the electricity generating sector. Increasing electricity generation from wind power represents the most economical renewable option to reduce emissions within the power generation sector and is the most mature technology available to achieve national targets that have been established for decarbonisation.

Energy and Climate Change Targets

Relevant to the Proposed Development, Chapter 7 of the Climate Action Plan 2019 (CAP) details the Plan's views surrounding electricity generation. Within Ireland, electricity accounted for 19.3% of Ireland's greenhouse gases in 2017. The CAP places emphasis on the importance of decarbonising electricity *"by harnessing our significant renewable energy resources by doing this we will also become less dependent on imported fossil fuels."* In 2017, a total of 30.1% of electricity produced in Ireland came from renewable sources whilst the target to be achieved by 2020 is set at 40%. The CAP goes on to note that "*given our 40% target is based on a percentage of total energy demand, rising demand makes meeting our 2020 target even more challenging and latest forecasts indicate we may miss this target by 3 to 4 percentage points'*. Specifically, the rapid growth of electricity demand in the country is projected to increase by 50% above existing capacity in the next decade. The continued decarbonisation of the energy network remains an essential component of this strategy in the context of 2030 and 2050 targets. Section 7.2 of the CAP seeks an increase in electricity generated from renewable sources to 70%, with onshore wind delivering 8.2GW.

Achieving 70% renewable electricity by 2030 will involve increasing renewable electricity generation, reinforcing the existing grid network (including greater interconnection to allow electricity to flow between Ireland and other countries) and putting systems in place to manage intermittent sources of power, especially from wind. Ultimately, the measures needed to deliver the 2030 targets centre on the increased harnessing of renewable energy. As noted above the Climate Action Plan sets out the need to deliver up to 8.2GW total of onshore wind capacity. As of 2019, there was 4.1GW of installed wind capacity in Ireland; therefore, Ireland needs to more than double its installed capacity of wind generation. The addition of the Proposed Development to Ireland's deployable onshore wind farm fleet would result in a direct positive impacts on current output, and furthermore, the continued progression towards future targets.

The EPA's emission projections were in part collaborated by the Sustainable Energy Authority of Ireland (SEAI)'s Report on Energy-related CO2 Emissions in Ireland 2005 – 2018 (February 2020) which concludes with an overview of the outstanding challenges associated with the emerging CO2 trends and, relevant to the Proposed Development, a clear directive for further action:

> *"This report shows us once again the challenges we face in reducing our CO_2 emissions from energy use. CO_2 emissions from travel and heating our homes and businesses increased again in 2018. While emissions from electricity decreased, we have a hill to climb if we are to make meaningful inroads in the other sectors. The data in this report pre-dates the release of the Government's Climate Action Plan. The ambitious course of action plotted in that plan has the potential to turn these trends around."*

In July 2020 the Environmental Protection Agency (EPA) published Irelands' *Greenhouse Gas Emissions Projections 2019-2040*. The report provides an updated assessment of Ireland's total projected greenhouse gas emissions out to 2040 which includes an assessment of progress towards achieving its emission reduction targets out to 2020 and 2030 set under the EU Effort Sharing Decision and Effort Sharing Regulation.

In relation to decarbonisation of electricity generation, the Projections state:

> "*A 70% contribution of renewable energy in electricity generation by 2030 will be achieved by approximately tripling the 2018 renewable generation capacity, while phasing out coal and peat use. Increased renewables, and greater interconnection, are projected to result in energy industries emissions decreasing by over 34% by 2030 compared to the most recent figures in 2018."*

The Climate Change Advisory Council notes within their *2019 Annual Review* that while the share of renewable electricity generation, particularly wind, is increasing in Ireland, the pace of decarbonisation of the electricity generation sector is not compatible with a low-carbon transition to 2050. As such, Ireland can continue to 'comply' with EU targets by purchasing emission allowances; however, the expenditure of public funds to do so would not result in any domestic benefit, and furthermore, would result in a more difficult and expensive challenge for the county to meet its future 2030 targets and beyond. The Review concludes that continued and additional investment in capacity and technologies in the renewable energy sector is required to reach these said targets.

EirGrid in their updated *All-Island Generation Capacity Statement 2020-2029* identifies the renewable energy mix which could achieve the 70% RES-E target by 2030 based on 2019's ten-year median demand forecast. The Statement projects that wind continues to be the largest contributor to the renewable energy mix in Ireland in 2020 (4,325MW) and up to and including 2029 (8,605MW).

The updated Statement adds "*To promote the generation of electricity from renewable sources, the Irish Government announced a new Renewable Electricity Support Scheme (RESS). Framed within the context of Ireland's Climate Action Plan the RESS-1 auction has provisionally awarded 2,237GWh of contracts in August 2020. This auction result accounts for approximately 10% of the amount forecast to be required to meet the 2030 targets. EirGrid worked closely with DCCAE and the CRU to implement the RESS auction process*"

EirGrid have now released their *Strategy 2020-2025: Transform the Power System for Future Generations* which is driven by climate change and the need to transform the electricity sector. Currently, the electricity grid can operate with up to 65% of renewable power but by 2030 this must increase to 95%.

The additional wind energy output from the Proposed Development will further assist Ireland's overall capability to meet its future targets.

Local Policy

The site of the Proposed Development is entirely within the administrative area of Kerry County Council. As such the extant Kerry County Development Plan 2015-2021 is relevant.

Kerry County Development Plan 2015-2021

The Kerry County Development Plan 2015-2021 (KCDP) incorporates the aims, objectives, policies and guidelines to provide for the proper planning and sustainable development of County Kerry. The (KCDP) is a spatial planning framework that gives effect to the delivery of sustainable and planned economic and social development in a manner consistent with higher level plans and strategies.

The following are key objectives provisions of the KCDP in relation to renewable energy relevant to the proposed development.

- **EP-1:**
  "Support and facilitate the sustainable provision of a reliable energy supply in the County, with emphasis on increasing energy supplies derived from renewable resources whilst seeking to protect and maintain biodiversity, archaeological and built heritage, the landscape and residential amenity."
- **EP-2**
  "Promote energy conservation through reduced consumption and incorporating renewable energy technology into building design standards."
- **EP-3:**
  "Facilitate sustainable energy infrastructure provision, so as to provide for the further physical and economic development of the County."
- **EP-7:**
  "Facilitate the sustainable development of additional electricity generation capacity throughout the region/county and to support the sustainable expansion of the network. National grid expansion is important in terms of ensuring adequacy of regional connectivity as well as facilitating the development and connectivity of sustainable renewable energy resources."

The KCDP also acknowledges that the renewable energy sector is expanding rapidly and is a growing source of employment and investment. To facilitate the sustainable growth of renewable energies Kerry County Council prepared and adopted a Renewable Energy Strategy in 2012, the KCDP states the following in relation to the Renewable Energy Strategy 2012.

"This strategy sets out the development criteria, development management standards and objectives for the development of renewable energy in the County and will be used in the assessment of all planning applications for such development."

Furthermore objective EP-11 of the KCDP states that it is an objective of the Council to:

- **EP-11:**
  "Implement the Renewable Energy Strategy for County Kerry (KCC 2012)"

Kerry County Council Renewable Energy Strategy

Kerry County Council adopted its current Renewable Energy Strategy (RES) as the 8th variation of the County Development Plan (2009-2015) on the 5th November, 2012. The planning authority recognises the importance of exploiting renewable energy sources in order to contribute to achieving national targets in relation to reductions in fossil fuel dependency and greenhouse gas emissions. The document recognises wind energy as the most suitable form of renewable energy to meet national targets for the consumption of electricity and continues to support the development of Wind Energy. In doing so, it identifies appropriate locations for the development of wind energy based on environmental, technical, landscape and economic considerations enabling developers to identify appropriate sites for wind energy development.

When identifying key areas for wind development, a methodology of identifying environmental, landscape, technical and economic criteria were developed with a Geographical Information System (GIS). This identified four types of wind deployment zones.

- **Strategic Site Search Area** - A Strategic Area can accommodate tall turbines laid out in relatively large wind farms, within which, wind developments can benefit from economies of scale in both construction and operation. To achieve their potential these areas must be developed in a co-ordinated way. Proposals must consider the possibility of shared infrastructure and the siting of turbines in any development must consider the need to maximise the development potential of the area as a whole.
- **Open to Consideration** - Site searches within these areas will identify sites with wind energy capacity and the environmental and infrastructural capacity to support wind development. They differ from Strategic Areas in that there are fewer suitable sites. It is recommended that during the site search process, developers consult with the Planning Authority. Again the capacity of these areas has limits and the cumulative impact of wind development in these areas will be monitored
- **Areas which currently lack grid infrastructure** - These areas are within, and adjacent to the Dingle, Iveragh and Beara peninsulas. This designation will be kept under review and amended to reflect any development in grid infrastructure.
- **Unsuitable** - These areas have not been identified in the legend of the Wind Deployment Zones Map, however, these are areas that are not considered suitable for wind farm development due to their overall sensitivity, arising from landscape, ecological, recreational and/or cultural and built heritage reasons and are taken to be the areas of Kerry not identified as being in any of the previously listed areas. The HDA and SEA process has informed the identification of these areas.

Based on Map 7.6 'Renewable Energy Strategy' the proposed development site is located within an area classified as 'Open to Consideration'. The following policies have been listed under the Kerry Wind Energy Strategy in relation to 'Open to Consideration':

- **Objective NR 7-33**
  "Proposals shall demonstrate conformity with existing and approved wind farms to avoid visual clutter and how they have taken regard of potential cumulative effects, where appropriate."
- **Objective NR 7-34**
  "Projects shall be designed and developed in line with the Wind Energy Development Guidelines, Guidelines for Planning Authorities (DoEHLG, 2006) and any update of

these guidelines in terms of siting, layout and environmental studies. Any proposed development of on-shore wind adjacent to Natura 2000 sites will have to ensure a suitable buffer zone exists between the development and the Natura 2000 boundary. The Stacks to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (Site Code 004161) will require a buffer zone of at least 250m between the SPA boundary and operating wind turbines."

- **Objective NR 7-35**
  "Applications shall be accompanied by a Natura Impact Statement under Article 6 of the Habitats Directive if the site is located in close proximity to a (candidate) Special Area of Conservation or Special Protection Area or if the site is within the catchment of a (candidate) Special Area of Conservation. Only proposals where a Habitats Directive Article 6 Assessment concludes that there will be no adverse effects on the integrity of Natura 2000 sites shall be permitted."
- **Objective NR 7-36**
  "All applications must comply with the objectives and development standards of this strategy and the provisions of the Kerry county Development Plan 2009-2015. This will include requirements and considerations in relation to: landscape; cultural heritage; Natura 2000 sites and the Habitats & Birds Directive; the objectives of the Water Framework Directive; Flood Directive; electricity infrastructure; settlement patterns; and wind energy potential."
- **Objective NR 7-37**
  "Applications for wind development shall be accompanied by a technical assessment in relation to the slope stability, landslide susceptibility of the development site and the proposed project. This assessment shall incorporate slope stability mapping and groundcover assessment in the context of potential cumulative effects arising from multiple developments and consider potential impacts on slope stability in relation to climate change impacts, particularly flash floods and changing weather conditions."

In summary the County Development Plan fully recognises the importance of combating climate change and deriving more energy from renewable sources. It is the intention of Kerry County Council to support and facilitate the sustainable provision of a reliable energy supply in the County, with emphasis on increasing energy supplies derived from renewable resources. It is acknowledged that the renewable energy sector is expanding rapidly and is a growing source of employment and investment. As noted in the above section the proposed development is located within an area which under the County Development Plan is classified as 'Open to Consideration'. Furthermore, there is a range of policy in place which supports the development of renewable energy. The Biodiversity and Landscape sections of this EIAR demonstrate that the proposal will not give rise to significant adverse impacts on natural heritage, landscape or visual amenity. The Noise and Shadow Flicker assessments also show that the proposed development will not give rise to significant adverse impacts on residential amenity. Accordingly the proposed development is compliant with the relevant provisions of the Kerry County Development Plan 2015-2021.

Wind Energy Development Guidelines

The relevant considerations under the '*Wind Energy Development Guidelines for Planning Authorities*' (Department of the Environment, Heritage and Local Government (DOEHLG), 2006) have been taken into account during the preparation of this EIAR.

The '*Wind Energy Development Guidelines for Planning Authorities*' (DoEHLG, 2006) are currently the subject of a targeted review. The Department of Housing, Planning and Local Government published the *Draft Wind Energy Guidelines* (referred to as the Draft Revised Guidelines) in December 2019 and these Draft Guidelines were under public consultation until 19th February 2020. Following the previous 2013 consultation and subsequent detailed engagement between the relevant Government Departments, a "preferred draft approach" to inform and advance the conclusion of the review of the 2006 guidelines was announced in June 2017.

The EIAR is cognisant of the *Draft Revised Wind Energy Development Guidelines* and will address each key matter (e.g. noise and shadow flicker standards) in turn within the relevant sections of this EIAR. As demonstrated in the subsequent chapters, the Proposed Development will not result in any likely significant effects on the receiving environment. In relation to Shadow Flicker, the Proposed Development can satisfy any guidelines requirement as this is an operational matter that can be controlled by the SCADA system if necessary. In relation to noise , it is this section of the Draft Guidelines that has given rise to the most scrutiny from industry experts who have sought significant amendments and clarifications. While the outcome of the public engagement process on the Draft Revised Guidelines is not yet known, the operational noise parameters can be controlled using the SCADA system, and therefore, the Proposed Development will ultimately comply with future guidelines should they be adopted/finalised during the consideration period of the current application.

Planning History

The relevant planning history of the Proposed Development site, the planning applications in the vicinity of the site along with other wind energy applications within the wider area are set out at Section 2.5 of Chapter 2-Background to the Proposed Development, of this EIAR.

Scoping and Consultation

Scoping is the process of determining the content, depth and extent of topics to be covered in the environmental information to be submitted to a competent authority for projects that are subject to an Environmental Impact Assessment. This process is conducted by contacting the relevant authorities and Non-Governmental Organisations (NGOs) with interest in the specific aspects of the environment with the potential to be affected by the proposal. These organisations are invited to submit comments on the scope of the EIAR and the specific standards of information they require. Comprehensive and timely scoping helps ensure that the EIAR refers to all relevant aspects of the subject development and its potential effects on the environment and provides initial feedback in the early stages of the project, when alterations are still easily incorporated into the design. In this way scoping not only informs the content and scope of the EIAR, it also provides a feedback mechanism for the proposal design itself.

A scoping report, providing details of the application site and the subject underground cable route, was prepared by MKO and circulated in December 2020 to relevant parties. The scoping report issued provided information on the topics below and is included in this EIAR.

- Description of the Proposed Development Site, including Site Location and Access; Land-Use, Designated Areas and Landscape Policy;
- Planning Context;
- Site Selection;
- Description of the Proposed Development; and
- Scope of the EIAR and Natura Impact Assessment.

MKO requested the comments of the relevant personnel/bodies in their respective capacities as consultees with regards to the EIA process. Details of that scoping progress can be found at Section 2.6 of this EIAR.

Scoping responses received are set out in the EIAR at Section 2.6.2 of Chapter 2, Background to the Proposed Development. The recommendations of the consultees have informed the EIAR preparation process and contents of same.

Consideration of Reasonable Alternatives

This chapter of the EIAR includes a description of the reasonable alternatives studied by the developer which are relevant to the project and its specific characteristics and provides an indication of the main reasons for the option chosen, taking into account the environmental effects. The consideration of alternatives includes alternative design, technology, layout, size and scale. A 'Do Nothing Scenario' i.e. an outline of what is likely to happen to the environment should the Proposed Development not be implemented, is also included.

The design of the Proposed Development has been an informed and collaborative process from the outset, involving the designers, developers, engineers, environmental, hydrological and geotechnical, archaeological specialists and traffic consultants. The aim of the process being to reduce the potential for environmental effects while designing a project capable of being constructed and viable.

The final proposed turbine layout takes account of all site constraints and the distances to be maintained between turbines and from houses, roads, etc. The layout is based on the results of all site investigations and baseline assessments that have been carried out during the EIAR process. As information regarding the site of the Proposed Development was compiled and assessed, the proposed layout has been revised and amended to take account of the physical constraints of the site and the requirement for buffer zones and other areas in which no turbines could be located.

It was decided at an early stage during the design of the Proposed Development that maximum possible use would be made of existing roadways and tracks where available to minimise the potential for impacts by using new roads. An alternative option to making maximum use of the existing road network within the site would be to construct a new road network, having no regard to existing roads or tracks. This approach was not favourable, as it would require unnecessary disturbance to the site and create the potential for additional environmental impacts to occur. It would also result in an unnecessary requirement for additional cut and fill material to be used in the construction of new roads.

There were a number of reviews of the specific locations of the various turbines during the optimisation of the site layout. The initial constraints and site screening study identified a significant buildable area to the north and east of the River Feale, primarily in the area of Ballyouneen, as well as to the south in the areas of Dysert Marshes and Ballynagare. The total buildable area was considered potentially suitable for up to 16 no. turbines (a cluster of 10 no. turbines to the south of the River Feale and a cluster of 6 turbines to the north). However, following one year of ornithological surveys and analysis, the decision was made to exclude the northern buildable area from further development. This decision was taken proactively in the interest of mitigating impacts on the population of Whooper Swan observed to be active in this area during the winter months. Within the smaller buildable area an initial turbine layout comprising 10 no. turbines was developed. However, the proposed 7-turbine layout was refined following feedback from the project team, landowners, neighbours and the need to ensure sufficient separation distances are maintained for on-site constraints.

The use of a two temporary construction compounds as opposed to a single large compound will result in shorter distances for traffic movements within the site during construction. As a result, vehicle emissions and the potential for dust arising will be reduced.

The proposed underground cabling route was one of two underground cabling routes considered at the outset of the design process of the Proposed Development. The final underground cabling route takes account of all site constraints and design constraints. The route also takes account of the findings from the site investigations and baseline assessments that have been carried out during the EIAR process.

The proposed borrow pit locations were selected due to the presence of competent or usable rock at an acceptable level below existing surface level. An alternative to using onsite borrow pits was the option of sourcing stone and hardcore materials from a licensed quarry in the vicinity. The movement of such material would result in a significant increase in construction traffic and heavy loads and was therefore considered the least preferable option.

The alternatives considered for the port of entry of wind turbines into Ireland for the proposed development include Shannon-Foynes Port, County Limerick and the Port of Galway. Shannon Foynes Port is the principal deepwater facility on the Shannon Estuary and caters for dry bulk, break bulk, liquid and project cargoes. The Port of Galway also offers a roll-on roll-off procedure to facilitate import of wind turbines. Both ports and indeed others in the state (including Cork and Dublin), offer potential for the importing of turbine components. Shannon Foynes Port is significantly closer to the proposed site and was therefore selected as port of entry for the project.

Description of the Proposed Development

The overall layout of the Proposed Development is shown on Figure 4.1. This drawing shows the proposed locations of the wind turbines, electricity substation extension, borrow pits, construction compounds, internal roads layout and the main site entrance. Detailed site layout drawings of the Proposed Development are included in Appendix 4.1 to this EIAR.

Development Components

The proposed wind turbines will have a maximum ground to blade tip height of between 169.5 and 170 metres with a rotor diameter of between 149 and 150 metres. The exact make and model of the turbine will be dictated by a competitive tender process, but it will not exceed the maximum size envelope set out above. Modern wind turbines from the main turbine manufacturers have evolved to share a common appearance and other major characteristics with only minor cosmetic differences differentiating one from another. The wind turbines that will be installed on the site will be conventional three-blade turbines, that will be geared to ensure the rotors of all turbines rotate in the same direction at all times. The turbines will be light grey matt colour.

Each wind turbine is secured to a reinforced concrete foundation that is installed below the finished ground surface. The size of the foundation will be dictated by the turbine manufacturer, and the final turbine selection will be the subject of a competitive tender process. Different turbine manufacturers use different shaped turbines foundations, ranging from circular to hexagonal and square. The turbine foundation transmits any load on the wind turbine into the ground. The maximum horizontal and vertical extent of the turbine foundation will be 25m (minimum of 19m) and 6m (minimum of 2.7m) respectively. Hard standing areas consisting of levelled and compacted hardcore are required around each turbine base to facilitate access, turbine assembly and turbine erection. The hard-standing areas are typically used to accommodate cranes used in the assembly and erection of the turbine, offloading and storage of turbine components, and generally provide a safe, level working area around each turbine position.

Site Roads

To provide access within the site of the Proposed Development and to connect the wind turbines and associated infrastructure, approximately 8.21 kilometres of new access roads will need to be constructed with approximately 1.11 kilometres of existing roadway/ tracks requiring upgrading.

Rock Extraction

It is proposed to develop 1 No. on-site borrow pits as part of the Proposed Development. It is proposed to obtain the majority of all rock and hardcore material that will be required during the construction of the Proposed Development from the on-site borrow pit.

Electricity Substation and Wind Farm Control Building

It is proposed to construct an electricity substation within the site. The construction and electrical components of the electricity substation will be to ESB specifications. Further details regarding the connection between the proposed site substation and the national electricity grid are provided in Section 4.3.8 of this EIAR. The proposed electricity substation compound measures approximately 50 metres in length by 25 metres in width and will include one wind farm control buildings and the electrical substation components necessary to consolidate the electrical energy generated by each wind turbine, and export that electricity from the wind farm site.

Site Underground Cabling

Each turbine will be connected to the on-site electricity substation via an underground 38kV (kilovolt) electricity cable. Fibre-optic cables will also connect each wind turbine to the wind farm control building at the onsite substation compound. The electricity and fibre-optic cables running from the turbines to the onsite substation compound will be run in trenches that will be approximately 1.3 metres in depth and 0.6 metres in width, along the sides of roadways. The route of the cable ducts will generally follow the access track to each turbine.

Meteorological Mast

One permanent meteorological (met) mast is proposed as part of the proposed development. The met mast will be equipped with wind monitoring equipment at various heights. The mast will be a slender structure, 110 metres in height. The mast will either be a free-standing structure or could be supported by guyed wires radiating out 51 metres in three directions from the tower.

Temporary Construction Compounds

Two temporary construction compounds are proposed as part of the Proposed Development. The construction compounds will consist of temporary site offices, staff facilities and car-parking areas for staff and visitors.

Peat and Spoil Management Plan

It is estimated that approximately 77,000 m^3 of peat and spoil will be excavated during the construction of the Proposed Development. This peat and spoil will be managed by means of placement within the proposed borrow pits or alongside the access roads.

Access and Transportation

There are seven proposed site entrances into the site from the local roads in the area. The site will be accessed from the R557 via the local road (L6055) travelling north from the R557 in the townland of Monument to the east of Lixnaw. Initially the site is accessed via a new site entrance by turning northwest off this local road. It is from this new entrance that the borrow pit, construction compound, and substation are accessed.

It is proposed that large wind turbine components will be delivered to the site of the Proposed Development, from the selected Port, via the N69 National Secondary Road. From Foynes port, the turbines will be transported south on the N21 National Primary Road towards Newcastle West. The turbines will then travel west on the N21 towards Tralee and turn right at the roundabout before Tralee and on to the N69 traveling north east. The turbines will continue north east on the N69 and then turn left on to the local road at Mountcoal cross before travelling northwest to the R557. The turbines will then turn left onto the R557 and continue northwest towards the proposed development site.

Construction materials such as concrete and steel will follow the same transport route as the wind turbines from both north and south of the N69 to the proposed development site.

Community Gain Proposal

The community benefit scheme proposes to provide a fund in the region of €257,000 per annum over the 15 year lifespan of the Renewable Electricity Support Scheme (RESS) based on the current estimated generating capacity. This will equate to potential funding of €3.1 million to the local community which is a substantial contribution. The number and size of grant allocations will be decided by a Community Fund liaison committee with various groups and project benefiting to varying degrees depending on their funding requirement.

Site Drainage

The protection of the watercourses within and surrounding the site, and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the site of the Proposed Development. The Proposed Development's drainage design has therefore been proposed specifically with the intention of having no negative impact on the water quality of the site and its associated rivers and lakes, and consequently no impact on downstream catchments and ecological ecosystems. No routes of any natural drainage features will be altered as part of the Proposed Development and turbine locations and associated new roadways were originally selected to avoid natural watercourses, and existing roads are to be used wherever possible. There will be no direct discharges to any natural watercourses, with all drainage waters being dispersed as overland flows. All discharges from the proposed works areas will be made over vegetation filters at an appropriate distance from natural watercourses. Buffer zones around the existing natural drainage features have been used to inform the layout of the Proposed Development.

Construction Phasing and Timing

It is estimated that the construction phase will take approximately 24 months from starting onsite to the full commissioning of the Proposed Development. The construction phase can be broken down into three main phases, 1) civil engineering works: 18 months, 2) electrical works: 9 months, and 3) turbine erection and commissioning: 6 months. The three phases can be undertaken concurrently.

Operation

During the operational phase, each turbine will be subject to a routine maintenance programme involving a number of checks and changing of consumables, including oil changes. In addition, there will be a requirement for unscheduled maintenance, which could vary between resetting alarms to major component changes requiring a crane. Typically, maintenance traffic will consist of four-wheel drive vehicles or vans. The electricity substation and site tracks will also require periodic maintenance.

Decommissioning

The wind turbines proposed as part of the Proposed Development are expected to have a lifespan of approximately 35 years. Following the end of their useful life, the wind turbines may be replaced with a new set of turbines, subject to planning permission being obtained, or the Proposed Development may be decommissioned. The substation extension will remain in place as it will be under the ownership of the ESB and will form a permanent part of the national electricity grid.

Population and Human Health

One of the principle concerns in the development process is that people, as individuals or communities, should experience no diminution in their quality of life from the direct, indirect or cumulative impacts arising from the construction and operation of a development. The key issues examined in this section of the EIAR relate to population and human health and incorporate population statistics, employment and economic activity, land-use, residential amenity (shadow flicker, noise, visuals and telecommunications), community facilities and services, tourism, property values, accidents/natural disasters, health and safety and other environmental hazards such as water contamination, air pollution, traffic and flooding.

The proposed development is located approximately 2km north of the village of Lixnaw and approximately 8.8km southwest of the town of Listowel, Co. Kerry. The majority of amenities and community facilities, including GAA and other sports clubs, youth clubs and recreational areas available in the area are located in the centres of settlement throughout the wider area. Retail and personal services within the vicinity are provided in the larger settlements such as Listowel and Tralee. There are no key identified tourist attractions pertaining specifically to the site of the Proposed Development itself.

The Study Area for the Population and Human Health assessment was defined by the 7 No. District Electoral Division (DED)s within and adjacent to the Proposed Development site. The population of the DEDs within the Study Area decreased by 0.6% between 2011 and 2016, dropping from 3,988 to 3,965 persons, respectively, with the rate of population change unevenly distributed between the DEDs. The highest level of employment within the Study Area was recorded in the Non-Manual category. The levels of employment within the Employer/Manager, Higher Professional, Lower Professional, Non-Manual, Skilled Manual, and Un-skilled categories in the Study Area were lower than those recorded for the State and County Kerry, while those recorded within the Skilled Manual, Semi-Skilled, Own Account, Other, and Farmer, categories were higher. The level of employment in the Agricultural Worker category was slightly higher than those recorded for the State and for County Kerry.

As stated above, up to 88 jobs could be created during the construction, operation and maintenance phases of the Proposed Development with most construction workers and materials sourced locally, thereby helping to sustain employment in the construction trade. This will have a Short-Term Significant Positive Impact.

There is currently no published credible scientific evidence to positively link wind turbines with adverse health effects. The main publications supporting the view that there is no evidence of any direct link between wind turbines and health are summarised in Chapter 5 of this EIAR. Although there have been no empirical studies carried out in Ireland on the effects of wind farms on property prices, it is a reasonable assumption based on the available international literature that the provision of a wind farm at the proposed location would not impact on the property values in the area. The provision of underground electric cables is common practice throughout the country and installation to the required specification does not give rise to any specific health concerns. The extremely low frequency (ELF) electric and magnetic fields (EMF) associated with the operation of the proposed cables fully comply with the international guidelines for ELF-EMF set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP), a formal advisory agency to the World Health Organisation, as well as the EU guidelines for human exposure to EMF.

A wind farm is not a recognised source of pollution. Should a major accident or natural disaster occur the potential sources of pollution onsite during both the construction and operational phases are limited. Sources of pollution with the potential to cause significant environmental pollution and associated negative effects on health such as bulk storage of hydrocarbons or chemicals, storage of wastes etc. are limited.

Impacts on human beings during the construction and operational phases of the Proposed Development are described in Chapter 5 in terms of health and safety, employment and investment, population, land-use, noise, dust, traffic, tourism, residential amenity, renewable energy production and reduction in greenhouse gas emissions and interference with communication systems. Where a negative impact was identified, the appropriate mitigation measures will be put in place to ensure that there will be No Adverse Impacts on human health in the surrounding area.

Following consideration of the residual effects (post-mitigation), the Proposed Development will not result in any significant effects on population and human health. Provided that the Proposed Development is constructed and operated in accordance with the design, best practice and mitigation that is described within this application, significant effects on population and human health are not anticipated at international, national or county or local scale.

Shadow Flicker

Shadow flicker is an effect that occurs when rotating wind turbine blades cast shadows over a window in a nearby property. Shadow flicker may be experienced by an occupant sitting in an enclosed room when sunlight reaching the window is momentarily interrupted by a shadow of a wind turbine's blade. Shadow flicker effect lasts only for a short period of time and happens only in certain specific combined circumstances. Current guidelines recommend that shadow flicker at neighbouring dwellings within 500 metres of a proposed turbine location should not exceed a total of 30 hours per year or 30 minutes per day. The study area for the shadow flicker assessment is ten times rotor diameter from each turbine as set out in the DoEHLG guidelines, at distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low. There is a total of 80 No. properties including inhabitable dwellings and derelict properties, within a distance of 10 rotor diameters (assumed at 1,500 metres) from the proposed turbine locations.

The potential flicker that will occur at houses located within the area surrounding the Proposed Development was calculated using the WindFarm (ReSoft) software package and a regional sun factor of 29.5% was applied. Of the 80 No. properties modelled; it is predicted that 39 properties may theoretically experience daily shadow flicker levels in excess of the DoEHLG guideline threshold of 30 minutes per day. This prediction is assuming worst-case conditions (i.e. 100% sunshine on all days where the shadow of the turbines passes over a house, wind blowing in the correct direction, no screening present, etc.) and in the absence of any turbine control measures. Of these 39 No. properties: 37 No. properties are inhabitable dwellings (4 of which are participating properties); and 2 No. properties are derelict properties. Of the 80 no. properties modelled, when the regional sunshine average (i.e. the mean number of sunshine hours throughout the year) of 29.5% is taken into account, the DoEHLG guideline limit of 30 hours per year will not be exceeded at any of the modelled properties.

Where shadow flicker exceedances are predicted, suitable mitigation measures as outlined in Chapter 5 will be employed at the potentially affected properties to ensure that the current adopted 2006 DoEHLG guidelines are complied with at any dwelling within the 1.5km study area. The same mitigation strategies also demonstrate that the Proposed Development can be brought in line with the shadow flicker requirements of the Draft Revised Wind Energy Development Guidelines (2019) should they be adopted while this application is in the planning system.

Biodiversity

This chapter assesses the likely significant effects (both alone and cumulatively with other projects) that the Proposed Development may have on Biodiversity, Flora and Fauna and sets out the mitigation measures proposed to award, reduce or offset any potential significant effects that are identified.

Multidisciplinary walkover surveys were undertaken 11th May, 26th May, 02nd July, 16th July, 09th September, 11th September and 24th September 2020 and on 1st April, 18th June, 21st June, 1st September and 8th October 2021. The Proposed Development site was systematically and thoroughly walked in a ground-truthing exercise with the habitats on the Proposed Development assessed, classified and sketched onto field maps. The grid connection route options were surveyed on the 18th June, 21st of June, 1st September and 8th October 2021. The majority of the survey timings fall within the recognised optimum period for vegetation surveys/habitat mapping, i.e. April to September (Smith et al., 2011). A comprehensive walkover of the entire site was completed with incidental records also incorporated from other dedicated species/habitat specific surveys including otter, bats, marsh fritillary or quadrat surveys.

The habitats on the site of the Proposed Development were the subject of a detailed survey and assessment. This habitat mapping and assessment was undertaken following with 'A Guide to Habitats in Ireland' (Fossitt, 2000). The study area is predominantly comprised of areas of Improved agricultural Grassland (GA1), and areas of degraded peatland dominated by Cutover bog (PB4). The remainder of the site is made up of Raised bog (PB1), Wet grassland (GS4), Reed and Large Sedge Swamp (FS1), Conifer plantation (WD4), and Scrub (WS1).

Turbines 5 and 7, meteorological mast, temporary construction compound, borrow pit and substation are all located within Improved Agricultural Grassland habitat (GA1). Turbines 2, 4 and 6 are located within Cutover bog habitat (PB4). Turbine 1 is located within an area of Reed and Large Sedge Swamp (FS1) and Turbine 3 is located in a remnant area of degraded Raised bog (PB1) habitat.

There will be some loss of degraded peatland habitat to the Proposed Development footprint. This is associated with associated with Turbines T2, T3, T4, and T6. There will be no significant habitat loss associated with the Proposed Development and a Biodiversity Management and Enhancement Plan has been prepared Based on the nature of the habitats within the development footprint and the highly altered state of the existing hydrology; no significant residual impact on peatland habitats exists. Provided that the Proposed Development is constructed and operated in accordance with the design, best practice and mitigation that is described within this application, significant impacts on ecology are not anticipated.

Ornithology

This chapter assesses the likely significant effects that the Proposed Development may have on bird species. Firstly, a brief description of the Proposed Development is provided. This is followed by a comprehensive description of the methodologies that were followed in order to obtain the information necessary to complete a thorough assessment of the potential effects of the Proposed Development on bird species. The survey data is presented in full in the Environmental Impact Assessment Report (EIAR) appendices with a summary of the information presented within this chapter. An analysis of the results is then provided, which discusses the ecological significance of the birds recorded within the study area. The potential effects of the Proposed Development are then described in terms of the construction, operation and decommissioning phases of the development. An accurate prediction of the effects is derived following a thorough understanding of the nature of the Proposed Development along with a comprehensive knowledge of bird activity within the study area. The identification of Key Ornithological Receptors (KORs) and the assessment of effects follow a precautionary approach.

The potential for effects on designated sites is fully described in the Natura Impact Statement (NIS) that accompanies this application. The findings presented in the NIS are that the Proposed Development, by itself or in combination with other plans and projects, in light of best scientific knowledge in the field, will not adversely affect the integrity of the relevant European sites and no reasonable scientific doubt remains as to the absence of such effects.

Based on the detailed assessment, it is considered that the potential effects of the Proposed Development upon birds will not be significant. Effects associated with habitat loss, disturbance displacement, collision risk and cumulative effects have been assessed to be no greater than Long-term slight negative effect (EPA, 2017) and low effect significance (Percival, 2003).

The implementation of the prescribed mitigation measures will render any potential effects on avian receptors to low significance. In conclusion, no significant effects as a result of the Proposed Development are foreseen on key ornithological receptors of the study area.

Land, Soils and Geology

This chapter assesses the likely significant effects that the Proposed Development may have on land, soils and geology and sets out the mitigation measures proposed to avoid, reduce or offset any potential significant effects that are identified.

The geology of the Proposed Development site predominately comprises alluvium and cutover raised peat overlying mineral subsoil which in turn is underlain by sandstone and limestone bedrock.

Peat depths at the wind farm site ranged from 0 to 6.3m with an average of 2.6m. All proposed turbine locations are underlain by peat with the exception of T7 in the southwest of the site. Average peat depths at the other 6 no. turbine locations ranged from 3.4 to 4.8m.

Construction of the wind farm site, underground cable route infrastructure and substation extension will require the removal of peat, soil and rock to competent foundation. Excavation of bedrock from the on-site borrow pit will provide material for access road, turbine bases and general hard-standing construction. Removal of soil, peat and bedrock represents a direct impact on the geology of the Proposed Development site which is considered to be an acceptable part of economic progression and development.

During the construction phase sources of contaminants (such as oil-based substances or other hazardous chemicals) will not be stored at the site except where this is done within safely bunded areas that safely contain all spillages and prevent the migration of contaminants into soil, peat and bedrock. Refueling will be done with a double skinned bowser with spill kits on the ready in case of accidental spillages. The risk is considered to be low once mitigation measures are implemented. Drainage and erosion prevention measures will be put in place at all works locations.

The peat stability assessment undertaken at the site shows that the wind farm site and underground cable route have a low risk of slope failure or mass movements. Peat removed during the excavation works will be deposited in temporary peat storage areas and finally deposited in the on-site borrow. This will reduce the requirement for stock piling and potential slope failure and erosion. The handling and management of peat will be undertaken in accordance with the Peat & Spoil Management Plan.

If the mitigation measures presented in the EIAR are put in place no significant residual impacts on the land, soils and geological environmental are anticipated.

The land and soils impact assessment undertaken in this EIAR outlines that significant effects are unlikely due to the direct, localized nature of the construction works. Therefore, no cumulative effects will occur with other local developments.

Hydrology and Hydrogeology

Hydro-Environmental Services (HES) was engaged by MKO to undertake an assessment of the potential direct, indirect and cumulative effects of the Proposed Development on water aspects (hydrology and hydrogeology) of the receiving environment.

On a regional scale, the site is located in the Tralee Bay-Feale surface water catchment. On a more local scale, the site is located in the Brick River surface water sub-catchment.

The Feale River forms the north-eastern boundary of the site. The Feale River rises near Rockchapel in the Mullaghareirk Mountains in north Co. Cork and flows to the northwest. Closer to the site the Feale is joined by the Smearlagh River to the south of Listowel. The Smearlagh River drains the central and eastern parts of the Stack's Mountains. The Feale then flows westwards collecting from the River Galey to the north and the River Brick to the south. The Brick River forms the western boundary of the site. The Feale River is tidal in the vicinity of the site, referred to as the Upper Feale Estuary and the Cashen River Estuary upstream and downstream of its confluence with the Brick River respectively. The tidal influence extends upstream of the site as far as Finuge, located approximately 4km east of the site. The Cashen River Estuary discharges into the Mouth of the Shannon approximately 3km south of Ballybunnion and 6km northwest of the site.

The underground cable route begins in the Brick River surface water sub-catchment, and enters the Feale River surface water sub-catchment to the west of the site in the townland of Ballyhorgan. The grid route then veers to the south and enters the Brick River surface water sub-catchment in the townland of Lissahane.

In terms of well water yields, the bedrock which underlies the northwestern corner of the site is classified as a Poor aquifer. Further south, the bedrock is classified as a Locally Important Aquifer. Meanwhile the bedrock which underlie the south and east of the site, is classified as a Regionally Important Aquifer.

Groundwater vulnerability at the site ranges from 'Low' to 'Extreme-E' vulnerability. The south and east of the site are underlain by a Regionally Important karst aquifer which can be particularly vulnerable to groundwater pollution. The majority of the site, including all proposed turbine locations, is mapped as being of 'Low' to 'Moderate' groundwater vulnerability. This is due to the widespread coverage of blanket peat across much of the site. Further south, the substation, construction compound and borrow pit are located in an area of 'Extreme-E'. Subsoils in this area are more permeable, mapped by the GSI as comprising till derived from sandstones and shales. A small section of the borrow pit is located in an area of 'Extreme-X' vulnerability. This area is mapped as having rock close to or at the surface. Due to the local hydrogeological regime at this site, with high rates of surface runoff and a high drainage density, it is unlikely that a pollutant will reach groundwater wells in the vicinity of the site.

The site borders the Cashen River Estuary pNHA to the north and the Lower River Shannon SAC (Site Code: 002165) to the north and west, along the Feale and Brick Rivers. From a surface water quality perspective, due to the proposed mitigation measures, there will be no impact on these designated sites.

Due to the nature of wind farm developments, being near surface construction activities, impacts on groundwater is generally negligible and surface water is generally the main sensitive receptor assessed during impact assessments. The primary risk to groundwater at the site would be from hydrocarbon spillage and leakages at the borrow pit or turbine bases These are common potential impacts to all construction sites (such as road works and industrial sites). These potential contamination sources are to be carefully managed at the site during the construction and operational phases of the development and measures are proposed within the EIAR to deal with these potential minor impacts.

Two methods will be employed to control drainage water within the site during construction, thereby protecting downstream surface water quality and aquatic habitats. The first method involves 'keeping clean water clean' by avoiding disturbance to natural drainage features, minimising any works in or around artificial drainage features, and diverting clean surface water flow around excavations and construction areas. The second method involves collecting any drainage waters from works areas within the site that might carry silt, to allow settlement and cleaning prior to its release. During the construction phase all runoff will be treated to a high quality prior to being released.

Other preventative measures also include fuel and concrete management and a waste management plan which will be incorporated into the overall Construction and Environmental Management Plan.

There will be no risk of increased flooding down-gradient of the site as a result of the Proposed Development due to these drainage measures. Impacts on water quality during the construction phase of the wind farm will be imperceptible to none. A surface water monitoring programme will be put in place during the construction phase.

During the operational phase drainage control measures will ensure that surface runoff from the developed areas of the site will continue to be of good quality and will therefore not impact on the quality of down-stream rivers and streams. The present drainage regime of the site will not be altered in any way. Impacts on water quality during the operational phase of the wind farm will be negligible to none.

In terms of potential cumulative hydrological impacts with other wind farm developments, the biggest risk is during the construction phase of the development as this is the phase when earthworks and excavations will be undertaken at the sites. However, no hydrological cumulative effects with respect other windfarm developments will occur due to the fact that majority of the other wind farm turbines are constructed and also due to the low turbine density within the regional catchment.

Air and Climate

This chapter identifies, describes and assesses the potential significant direct and indirect effects on air quality and climate arising from the construction, operation and decommissioning of the Proposed Development.

The Environmental Protection Agency (EPA) has designated four Air Quality Zones for Ireland:

- Zone A: Dublin City and environs
- Zone B: Cork City and environs
- Zone C: 16 urban areas with population greater than 15,000
- Zone D: Remainder of the country.

These zones were defined to meet the criteria for air quality monitoring, assessment and management described in the Clean Air for Europe (CAFE) Directive (as amended) and the Fourth Daughter Directive. The site of the Proposed Development lies within Zone D, which represents rural areas located away from large population centres.

Due to the non-industrial nature of the Proposed Development and the general character of the surrounding environment, air quality sampling was deemed to be unnecessary for this EIAR.

The production of energy from wind turbines has no direct emissions as is expected from fossil fuel-based power stations. Harnessing more energy by means of wind farms will reduce dependency on fossil fuels, thereby resulting in a reduction in harmful emissions that can be damaging to human health and the environment. Some minor short term or temporary indirect emissions associated with the construction of the wind farm include vehicular and dust emissions.

A Construction and Environmental Management Plan (CEMP) will be in place throughout the construction phase (see Appendix 4-2 of the EIAR) and includes dust suppression measures. In addition, turbines and construction materials will be transported to the site on specified haul routes only. The agreed haul route roads adjacent to the site will be regularly inspected for cleanliness and cleaned as necessary.

Climate Change and Carbon Balance Calculations

Climate change is one of the most challenging global issues facing us today and is primarily the result of increased levels of greenhouse gases in the atmosphere. These greenhouse gases come primarily from the combustion of fossil fuels in energy use. Changing climate patterns are linked to increased frequency of extreme weather conditions such as storms, floods and droughts. In addition, warmer weather trends can place pressure on animals and plants that cannot adapt to a rapidly changing environment. Moving away from our reliance on coal, oil and other fossil fuel-driven power plants is essential to reduce emissions of greenhouse gases and combat climate change.

In July 2020, the Environmental Protection Agency (EPA) published an update on Ireland's Greenhouse Gas Emission Projections to 2040. The report includes an assessment of Ireland's progress towards achieving its emission reduction targets out to 2020, 2030 and 2040 set under the EU Effort Sharing Decision (Decision No 406/2009/EU) and Effort Sharing Regulation (Regulation (EU) 2018/842).

Projected greenhouse gas emissions up to 2040 are obtained using two scenarios; '*With Existing Measures'* and *'With Additional Measures'*. The '*With Existing Measures'* scenario assumes that no additional policies and measures, beyond those already in place by the end of 2017 are implemented. The *'With Additional Measures'* scenario assumes the implementation of the *'With Existing Measures'* scenario and further implementation of the governments renewable and energy efficiency policies including those set out in the National Renewable Energy Action Plan (NREA), the National Energy Efficiency Action Plan (NEEAP) and the National Development Plan 2018-2027.

The EPA Emission Projections Update notes that Ireland's non-Emissions Trading Scheme (ETS) emissions are projected to be 5% and 6% below 2005 levels in 2020 under the *'With Measures'* and *'With Additional Measures'* scenarios, respectively. The target for Ireland is a 20% reduction. Over the period 2013 – 2020, Ireland is projected to cumulatively exceed its compliance obligations by 13.4 Mt CO_2 (metric tonnes of Carbon Dioxide) equivalent under the *'With Existing Measures'* scenario and 12.6 Mt CO_2 equivalent under the *'With Additional Measures'* scenario. Reporting on Ireland's compliance obligations status for this period have not yet been published.

The report concludes:

- *"Projections indicate that Ireland will exceed the carbon budget over the period 2021-2030 by 51 Mt CO_2 equivalent assuming LULUCF flexibilities described in the Regulation are fully utilised."*
- *"To determine compliance under the Effort Sharing Decision, any overachievement of the binding emission limit in a particular year (between 2013 and 2020) can be banked and used towards compliance in a future year. However, even using this mechanism Ireland will still be in non-compliance according to the latest projections."*
- *"A significant reduction in emissions over the longer term is projected as a result of the expansion of renewables (e.g. wind), assumed to reach 55% by 2030 under the 'With Existing Measures' scenario and 70% by 2030 under the 'With Additional Measures' scenario"*
- *"The projects reflect plans to bring Ireland onto a lower carbon trajectory in the longer term. However, Ireland still faces significant challenges in meeting EU 2030 targets in the non-ETS sector and national 2050 reduction targets in the electricity generation, built environment and transport sectors. Progress in achieving targets is dependent on the level of implementation of current and future plans."*

The carbon balance of proposed wind farm developments in peatland habitats has attracted significant attention in recent years. When development such as wind farms are proposed for peatland areas, there will be direct impacts and loss of peat in the area of the development footprint. There may also be indirect impacts where it is necessary to install drainage in certain areas to facilitate construction. The works can either directly or indirectly allow the peat to dry out, which permits the full decomposition of the stored organic material with the associated release of the stored carbon as CO_2. It is essential therefore that any wind farm development in a peatland area saves more CO_2 than is released.

A methodology for calculation carbon losses was published in June 2008 by scientists at the University of Aberdeen and the Macauley Institute with support from the Rural and Environment Research and Analysis Directorate of the Scottish Government, Science Policy and Co-ordination Division. This methodology was refined and updated in 2011 based on feedback from users of the initial methodology and further research in the area. The web-based version of the carbon calculator, which supersedes the excel based versions of the tool, was released in 2016. The tool provides a transparent and easy to follow method for estimating the impacts of wind farms on the carbon dynamics of peatlands and was used to assess the effects of the proposed wind farm in terms of potential carbon losses and savings taking into account peat removal, drainage and operation of wind farm. The model calculates the total carbon emissions associated with the proposed wind farm development including manufacturing of the turbine technology, transport, construction of the development and carbon losses due to peatland disturbance and forestry felling. The model also calculates the carbon savings associated with the Proposed Development.

In total, it is estimated that 1,967,770 tonnes of carbon dioxide will be displaced over the proposed 35-year lifetime of the renewable energy development.

Construction of the Proposed Development will have a Short-Term, Imperceptible Negative Effect as a result of greenhouse gas emissions from construction plant and vehicles. Operation of the Proposed Development will have a Long-Term Slight Positive Impact on climate as a result of reduced greenhouse gas emissions.

Noise and Vibration

AWN Consulting Limited has been commissioned to conduct an assessment into the likely environmental noise and vibration impacts of the proposed Ballynagare wind farm development (the 'Proposed Development').

The background noise environment has been established through noise monitoring surveys undertaken at five noise sensitive locations (NSLs) surrounding the Proposed Development. Typical background noise levels for day and night periods at various wind speeds have been measured in accordance with best practice guidance contained in the Institute of Acoustics document 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' (IoA GPG). The results of the background noise survey have been used to derived appropriate noise criteria for the development in line with the guidance contained in 'Wind Energy Development Guidelines for Planning Authorities 2006.

When considering a development of this nature, the potential noise and vibration effects on the surroundings must be considered for three stages: the short-term construction and decommissioning phases and the long-term operational phase.

The assessment of construction and decommissioning noise and vibration and has been conducted in accordance with best practice guidance contained in BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise and BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Vibration. Subject to good working practice as recommended in the EIAR Chapter, it is not expected that there will be any significant noise and vibration impacts associated with the construction phase and the likely noise from construction activity at the nearest NSLs is expected to be below recommended threshold values. The associated construction noise and vibration impacts are not expected to cause any significant effects.

Based on detailed information on the site layout, the likely turbine noise emissions and turbine hub height for the proposed development, a series of 'worst-case' turbine noise prediction models have been prepared for review. The predicted turbine noise levels have been calculated at all NSLs in accordance with the IOA GPG recommendations. The assessment has confirmed that the residual turbine noise levels associated with the Proposed Development will be within the best practice noise criteria curves recommended in Irish guidance document 'Wind Energy Development Guidelines for Planning Authorities 2006. Therefore, it is not considered that a significant effect is associated with the Proposed Development.

No significant vibration effects are associated with the operation of the Proposed Development.

In summary, the noise and vibration impact of the proposed development is not significant considering best practice guidance for wind turbine developments.

Landscape and Visual

The landscape and visual section of the EIAR addresses the potential landscape and visual effects of the proposed Ballynagare wind farm, Co. Kerry. It includes a description of Kerry County Council landscape policy and examines the site's landscape values and sensitivity. The landscape of the area is described in terms of its character. The visual impact assessment of the proposed development is based on the selection and representation of viewpoints. A study area of 20km radius from the site boundary was selected for assessment of both the landscape and visual effects.

Current land-use on the site comprises mainly of cutover bog and some areas of agricultural grassland. The character of the wider landscape is that of a settled working rural landscape. Within the wider landscape, agriculture is also common, with occasional pockets of cutover peat, whilst the frequency of woodland increases toward Listowel.

The proposed development site, the areas surrounding as well as many other areas within the study area can be described as 'hilly and flat farmland', however, there are also areas of flat peatland within the study boundary. Although in some cases the turbines will be viewed from this other landscape types, it is considered that in terms of the siting and design the 'hilly and flat farmland' landscape type most strongly influences the siting and design of the proposed Ballynagare development.

Predicted Impacts on Landscape

In terms of landscape character, only County Kerry's Landscape Character Area 3 Cashen River, in which the turbines of the proposed development are located, experiences direct effects on landscape character as a result of the project. Any other effects on other LCAs are indirect, as the proposed development will be visible from within these LCAs but located outside of them. The site is not located within or close to any designated County Kerry zones of special landscape amenity and has not had any significant effect on these areas. In some LCAs the proposed development will add to the cumulative landscape status, although it would not change the character of the individual LCAs in terms of wind energy and therefore the cumulative landscape effects are considered Low.

The only landscape designation brought forward as a landscape receptor likely to experience landscape effects is the zone of Rural Secondary Special Amenity north of Cashen Bay, River Feale estuary and Banna Strand. Here the ZTV mapping shows widespread full theoretical visibility. Assessment of landscape effects attributed by the proposed development are determined to be insignificant. Heritage landscapes were also observed within County Clare from across the Shannon River towards the proposed site boundary, as evident in VP5, almost no visibility of the proposed development will be seen from this location due to the distance of >18km.

The assessment of predicated impacts on the landscape determined that the proposed development is only likely to induce 'Not Significant' or 'Imperceptible' effects on the landscapes of the other LCAs assessed within the LVIA study area.

Predicted Visual Impacts

A combination of ZTV mapping, photomontage assessment and on-site visual assessments has determined that visibility of the site and likely visual effects are primarily constrained to the flat coastal plain surrounding the proposed site from the north, east and west (at a distance of approximately 10km). Topographical landform significantly mitigates likely visual effects occurring in the majority of the landscape to the south, east and north beyond 10km of the site. Areas to the west and south-west where visibility of the site could potentially occur will be restricted to remote, elevated locations where there is a notable absence of sensitive visual receptors and visibility is significantly mitigated by distance, therefore, resulting visual effects in these areas will be insignificant.

The visual baseline reports that visual receptors of highest sensitivity in the LVIA study area are located to the west at Ballybunion and Kerry Head and north-west around the town of Ballyheigue. Topographical screening and the factor of distance renders visibility of the proposed Ballynagare development to be highly unlikely from these receptors, resulting in insignificant visual effects.

An assessment of the visual effects of the Ballynagare wind farm development was undertaken from the sixteen photomontage viewpoint locations. The significance of the residual visual effect was not considered to be “Profound” “Very Significant” or “Significant” at any of the 16 viewpoint locations. The visual assessment concluded that residual visual effects of “Moderate” was deemed to arise at three of the sixteen viewpoint locations. All other viewpoints were assessed as resulting in Slight (5), Not Significant or Imperceptible residual visual effects.

Visual receptor sensitivity from Viewpoints 1 and 3 were deemed High due to designations in the CDP, they’re both located within or along recreational and tourist designations and their intervening distance is <5km from the nearest turbine. The Rattoo Church and Round Tower at Viewpoint 1 is not listed as a common tourist destination and the local road of the Rattoo Church is in poor condition with very few residential receptors, therefore is unlikely to be travelled often. Viewpoint 3 located at the Ferry Bridge, Scenic Route 1 and Wild Atlantic Way will have direct views of the turbines over Cashen River, however, the coniferous forestry plantation in the foreground significantly reduces the aesthetic quality of landscape views. Additionally, the key views of the Cashen River and Stacks Mountain are not impacted with the addition of the proposed development and the turbines are readily absorbed into what is a predominantly working and man-made landscape.

As demonstrated in the Photomontage booklet and photomontage assessment tables (Appendix 13-3), the turbine locations spacing and heights have been appropriately selected for the Ballynagare site. The strategic siting ensures the wind farm will be viewed as a spatially coherent development, with minimal occurrence of visual confusion and overlapping, significantly mitigating the impact of likely visual effects. Overall, landscape and visual effects arising from the proposed development will be minimal and no significant effects are foreseen.

Archaeology and Cultural Heritage

This chapter comprises an assessment of the potential impact of the proposed development on the Cultural Heritage resource. Cultural heritage includes archaeology, architectural heritage and any other tangible assets. The assessment was based on GIS based mapping, ZTV and Viewshed analysis to assist with the assessment of impacts on setting followed by a desktop analysis of all baseline data and a comprehensive programme of field inspection of the proposed infrastructure within the proposed development site boundary.

Ten recorded monuments are located within the wind farm EIAR site boundary while 199 monuments are situated within 5km of the nearest proposed turbine. This is considered to be a relatively high density of monuments. Of those monuments located within the proposed wind farm EIAR boundary, only one KE009-088 Road – unclassified togher is located at or in close proximity to proposed infrastructure. A number of mitigation measures have been recommended in order to ameliorate any potential impacts to this monument.

The potential impacts on unknown sub-surface features which may exist within the proposed wind farm site is addressed by means of pre-development archaeological testing and construction stage monitoring.

Indirect effects on the setting of National Monuments within 10km, RMPs within 5km and RPS/NIAH within 5km were included in order to assess impacts on setting in the wider landscape. Viewshed analysis and a review of the ZTV was undertaken to establish the nature and degree of impacts on the setting of National Monuments. The potential visual impact to National Monument No. 55 Rattoo ecclesiastical site as a result of the proposed Ballynagare turbines is regarded as Moderate-Significant.

Potential visual effects on recorded monuments, RPS and NIAH structures within 5km of the proposed turbines was also assessed and is regarded as Slight-Not Significant.

The grid connection route was also assessed and included in the assessment. Mitigation in the form of site monitoring of ground works where it extends through the zone of notification around an adjacent recorded monument is recommended.

An assessment of cumulative impacts was also undertaken taking into consideration projects within 20km of the proposed development. This included all permitted, proposed and existing turbines, as well as other projects listed in Chapter 2 of this EIAR. No direct cumulative impacts will occur. Some increases in impacts to the visual setting of some cultural heritage sites will occur taking into consideration all turbines (if constructed). These effects are reversible should the turbines be decommissioned after the permitted lifetime of the proposed development.

Material Assets

Traffic and Transport

An assessment of the traffic effects of the Proposed Development was undertaken for both the construction and operational stages of the development. The assessment considered the impact that the traffic generated by the Proposed Development would have on the local highway network, and also presents an assessment of the route geometry with respect to accommodating the abnormally sized vehicles required to deliver the turbine plant to the site.

The delivery route for the abnormally sized loads leaves the national road network on the N69 to join the L6055 at Mountcoal, before heading northwest for approximately 4km to the priority junction with the R557. The route then heads southwest for 2.5kms before turning right into an unnamed local road towards the site at Ballynagare. Access to the site is then gained by turning left onto the proposed access road.

The types of vehicles that will be required to negotiate the local network will be up to 79.5 metres long with a blade length of 73.65 metres. An assessment of the geometric requirements of the delivery vehicles was undertaken on the proposed delivery route. Locations where it was established that the existing road geometry will not accommodate all of the vehicles associated with the Proposed Development are highlighted, with the extent of remedial works indicated.

In terms of daily traffic flows it is estimated that the impact of the development traffic on the delivery routes will be as follows:

- During the 7 days when the concrete foundations are poured the effect on the surrounding road network will be negative, resulting in an increase in traffic levels ranging from 5.1% on the N69 and 12.5% on the R557, to 65.3% on the local road leading to the site and 77.7% on the L6055. The direct effect will be temporary, and will be slight on the N69 and R557, to moderate on the L6055 and the local road leading to the site.

- During the remaining 248 days for the site preparation and ground works when deliveries to the site will take place, the effect on the surrounding road network will be negative, resulting in an increase in traffic levels ranging from 1.3% on the N69 and 3.2% on the R557, to 16.9% on the local road leading to the site and 20.1% on the L6055. On these days, the direct effect will be temporary and will be slight.

- During the 7 days when general materials are delivered to the site using standard HGVs, the effect of the additional traffic will result in increased traffic volumes between 0.7% on the N69 and 1.6% on the R557, to 8.5% on the local road leading to the site and 10.1% on the L6055. The direct effects will be temporary and will be slight.

- During the 21 days of the turbine construction stage when the various component parts of the wind turbine plant are delivered to the site using extended articulated HGVs the delivery of construction materials will result in a negative impact on the surrounding road network, increasing traffic levels, ranging from 1.2% on the N69 and 2.9% on the R557, to an increase of 15.4% on the local road leading to the site and 18.3% on the on the L6055. The direct effect during this period will be temporary and will be moderate due to the size of vehicles involved. This will reduce to slight if these deliveries are undertaken at night as proposed.

Once the Proposed Development is operational the traffic impact created by maintenance staff will be negligible.

The design life of the Proposed Development is 35 years. If the site is decommissioned, cranes will disassemble each turbine tower and all equipment. All turbine infrastructure including turbine components will be separated and removed off-site for re-use, recycling and waste disposal. Turbine foundations would remain in place underground and would be covered with earth and reseeded as appropriate. It is proposed to leave the access roads and hardstanding areas in situ at the decommissioning stage. The mitigation measures prescribed for the construction phase of the Proposed Development will be implemented during the decommissioning phase thereby minimising any potential impacts

Telecommunications and Aviation

Wind turbines, like all large structures, have the potential to interfere with broadcast signals, by acting as a physical barrier or causing a degree of scattering to microwave links. The most significant effect at a domestic level relates to a possible flicker effect caused by the moving rotor, affecting, for example, radio signals. The most significant potential effect occurs where the wind farm is directly in line with the transmitter radio path.

Of the scoping responses received from telephone, broadband and other telecommunications operators, all operate links either outside the Proposed Development site or do not operate any links in the area.

In January 2021, scoping responses were received from Shannon Airport and the Irish Aviation Authority (IAA), which set out lighting requirements for turbines

All of the above requirements outlined by the IAA will be complied with should the Proposed Development receive a grant of planning permission.

In summary, there will be no significant impact on telecommunications and aviation as a result of the Proposed Development.

Interactions of the Foregoing

Chapters 5 to 14 of this EIAR identify the potential significant environmental effects that may occur in terms of Population and Human Health, Biodiversity, Ornithology, Land, Soils and Geology , Hydrology and Hydrogeology, Air and Climate, Noise and Vibration, Landscape and Visual, Cultural Heritage and Material Assets, as a result of the Proposed Development. All of the potential significant effects of the Proposed Development and the measures proposed to mitigate them have been outlined in the main EIAR. However, for any development with the potential for significant environmental effects there is also the potential for interaction between these potential significant effects. The result of interactive effects may exacerbate the magnitude of the effects or ameliorate them or have a neutral effect.

A matrix is presented in Chapter 15 of the EIAR to identify interactions between the various aspects of the environment already discussed in the EIAR. The matrix highlights the occurrence of potential positive or negative impacts during both the construction and operational phases of the Proposed Development. Where any potential interactive impacts have been identified, appropriate mitigation is included in the relevant sections (Chapters 5–14) of the EIAR.

1. INTRODUCTION

1.1 Introduction

This Environmental Impact Assessment Report (EIAR) has been prepared by McCarthy Keville O'Sullivan Ltd. (MKO) on behalf of Ballynagare Wind Farm Ltd. who intend to apply to apply to Kerry County Council (KCC) for planning permission to construct a renewable energy development including on-site substation, grid connection, and all associated infrastructure in the townlands of Ballynagare, Dysert Marshes, Dysert, Curraghcroneen, Farrandeen, Monument, and adjacent townlands in County Kerry (the 'project').

The proposed development is located approximately 2km north of the village of Lixnaw and approximately 8.8km southwest of the town of Listowel, Co. Kerry. The approximate location for the centre of the proposed development is E489583, N5632204. The primary EIAR study area for proposed development covers an area of approximately 640 hectares, in total.

The proposed development is being brought forward in response to local, national, regional and European policy regarding Ireland's transition to a low carbon economy and associated climate change policy objectives.

The proposed development will comprise of 7 No. wind turbines with a tip height of 169.5 metres (m) minimum up to 170m maximum and will have a maximum export capacity (MEC) of up to 42 megawatts (MW).

This EIAR accompanies the planning application for the proposed development submitted to Kerry County Council. The planning application is also accompanied by a Natura Impact Statement ('NIS').

It is intended to connect the proposed development to the national grid via a 38kV underground cable which will be located within the public road corridor. The underground cable will connect the proposed on-site 38kV substation (and hence the proposed development) to the National Grid via the existing Clahane electricity substation in the townland of Pallas located approximately 5.5 kilometres southeast (straight-line direction) of the proposed on-site substation.

Works required along the proposed turbine delivery route are not included in the planning application but are assessed as part of this EIAR.

A full description of the proposed development for the purposes of the planning application and the additional elements that form part of the overall project, assessed in this EIAR, are contained in Chapter 4 of this EIAR.

The townlands within which the proposed development and ancillary works are located, including the grid connection cabling route, are listed in Table 1-1.

Table 1.1 Townlands within which the Proposed Development is located.

Development Works	Townland
Wind turbines and access roads, Substation, Control Building, Construction Compound & Borrow pit	Ballynagare, Dysert Marshes, Farrandeen, and Monument
Underground Grid Connection Cable Route to Clahane 110kV substation	Knockaunacurraheen, Ballintogher, Ballnageragh, Clooncolla, Ballyhorgan West, Ballyhorgan East, Lissahane, Knockburrane, Ballygarret, Banemore, and Pallas.

1.2 Legislative Context

1.2.1 Environmental Impact Assessment

The consolidated European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive'), was transposed into Irish planning legislation by the Planning and Development Acts 2000 to 2021 and the Planning and Development Regulations 2001 to 2021. The EIA Directive was amended by Directive 2014/52/EU which has been transposed into Irish law by the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018).

This EIAR has been prepared in accordance with the EIA Directives and the above-mentioned Irish planning legislation incorporating and transposing the Directives.

The EIA Directives require Member States to ensure that a competent authority carries out an assessment of the likely significant effects of certain types of project, as listed in the Directives, prior to any determination on development consent for the project.

The Environmental Impact Assessment (EIA) of the proposed development will be undertaken by Kerry County Council as the competent authority. Article 5 of the EIA Directive as amended by Directive 2014/52/EU provides where an EIA is required, the developer shall prepare and submit an environmental impact assessment report (EIAR). The information to be provided by the developer shall include at least:

a) *description of the project comprising information on the site, design, size and other relevant features of the project;*
b) *a description of the likely significant effects of the project on the environment;*
c) *a description of the features of the project and/or measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment;*
d) *a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment;*
e) *non-technical summary of the information referred to in points (a) to (d); and*
f) *any additional information specified in Annex IV relevant to the specific characteristics of a particular project or type of project and to the environmental features likely to be affected.*

In addition, Schedule 6 to the Planning and Development Act 2000, as amended sets out the information to be contained in an EIAR, with which this EIAR complies.

MKO was appointed as environmental consultant on the proposed development and commissioned to prepare this EIAR in accordance with the requirements of the EIA Directives.

The relevant classes/scales of development that require Environmental Impact Assessment (EIA) are set out in Schedule 5 of the Planning and Development Regulations 2001 to 2021. The relevant class of development in this case relates to "installations for the harnessing of wind power for energy production (wind farms) with more than 5 turbines or having a total output greater than 5 megawatts", as per paragraph 3(i) of Part 2 of Schedule 5. The proposed development exceeds 5 turbines and 5 Megawatts in scale, and therefore is required to be subject to EIA.

The EIAR provides information on the receiving environment and assesses the likely significant effects of the proposed development on it and proposes mitigation measures to avoid or reduce these effects. The function of the EIAR is to provide information to allow the competent authority to conduct the Environmental Impact Assessment (EIA) of the proposed development.

All elements of the overall project, (including the wind turbines and associated infrastructure, substation, grid connection, whooper swan mitigation lands, and turbine delivery route) have been assessed as part of this EIAR.

1.2.2 EIAR Guidance

The Environmental Protection Agency (EPA) published its 'Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (EPA, August 2017), which is intended to guide practitioners preparing an EIAR in line with the requirements set out in the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018).

In preparing this EIAR regard has also been taken of the provisions of the 'Guidelines for Planning Authorities and An Bord Pleanála on Carrying out Environmental Impact Assessment', published by the Department of Housing, Planning and Local Government (DHPLG) in August 2018 to the extent these guidelines are relevant having regard to the enactment of the revised EIA Directive.

The European Commission also published a number of guidance documents in December 2017 in relation to Environmental Impact Assessment of Projects (Directive 2011/92/EU as amended by 2014/52/EU) including 'Guidance on Screening', 'Guidance on Scoping' and 'Guidance on the preparation of the Environmental Impact Assessment Report'. MKO has prepared the EIAR with regard to these guidelines also.

1.2.3 Wind Energy Development Guidelines for Planning Authorities

The relevant considerations under the '*Wind Energy Development Guidelines for Planning Authorities'* (Department of the Environment, Heritage and Local Government (DOEHLG), 2006) have also been taken into account.

The 'Wind Energy Development Guidelines for Planning Authorities' (DoEHLG, 2006) were the subject of a targeted review in 2013. The proposed changes to the assessment of impacts associated with onshore wind energy developments are outlined in the document *'Proposed Revisions to Wind Energy Development Guidelines 2006 – Targeted Review'* (December 2013). A consultation process in relation to the document is currently being undertaken by the Department of Communications, Climate Action and Environment (DCCAE) and as of December 2019, the proposed changes to the assessment of impacts associated with onshore wind energy developments are outlined in the document *Draft Revised Wind Energy Development Guidelines* (December 2019). A consultation process in relation to the 2019 document commenced on the 12th December 2019 and concluded on February 19, 2020. The final

Revised Wind Energy Development Guidelines have yet to be published by the Department of Housing, Planning and Local Government (DoHPLG).

At time of writing, the Draft Guidelines have not yet been adopted, and the relevant guidelines for the purposes of section 28 of the Planning and Development Act 2000, as amended remain those published issued in 2006. Notwithstanding this, however, due to the timelines associated with the planning process for renewable energy projects, it is possible that a version of the draft guidelines may be finalised and issued during the consideration period for the current proposed development. Should the revised Wind Energy Development Guidelines be adopted in advance of a planning decision being made on the proposed development, it is anticipated that the Ballynagare Wind Farm will be capable of complying with the revised guidance. In particular, the distance to third party sensitive receptors will achieve the proposed 4 times turbine tip height and any revised noise and shadow flicker requirements can be achieved by implementing mitigation through use of the turbine control systems if required. If necessary, further information may be sought from the applicant.

1.3 The Applicant

The applicant for the proposed development, Ballynagare Wind Farm Limited, is a subsidiary company of EMPower which is an Irish based international wind energy developer with over 700 MW in development in Europe and Africa. EMPower's senior management team has a combined 95 years' experience delivering projects from conception to operation across five continents. EMPower is a private limited company and is owned by GGE Ireland Limited, Wind Power Invest A/S and EMP Holdings Limited.

1.4 Brief Description of the Proposed Development

Ballynagare Wind Farm Limited (the Applicant) is seeking planning permission to construct a wind energy development on land at Ballynagare, approximately 9km west of Listowel and approximately 2km north of Lixnaw County Kerry. The development is located in the townlands of Ballynagare, Dysert Marshes, Farrandeen, Monument, Knockaunacurraheen, Ballintogher, Ballnageragh, Clooncolla, Ballyhorgan West, Ballyhorgan East, Lissahane, Knockburrane, Ballygarret, Banemore, and Pallas.

The development comprises:

- Construction of 7 no. wind turbines with the following maximum and minimum parameters:
  - Overall ground to blade tip height in the range of 170m maximum to 169.5m minimum
  - Hub height of 95m
  - Rotor diameter in the range of 150m maximum to 149m minimum
- Turbine hardstand areas;
- Provision of 1 no. permanent meteorological mast with a height of 110 metres.
- Upgrade of existing roads and access junctions
- Provision of new site entrances, roads and hardstand areas
- 2 no. peat storage areas
- 2 no. construction compounds
- 1 no. borrow pit
- All site drainage works
- 1 no. onsite 38kV substation, control building and plant, associated security fencing and wastewater holding tank
- All associated underground electrical and communication cabling connecting the turbines to the proposed on-site substation
- Connection of the proposed 38kV on-site substation via underground cable in the public road to the entrance of the existing Clahane 110kV substation in the townland of Pallas

- All ancillary site and ground works, apparatus and signage

The application is seeking a ten-year planning permission and 35 year operational life from the date of commissioning of the wind farm. Current and future wind turbine generator technology will ensure that the wind turbine model, chosen for the proposed development, will have an operational lifespan greater than the 35 year operational life that is being sought as part of this application.

Modern wind turbine generators typically have an output of between 3 and 6 MW. Turbines of the exact same make, model and dimensions can also have different power outputs depending on the capacity of the electrical generator installed in the turbine nacelle. For the purposes of this EIAR, a rated output of 6.0 MW has been chosen to calculate the power output of this proposed development's 7-turbines, which would result in an estimated installed capacity of 42MW. The actual installed capacity will vary depending on the exact make and model of turbine available at the time of construction, however for assessment purposes any difference in installed capacity will be negligible in terms of environmental effects.

The layout of the proposed development has been constraints-led, thereby avoiding any environmentally sensitive parts of the site. The roads layout for the proposed development makes use of the existing onsite access roads and tracks where possible, with approximately 1.11 kilometres of existing farm tracks and roadway requiring upgrading and approximately 8.21kilometres of new access road proposed to be constructed.

It is proposed to construct a 38 kV substation as part proposed development, and to connect to the National Grid via an underground cable connection running from the proposed on-site substation to the existing Clahane Substation, located approximately 7 kilometres to the southeast, in the townland of Pallas. The underground cabling will follow the route of existing public roadways.

The overall project, including wind farm, sub-station, grid connection, whooper swan mitigation lands, turbine delivery route, and borrow pit have been assessed as part of this EIAR.

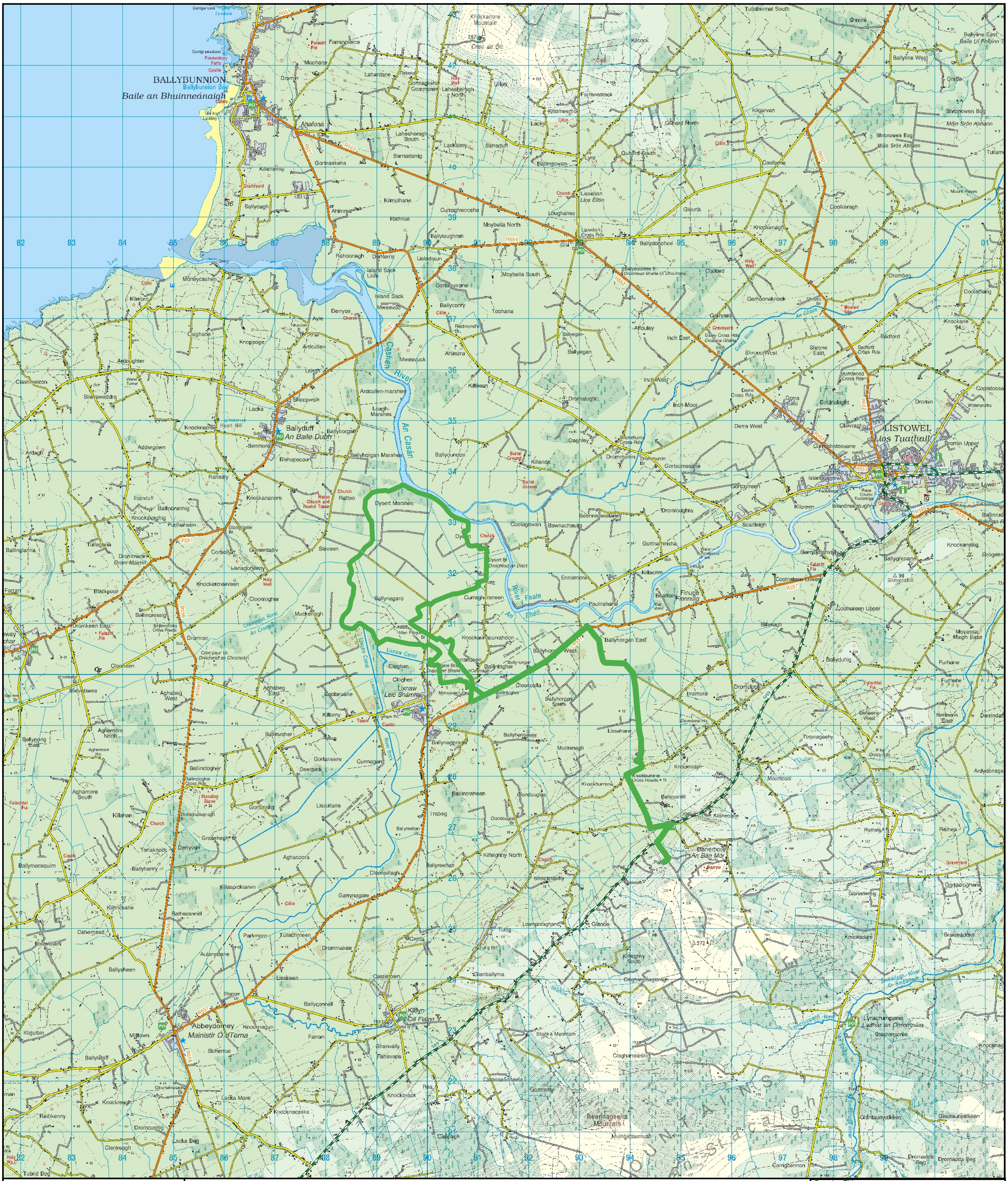
1.4.1 References to Proposed Development

For the purposes of this EIAR, where the 'proposed development' is referred to, this relates to the development for which permission is sought.

Chapter 4 of this EIAR includes a description of all the components of the proposed project including those components for which planning permission is not being sought, such as the proposed whooper swan habitat enhancement area. The overall project as described in Chapter 4 has been assessed in the EIAR.

Where 'the site' is referred to, this relates to the primary EIAR Study Area for the development, as delineated by the EIAR Study Area in green as shown on Figure 1-1. Individual topics for assessment purposes, i.e. each chapter, indicate the study area used for that topic. The actual development boundary for the purposes of the planning permission application, as shown on the planning application drawings, occupies a smaller area within the primary EIAR Study Area.

The EIAR Study Area, 'the site', encompasses an area of approximately 611 hectares. The permanent footprint of the proposed development measures approximately 9.67 hectares, which represents approximately 1.6% of the primary EIAR Study Area.



Map Legend

EIAR Study Area

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Drawing Title	
Site Location Map	
Project Title	
Ballynagare Wind Farm	
Drawn By	Checked By
TB	MW
Project No.	Drawing No.
200512	Figure 1.1
Scale	Date
1:100000	05/09/2021

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1.5 Need for the Proposed Development

1.5.1 Overview

In March 2019, the Government announced a renewable electricity target of 70% by 2030 as part of the governments Climate Action Plan. The proposed development would likely be operational after 2021 and would therefore contribute to this 2030 target. More recently, the EPA reported that Ireland is set to fall far short of its carbon emissions reduction targets for 2030, despite climate action measures in the National Development Plan (EPA, June 2019). The proposed Ballynagare Wind Farm is critical to helping Ireland address these challenges as well as addressing the country's over-dependence on imported fossil fuels.

The need for the proposed development is driven by the following factors:

1. *A legal commitment from Ireland to limit greenhouse gas emissions under the Kyoto protocol to reduce global warming;*
2. *A requirement to increase Ireland's national energy security as set out in the Energy White Paper;*
3. *A requirement to diversify Irelands energy sources, with a view to achievement of national renewable energy targets and an avoidance of significant fines from the EU (the EU Renewables Directive);*
4. *Provision of cost-effective power production for Ireland which would deliver local benefits; and*
5. *Increasing energy price stability in Ireland through reducing an over reliance on imported gas.*

These factors are addressed in further detail below. Section 2.1 in Chapter 2 of this EIAR on Background to the proposed development, presents a full description of the international and national renewable energy policy context for the proposed project. Section 2.2 addresses climate change, including Ireland's current status with regard to meeting greenhouse gas emission reduction targets.

1.5.2 Climate Change and Greenhouse Gas Emissions

At the Paris climate conference (COP21) in December 2015, 195 countries adopted the first-ever universal, legally binding global climate deal the Paris Agreement. The Paris Agreement sets out a global action plan to avoid dangerous climate change by limiting global warming to well below 2°C above pre-industrial levels. Under the Paris Agreement, the EU and Governments also agreed on the need for global emissions to peak as soon as possible, recognising that this will take longer for developing countries and to undertake rapid reductions thereafter in accordance with the best available science.

The International Panel on Climate Change (IPCC) has put forward its clear assessment that the window for action on climate change is rapidly closing and that renewable energy sources such as wind will have to grow from 30% of global electricity at present to 80% by 2050 if we are to limit global warming to below 2 degrees[1] and in accordance with the COP 21 agreement to limit global warming to well below 2°C above pre-industrial levels.

In this regard, the Government enacted the Climate Action and Low Carbon Development Act 2015 which provides for the approval of plans by the Government in relation to climate change for the purpose of pursuing the transition to a low carbon, climate resilient and environmentally sustainable economy. On 23 March 2021, the Government published a revised draft text of the Climate Action and

[1] *IPCC Fifth Assessment Synthesis Report, Intergovernmental Panel on Climate Change AR5 Report*

Low Carbon Development (Amendment) Bill 2021 which proposes to amend the Climate Action and Low Carbon Development Act 2015.

The IPCC published an article on the 6th October 2018 titled '*Global Warming of 1.5°C*'[2], which notes the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of mitigation pathways, strengthening of the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. It provided detail on the impact of climate change if emissions are not reduced.

The Energy White Paper, published by the Department of Communications, Energy & Natural Resources in 2015, notes that:

> *"The use of renewables in electricity generation in 2014 reduced CO_2 emissions by 2.6 Mt and avoided €255 million in fossil fuel imports".*

It is estimated that the proposed development will have a potential output of up to approximately 42 MW from the proposed wind turbines. The proposed development will result in the net displacement of approximately 56,222 tonnes of Carbon Dioxide (CO_2) per annum, including accounting for back-up generation. The carbon offsets resulting from the proposed development are described in detail in Section 10.2.3 of Chapter 10 of this EIAR: Air and Climate.

1.5.3 Energy Security

At a national level, Ireland currently has one of the highest external dependencies in the EU on imported sources of energy, such as coal, oil and natural gas.

A report by the Sustainable Energy Authority of Ireland (SEAI), published in September 2020 (Energy Security in Ireland, 2020 Report), presents national energy statistics on energy production and consumption in Ireland during 2018. Renewable energy sources (which include wind) accounted for 32.5% of Ireland's gross electricity consumption in 2018, which was well over halfway to Ireland's 2020 target of 40%. EirGrid in their 'All Island Generation Capacity Statement 2020 - 2029' (August 2020), states that new wind farms commissioned in Ireland in 2019 brought total wind capacity to over 4,127MW, contributing to the increase in overall RES-E percentage to 35.7% with wind energy accounting for 32%.

It is estimated that in 2015 the cost of all energy imports to Ireland was approximately €4.6 billion; this fell to €3.4 billion in 2016 due mainly to reduced gas imports but increased again in 2017 to €4 billion. Irelands import dependency varied between 85% and 90% until 2016, where it fell to 69% with the Corrib gas field starting production. fell further to 66% in 2017 but has increased again to 69% in 2019, however Ireland is still one of the more import dependent countries in the EU, with the EU average being just over 50%. In 2019, although noted that the cost of energy imports to Ireland was approximately €4.5 billion; renewables made up 12% of gross final consumption relative to a 2020 target of 16%. This avoided 5.8 million tonnes of CO2 emissions and €500 million of fossil fuel imports ('Energy in Ireland - 2020 Report, SEAI, December 2020).

Ireland continues to be hugely energy import-dependent leaving it exposed to large energy price fluctuations at a minimum and the possibility of fuel shortages if a major energy crisis were to occur. The international fossil fuel market is growing increasingly expensive and is increasingly affected by international politics which can add to price fluctuations. This volatility will be increased as carbon prices increase in the future. This has implications for every Irish citizen.

[2] *Global Warming of 1.5°C, Intergovernmental Panel on Climate Change,* http://www.ipcc.ch/report/sr15/

The SEAI has stated that our heavy dependence on imported fossil fuels, "is a lost opportunity in terms of keeping this money here in Ireland and further developing our abundant renewable resources".

The cost of carbon credits is included in all electricity traded, and the price of electricity generated by coal is particularly vulnerable due to its high carbon emissions per unit of electricity generated. Coal still generates almost 25% of Ireland's electricity, but the National Climate Policy calls for an aggregate reduction in carbon dioxide emissions of at least 80% (compared to 1990 levels) by 2050. Any steps to reduce this dependence on imported fossil fuels will add to financial autonomy and stability in Ireland. The use of Ireland's indigenous energy resources, such as wind, will contribute to a reduction in energy imports.

The Energy White Paper 2015 notes "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 financial autonomy and stability in Ireland. As the White Paper notes:

> "*In the longer term, fossil fuels will be largely replaced by renewable sources*".

1.5.4 Competitiveness of Wind Energy

While Ireland has a range of renewable resources, as the White Paper states "[Onshore Wind] is a proven technology and Ireland's abundant wind resource means that a wind generator in Ireland generates more electricity than similar installations in other countries. This results in a lower cost of support."

In fact, the cost of support is more than offset by the fact that adding large quantities of wind to the wholesale market drives down auction prices in any half hour trading period when the wind is blowing, i.e. for 80% of the hours of the year. Wind is capable of an average capacity factor of 35%[3] , which is its average output throughout the year relative to its maximum output. However, wind is generating power at some level for 80% of the hours of the year. EirGrid's website has more detailed information. A Pőyry study from 2015 showed that reaching our targets in 2020 would reduce wholesale prices by more than costs of new grid infrastructure, backup and the subsidies paid to wind, resulting in a net saving of €43m per year in 2020. The EU has noted that Ireland has one of the lowest costs of supporting renewables mainly because onshore wind is on a par with the cost of power from conventional generation when a full cost benefit analysis is undertaken.

1.5.5 EU 2020 Renewable Energy Targets

The burning of fossil fuels for energy creates greenhouse gases, which contribute significantly to climate change. These and other emissions also create acid rain and air pollution. Sources of renewable energy that are utilised locally with minimal impact on the environment are necessary to meet the challenges of the future. The EU adopted Directive (2009/28/EC) on the Promotion of the Use of Energy from Renewable Sources in April 2009 which includes a common EU framework for the promotion of energy from renewable sources.

The Directive sets a legally binding mandatory national target for the overall share of energy from renewable sources for each Member State. This package is designed to achieve the EU's overall 20:20:20 environmental target, which consists of a 20% reduction in greenhouse gases, a 20% share of renewable energy in the EU's total energy consumption and a 20% increase in energy efficiency by 2020. To ensure that the mandatory national targets are achieved, Member States must follow an

[3] Baringa (October 2018), 70 by 30 – a 70% Renewable Electricity Vision for Ireland in 2030 (Table A.6),. Report available at: https://www.iwea.com/images/files/70by30-report-final.pdf

indicative trajectory towards the achievement of their target as outlined in Ireland's National Renewable Energy Action Plan (NREAP).

Ireland's mandatory national target is to supply 16% of its overall energy needs from renewable sources by 2020. This target covers energy in the form of electricity (RES-E), heat (RES-H) and transport fuels (RES-T). The contribution of renewables to gross final consumption (GFC) was 11% in 2018, compared to the 2020 target of 16%. ('*Energy in Ireland – 2019 Report*, SEAI, December 2019). Furthermore, the Department of Communications, Climate Action and Environment (DCCAE) reported in their '*Fourth Progress Report on the National Renewable Energy Action Plan'* December 2017 that Ireland will achieve 13% of its 16% RES target by 2020. A Briefing Note from the Department of Public Expenditure and Reform dated 5 March 2920 stated "*Ireland is likely to achieve 80% of the required progress towards the target (13% achieved, 16% target)*".

For RES-E alone, Ireland has set a national target of 40% by 2020 as outlined in NREAP. Government policies identify the development of renewable energy, including wind energy, as a primary strategy in implementing national energy policy.

Noted above and further emphasised in the most recent SEAI report, *'Renewable Energy in Ireland – 2020 Report'* (SEAI, December 2020); the share of renewable electricity (RES-E) was recorded at 33.2% in 2018, out of their 40% target; further reporting that Ireland is not on track to meet its 2020 renewable energy target.

More recently, new analysis from EirGrid, has shown that 32% of electricity demand in Ireland during 2018 was met by renewable sources[4]. This shows a positive increase in renewable energy in Ireland from that previously recorded in 2017, but still highlights the progress required to meet our 2020 target.

1.5.6 EU 2030 Renewable Energy Targets

In March 2019, the Minister for Communications, Climate Action, and the Environment, Richard Bruton, announced a renewable electricity target of 70% by 2030 for Ireland. The Joint Committee on Climate Change Action recommended in their recent report, '*Climate Change: A Cross- Party Consensus for Action'* (March 2019)[5], that new climate change legislation be enacted by the Oireachtas in 2019 to include:

- A target of net zero economy-wide GHG emissions by 2050;
- A provision for a 2030 target, consistent with the GHG emissions reduction pathway to 2050 to be set by 2020 by Statutory Instrument requiring the formal approval of both Houses of the Oireachtas following receipt of advice from the Climate Action Council;
- Provision for five-yearly carbon budgets, consistent with the emissions reduction pathway to 2030 and 2050 targets, to be set by Statutory Instrument requiring the formal approval of both Houses of the Oireachtas following receipt of advice from the Climate Action Council; and
- A target for the renewable share of electricity generation of 70% by 2030.

This commitment made by the Department of Communications, Climate Action, and the Environment also forms part of a Climate Action Plan released in August 2019. The plan, which is further detailed in Chapter 2, Section 2.1.3 identifies a need for 8.2GW of onshore wind generation with Ireland needing more than double its current installed capacity of wind generation. An Interim Climate Actions Report 2021 was published by the Government and will be used to drive continued delivery of climate action across all Government Departments and bodies, while the Climate Action Plan 2021 is being prepared

[4] http://www.eirgridgroup.com/newsroom/renewables-demand-record/index.xml
[5] https://data.oireachtas.ie/ie/oireachtas/committee/dail/32/joint_committee_on_climate_action/reports/2019/2019-03-28_report-climate-change-a-cross-party-consensus-for-action_en.pdf

for publication. It formally replaces the Annex of Actions published as part of the Climate Action Plan 2019,

As noted previously, Ireland is not on track for meeting its 2020 renewable energy targets. It is now more critical than ever that we continue to progress renewable energy development in Ireland so that we are successful in meeting our 2030 target. Further detail on the EU 2030 targets is noted in Chapter 2.

1.5.7 Reduction of Carbon Emissions and Other Greenhouse Gases

This production of renewable energy will assist in achieving the Government's and EU's stated goals of ensuring safe and secure energy supplies, promoting an energy future that is sustainable and competitively priced to consumers whilst combating energy price volatility and the effects of climate change. The Energy White Paper in 2015 outlines an ambitious Greenhouse gas reduction target of between 80% to 95% compared to 1990 levels out to 2050. Furthermore, if national carbon emissions targets are divided out amongst each county, each Local Authority may be responsible for meeting its own targets.

In addition to a reduced dependence on oil and other imported fuels, the generation of electricity from wind by the proposed development will displace approximately 56,222 tonnes of carbon emissions per annum from the largely carbon-based traditional energy mix, the detail of which is presented in Section 10.2.3 of this EIAR.

EU and World Health Organisation reports estimate that poor air quality accounted for premature deaths of almost 600,000 people in Europe in 2012 . In Ireland, the premature deaths attributable to air pollution are estimated at 1,200 people ('*Ireland's Environment – An Assessment*', Environmental Protection Agency, 2016.) The report '*Ireland's Environment – An Assessment'* states that the pollutants of most concern are NOx, (the collective term for the gases nitric oxide and nitrogen dioxide, PM (particulate matter) and O_3 (ozone). The EPA report goes on to state that:

> *"Ireland has considerable renewable energy resources, only a fraction of which are utilised to address our energy requirements.*
>
> *Wind, ocean, solar, hydro and geothermal energy do not produce GHG (greenhouse gas) emissions or emissions of air pollutants such as particulates, sulphur dioxide and nitrogen dioxide. Use of these renewable resources can have considerable co-benefits for human health and ecosystems. Meeting energy requirements from renewable resources can provide significant economic and employment benefits at local to national scales."*

The proposed development therefore represents an opportunity to further harness Ireland's significant renewable energy resources, with valuable benefits to air quality and in turn to human health. The consumption of fossil fuels for energy results in the release of particulates, sulphur dioxide and nitrogen dioxide to our air. The use of wind energy, by providing an alternative to electricity derived from coal, oil or gas-fired power stations, results in emission savings of carbon dioxide (CO_2), oxides of nitrogen (NOx), and sulphur dioxide SO_2, thereby resulting in cleaner air and associated positive health effects.

1.5.8 Economic Benefits

In addition to helping Ireland avoid significant fines and reducing environmentally damaging emissions, the proposed project will have significant economic benefits. At a national level, Ireland currently has one of the highest external dependencies in the EU on imported sources of energy, such as coal, oil and natural gas. As detailed above, in 2019 the cost of all energy imports to Ireland was approximately €4.5

billion with imported fossil fuels accounting for 57% of all energy consumed ('Energy in Ireland 2020, Sustainable Energy Authority of Ireland, December 2020).

The SEAI report 'Energy in Ireland 2020' indicated that renewable electricity (mostly wind energy):

- Displaced over €500 million of fossil fuel imports; and
- Reduced CO2 emissions by 5.8 million tonnes;

The 2014 report 'The Value of Wind Energy to Ireland', published by Pőyry, stated that growth of the wind sector in Ireland could support 23,850 jobs (construction and operational phases) by 2030. The reduction in fuel imports not only benefits security of supply but also creates a net transfer to the Irish economy with the energy import bill potentially falling by €282m in 2020 and potentiality allowing for a saving of almost €671m of expenditure on fuel imports per annum by the time we reach 2030.

The proposed development will be capable of providing power to over 27,800 households every year, as presented in the calculations in Section 4.3.1.6 of this EIAR.

At a Regional Level, the proposed development will help to supply the rising demand for electricity, resulting from renewed economic growth. The EirGrid report '*All-Island Generation Capacity Statement 2019 – 2028'* (SONI and Eirgrid, 2019) notes that electricity demand on the island of Ireland is expected to grow by between 25% and 47% over the next ten years. Much of this growth is expected to come from new data centres in Ireland.

The proposed development will have several significant long-term and short-term benefits for the local economy including job creation, landowner payments, local authority commercial rate payments and a Community Benefit Scheme.

Ballynagare wind farm will involve a €46.2 million investment in Irish renewable energy. The project is estimated to contribute €10.1 million in county council rates. The annual commercial rate payments from the proposed development to Kerry County Council will be redirected to the provision of public services within Co. Kerry. These services include provisions such as road upkeep, fire services, environmental protection, street lighting, footpath maintenance etc. along with other community and cultural support initiatives.

It is estimated that the proposed project will create approximately 88 direct jobs during the construction, operational and maintenance phases of the proposed development. It is estimated that 71 of these jobs would be created for the construction phase, while 17 operations and maintenance jobs would endure throughout the project's lifetime. During construction, additional employment will be created in the region through the supply of services and materials to the development. In addition to this, there will also be income generated by local employment from the purchase of local services i.e. travel and lodgings.

There are substantial opportunities available for areas where wind farms and other types of renewable energy developments are located, in the form of Community Gain Funds. Based on the current proposal, a Community Gain Fund in the region of €3.1 million will be made available over the lifetime of the project. The value of this fund will be proportional to the level of installed MWs at the site and will support and facilitate projects and initiatives including youth, sport and community facilities, schools, educational and training initiatives, and wider amenity, heritage, and environmental projects.

Further details on the proposed Community Gain proposals are presented in Section 4.5 of this EIAR.

1.6 Purpose and Scope of the EIAR

The purpose of this EIAR is to document the current state of the environment in the vicinity of the proposed development and to quantify the likely significant effects of the proposed development on the environment in accordance with the requirements of the EIA Directive, as amended. The compilation of this document served to highlight any areas where mitigation measures may be necessary in order to protect the surrounding environment from the possibility of any negative impacts arising from the proposed development.

It is important to distinguish the Environmental Impact Assessment (EIA) to be carried out by the Board, from the EIAR and the accompanying planning application. The EIA is the assessment carried out by the competent authority, which includes an examination that identifies, describes and assesses in an appropriate manner, in the light of each individual case and in accordance with Articles 4 to 11 of the Environmental Impact Assessment Directive, the direct and indirect effects of the proposed development on the following:

a. population and human health
b. biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC
c. land, soil, water, air and climate
d. material assets, cultural heritage and the landscape
e. the interaction between the factors referred to in points (a) to (d)

The EIAR submitted by the applicant provides the relevant environmental information to enable the EIA to be carried out by the competent authority. The information to be contained in the EIAR is prescribed in Article 5 of the revised EIA Directive described in Section 1.4 above.

1.7 Structure and Content of the EIAR

1.7.1 General Structure

This EIAR uses the grouped structure method to describe the existing environment, the potential impacts of the proposed development thereon and the proposed mitigation measures. Background information relating to the proposed development, scoping and consultation undertaken and a description of the proposed development are presented in separate sections. The grouped format sections describe the impacts of the proposed development in terms of human beings, flora and fauna, soils and geology, hydrology and hydrogeology, air and climate, noise and vibration, landscape and visual, cultural heritage and material assets such as traffic and transportation, together with the interaction of the foregoing.

The chapters of this EIAR are as follows:

- Introduction
- Background to the Proposed Development
- Site Selection and Reasonable Alternatives
- Description of the Proposed Development
- Population and Human Health
- Biodiversity (excluding Birds)
- Birds
- Land, Soils and Geology
- Hydrology and Hydrogeology
- Air and Climate
- Noise and Vibration

- Landscape and Visual
- Archaeological, Architectural and Cultural Heritage
- Material Assets (including Traffic and Transport, Telecommunications and Aviation)
- Interactions of the Foregoing

The EIAR also includes a Non-Technical Summary, which is a condensed and easily comprehensible version of the EIAR document. The non-technical summary is laid out in a similar format to the main EIAR document and comprises a description of the proposed development followed by the existing environment, impacts and mitigation measures presented in the grouped format.

1.7.2 Description of Likely Significant Effects and Impacts

As stated in the '*Guidelines on the Information to be contained in Environmental Impact Statements'* (EPA, 2017), an assessment of the likely impacts of a proposed development is a statutory requirement of the EIA process. The statutory criteria for the presentation of the characteristics of potential impacts requires that potential significant impacts be described with reference to the extent, magnitude, complexity, probability, duration, frequency, reversibility and trans-frontier nature (if applicable) of the impact.

The classification of impacts in this EIAR follows the definitions provided in the Glossary of Impacts contained in the following guidance documents produced by the Environmental Protection Agency (EPA):

- *'Guidelines on the Information to be contained in Environmental Impact Assessment Reports – Draft August 2017'* (EPA, 2017).
- *'Revised Guidelines on the Information to be contained in Environmental Impact Statements – Draft September 2015'* (EPA, 2015)
- *'Advice Notes for Preparing Environmental Impact Statements – Draft September 2015'* (EPA, 2015).
- *'Advice Notes on Current Practice in the Preparation of Environmental Impact Statements'* (EPA, 2003)
- *'Guidelines on the Information to be contained in Environmental Impact Statements'* (EPA, 2002).

Table 1.2 presents the glossary of impacts as published in the EPA guidance documents. Standard definitions are provided in this glossary, which permit the evaluation and classification of the quality, significance, duration and type of impacts associated with a proposed development on the receiving environment. The use of pre-existing standardised terms for the classification of impacts ensures that the EIA employs a systematic approach, which can be replicated across all disciplines covered in the EIAR. The consistent application of terminology throughout the EIAR facilitates the assessment of the proposed development on the receiving environment.

Table 1.2 Impact Classification Terminology (EPA, 2017)

Impact Characteristic	Term	Description
Quality	Positive	A change which improves the quality of the environment
	Neutral	No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.
	Negative	A change which reduces the quality of the environment
Significance	Imperceptible	An effect capable of measurement but without significant consequences
	Not significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
	Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
	Moderate	An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends
	Significant	An effect, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
	Very significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment
	Profound	An effect which obliterates sensitive characteristics
Extent & Context	Extent	Describe the size of the area, number of sites and the proportion of a population affected by an effect

	Context	Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions
Probability	Likely	Effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented
	Unlikely	Effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented
Duration and Frequency	Momentary	Effects lasting from seconds to minutes
	Brief	Effects lasting less than a day
	Temporary	Effects lasting less than a year
	Short-term	Effects lasting one to seven years
	Medium-term	Effects lasting seven to fifteen years
	Long-term	Effects lasting fifteen to sixty years
	Permanent	Effect lasting over sixty years
	Reversible	Effects that can be undone, for example through remediation or restoration
	Frequency	Describe how often the effect will occur. (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually)
Type	Indirect	Impacts on the environment, which are not a direct result of the project, often produced away from the project site or because of a complex pathway

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

Each impact is described in terms of its quality, significance, extent, duration & frequency and type, where possible. A 'Do-Nothing' impact is also predicted in respect of each environmental theme in the EIAR. Residual impacts are also presented following any impact for which mitigation measures are prescribed and any interactions between the impacts are assessed. The remaining impact types are presented as required or applicable throughout the EIAR.

1.8 Project Team

1.8.1 Project Team Responsibilities

The companies and staff listed in Table 1.3 were responsible for completion of the EIAR of the proposed development. Further details regarding project team members are provided below.

The EIAR project team comprises a multidisciplinary team of experts with extensive experience in the assessment of wind energy developments and in their relevant area of expertise. The qualifications and experience of the principal staff from each company involved in the preparation of this EIAR are summarised in Section 1.8.2 below. Each chapter of this EIAR has been prepared by a competent expert in the subject matter. Further details on project team expertise are provided in the Statement of Authority at the beginning of each impact assessment chapter.

Table 1.3 Project Team

Consultants	Principal Staff Involved in Project	EIAR Input
McCarthy Keville O' Sullivan Ltd. (MKO) Tuam Road Galway H91 VW84	Brian Keville Michael Watson Jimmy Green Thomas Blackwell Pat Roberts Dervla O' Dowd Meabhann Crowe Paul Sweeney Padraig Cregg Susan Doyle John Hynes Olivia O'Gorman Owen Cahill James Newell Joseph O'Brien	Project Managers, Scoping and Consultation, Preparation of Natura Impact Statement, Report Sections: 1. *Introduction* 2. *Background to the Proposed Development* 3. *Site Selection and Reasonable Alternatives* 4. *Description of the Proposed Development* 5. *Population & Human Health* 6. *Biodiversity* 7. *Birds* 10. *Air & Climate* 12. *Landscape & Visual* 14. *Material Assets (non-Traffic)* 15. *Interaction of the Foregoing*
Hydro Environmental Services 22 Lower Main Street Dungarvan Co. Waterford	Michael Gill David Broderick	Flood Risk Assessment, Drainage Design, Preparation of Report Sections: 8. *Land, Soils & Geology* 9. *Water*
Gavin &Doherty Geosolutions Unit A2, Nutgrove Office Park, Rathfarnham, Dublin 14, D14 X627, Ireland	Laura Burke	Peat Stability Analysis Peat and Spoil Management Plan
AWN Consulting	Dermot Blunnie	Baseline Noise Survey, Preparation of Report Section

The Tecpro Building Clonsgaugh Business & Technology Park Dublin 17	Leo Williams	*11. Noise and Vibration*
Tobar Archaeological Services Saleen Midleton Co. Cork	Annette Quinn Miriam Carroll	Archaeological Consultants; Preparation of EIAR Section: *13. Archaeological, Architectural and Cultural Heritage*
Alan Lipscombe Traffic and Transport Consultants Claran, Headford, Co. Galway	Alan Lipscombe	Swept Path Analysis, Preparation of Report Section: *14. Material Assets - Traffic and Transport*

1.8.2 Project Team Members

1.8.2.1 MKO

Brian Keville B.Sc. (Env.)

Brian Keville has over 17 years' professional experience as an environmental consultant having graduated from the National University of Ireland, Galway with a first class honours degree in Environmental Science. Brian was one of the founding directors of environmental consultancy, Keville & O'Sullivan Associates Ltd., prior to the company merging in 2008 to form McCarthy Keville O'Sullivan Ltd., and which recently rebranded as MKO (March 2019). Brian's professional experience has focused on project and environmental management, and environmental impact assessments. Brian has acted as project manager and lead-consultant on numerous environmental impact assessments, across various Irish counties and planning authority areas. These projects have included large infrastructural projects such as roads, ports and municipal services projects, through to commercial, mixed-use, industrial and renewable energy projects. The majority of this work has required liaison and co-ordination with government agencies and bodies, technical project teams, sub-consultants and clients.

Michael Watson, MA; Miema CEnv PGeo

Michael Watson is Project Director and head of the Environment Team in MKO. Michael has over 18 years' experience in the environmental sector. Following the completion of his Master's Degree in Environmental Resource Management, Geography, from National University of Ireland, Maynooth he worked for the Geological Survey of Ireland and then a prominent private environmental & hydrogeological consultancy prior to joining MKO in 2014. Michael's professional experience includes managing Environmental Impact Assessments, EPA License applications, hydrogeological assessments, environmental due diligence and general environmental assessment on behalf of clients in the wind farm, waste management, public sector, commercial and industrial sectors nationally. Michaels key strengths include project strategy advice for a wide range and scale of projects, project management and liaising with the relevant local authorities, Environmental Protection Agency (EPA) and statutory consultees as well as coordinating the project teams and sub-contractors. Michael is a key member of the MKO senior management team and as head of the Environment Team has responsibilities to mentor various grades of team members, foster a positive culture and promote continuous professional development for employees. Michael also has a Bachelor of Arts Degree in Geography and Economics from NUI Maynooth, is a Member of IEMA, a Chartered Environmentalist (CEnv) and Professional Geologist (PGeo).

Jimmy Green BA, MRUP; MIPI

Jimmy Green holds the position of Senior Planner in MKO and has a wide range of experience in project management and coordination, planning research, analysis, and retail planning. Jimmy has extensive planning experience in both the public and private sectors having worked as an Assistant Planner in Donegal County Council and subsequently as both an Executive and Senior Executive Planner in Galway County Council prior to joining private practice in October 2004. Since moving into the private sector he has provided consulting services to a wide range of private and public sector clients, and his experience includes planning application project management, environmental impact assessment preparation, retail impact assessment, development potential reporting, preparation of linguistic impact statements and submissions to Development Plans/Local Area Plans. Jimmy has a Bachelor of Arts Degree in Human and Physical Geography from National University Ireland Galway and a Masters in Regional and Urban Planning from University College Dublin. Jimmy is also a corporate member of the Irish Planning Institute.

Thomas Blackwell, M.Sc., BA, PWS

Thomas is a Senior Environmentalist with MKO with over 15 years of progressive experience in environmental consulting. Thomas holds a BA (Hons) in Geography from Trinity College Dublin and a M.Sc. in Environmental Resource Management from University College Dublin. Prior to taking up his position with MKO in August 2019, Thomas worked as a Senior Environmental Scientist with HDR, Inc. in the United States and held previous posts with private consulting firms in both the USA and Ireland. Thomas is a registered Professional Wetland Scientist with the Society of Wetland Scientists with specialist knowledge in wetland assessment and delineation, mitigation planning and design, stream geomorphic assessment, and stream and wetland restoration design. Thomas' professional experience includes managing Environmental Impact Assessments, environmental permitting, environmental due diligence and compliance, and general environmental assessment on behalf of clients in the solar farm, mining, solid waste management, residential and commercial development, and public sectors. Thomas' key strengths and areas of expertise are in project management and strategy development, environmental permitting and assessment for renewable energy projects, fluvial geomorphology and stream restoration design. Since joining MKO, Thomas has been involved as an Environmental Consultant on a range of energy infrastructure, and residential projects.

Pat Roberts B.Sc. (Env.)

Pat Roberts is a Senior Ecologist and director of the Ecology team with MKO with over 12 years' post graduate experience of providing ecological services in relation to a wide range of developments at the planning, construction and monitoring stages. Pat holds a B.Sc.(Hons) in Environmental Science. Pat has extensive experience of providing ecological consultancy on large scale industrial and civil engineering projects. He is highly experienced in the completion of ecological baseline surveys and impact assessment at the planning stage. He has worked closely with construction personnel at the set-up stage of numerous construction sites to implement and monitor any prescribed best practice measures. He has designed numerous Environmental Operating Plans and prepared many environmental method statements in close conjunction with project teams and contractors. He has worked extensively on the identification, control and management of invasive species on numerous construction sites. Prior to taking up his position with MKO in June 2005, Pat worked in Ireland, USA and UK as a Tree Surgeon and as a nature conservation warden with the National Trust (UK) and the US National Park Service. Pat's key strengths include his depth of knowledge and experience of a wide range of ecological and biodiversity topics and also in his ability to understand the requirements of the client in a wide range of situations. He currently manages the ecological team within MKO and ensures that the outputs from that team are of a very high standard and meet the requirements of the clients and relevant legislation and guidelines. He is a full member of the Chartered Institute of Ecologists and Environmental Managers (CIEEM)

Dervla O'Dowd B.Sc. (Env.)

Dervla O'Dowd is a Senior Ecologist and Project Manager with MKO with twelve years of experience in environmental consultancy. Dervla graduated with a first class honours B.Sc. in Environmental Science from NUI, Galway in 2005 and joined Keville O'Sullivan Associates in the same year. Dervla has gained extensive experience in the project management and ecological assessment of the impacts of various infrastructural projects including wind energy projects, water supply schemes, road schemes and housing developments nationwide and has also been involved in the compilation of Environmental Impact Statements, with emphasis on sections such as Flora & Fauna, and acted as EIS/EIAR co-ordinator on many of these projects. Dervla has also provided site supervision for infrastructural works within designated conservations areas, in particular within aquatic habitats, and has also been involved in the development of environmental/ecological educational resource materials and major ecological surveys of inland waterways. Currently, Dervla is responsible for coordinating ecological work, in particular ornithological surveys required on major infrastructural projects, with emphasis on wind energy projects. Dervla's key strengths and areas of expertise are in project management, project strategy, business development and survey co-ordination to ensure the efficient operation of the Ornithology team's field survey schedule. Dervla holds full membership of the Chartered Institute of Ecology and Environmental Management and a current Safe Pass card.

Meabhann Crowe M.Sc, BA (Hons), MRTPI

Meabhann Crowe is a Project Planner with MKO with over 10 years private sector experience. She is a fully chartered member of the Royal Town Planning Institute (MRTPI). Meabhann holds a BA (Hons) in Geography, Sociological and Political Science and a Masters in Urban and Regional Planning. Prior to taking up her position with McCarthy Keville O'Sullivan in October 2018, Meabhann was employed as an Associate Director with Colliers International in their Edinburgh office, prior to which she was employed for several years with Halliday Fraser Munro. In her time in the industry Meabhann has been active on a number of instructions across a broad spectrum of mixed-use, residential, commercial, renewable energy and retail projects.

Meabhann brings particular expertise in initial development feasibility appraisals and development strategies. Her experience in managing large multi-disciplinary teams in the preparation of local and major planning applications across residential and mixed-use and retail developments means she has a wealth of knowledge to draw on in the early stages of development. She has particular experience in preparing and managing site strategies which include both responding to emerging planning policy whilst also preparing and progressing planning applications and appeals.

Paul Sweeney BA. MSc.

Paul Sweeney is a Graduate Planner with MKO having joined the team in April 2018. Paul holds a BA (Hons) in Geography and English and a Masters in Planning and Sustainable Development from University College Cork where he graduated in 2017. Since joining MKO, Paul has started to develop experience in a range of sectors through various projects and planning issues with a current focus within the Environmental and Energy sector.

Padraig Cregg M.Sc, B.Sc (Hons)

Padraig Cregg is a Senior Ornithologist with MKOwith over 7 years' experience in both private practice and NGOs. Padraig holds a BSc (Hons) in Zoology and Masters in Evolutionary and Behavioural Ecology. Prior to taking up his position with McCarthy Keville O'Sullivan in December 2018, Padraig worked as a Senior Ornithologist and held previous posts with TOBIN Consulting Engineers, Energised Environments Ltd in Scotland, WSP Environment and Energy Ltd in Scotland and BirdWatch Ireland. Padraig has specialist knowledge in designing, executing and project managing ornithological assessments, primarily in the renewable industry. Padraig's key strengths and areas of expertise are in ornithology and ecology surveying and in writing Natura Impact Statements (NIS) and the Biodiversity chapter of Environmental Impact Assessment Reports (EIAR) to accompany planning applications. Since joining MKO Padraig has been involved in designing, executing and project managing the ornithological assessment on over 20 proposed wind farm developments. He has played a key role in project managing these planning applications through the statutory planning system, with more projects in the pipeline. Within MKO Padraig plays a large role in the management and confidence building of junior members of staff and works as part of a large multi-disciplinary team to produce EIAR and NIS Reports.

Susan Doyle M.Sc, B.A (Hons)

Susan Doyle is a project ornithologist at MKO. She completed her primary degree in Zoology (moderatorship in Natural Science) at Trinity College Dublin in 2013 and her master's degree in Ecological Assessment in University College Cork in 2014. Susan has five years' experience in ecological consultancy and has worked on wind farm projects, solar farm projects, residential developments, data centres, county council projects and National Parks and Wildlife Service projects. She specialises in ornithological consulting, including Environmental Impact Assessments, Natura Impact Statements and Appropriate Assessments. Prior to joining MKO in October 2020, Susan gained experience through her involvement in several bird conservation projects, including protected curlew, seabirds, waders and waterfowl, as well as research into breeding hen harrier, satellite telemetry in migrant birds and avian diseases in Ireland, providing her with extensive experience in a wide variety of bird survey methods, data management and reporting.

John Hynes M.Sc. (Ecology), B.Sc.

John Hynes is a Senior Ecologist with MKO with over 7 years' experience in both private practice and local authorities. John holds a B.SC in Environmental Science and a M.Sc. in Applied Ecology. Prior to taking up his position with MKO in March 2014, John worked as an Ecologist with Ryan Hanley Consulting Ltd. and Galway County Council. John has specialist knowledge in Flora and Fauna field surveys. Geographic Information Systems, data analysis, Appropriate Assessment, Ecological Impact Assessment and Environmental Impact Assessment. John's key strengths and areas of expertise are in project management, GIS and impact assessment. Since joining MKO John has been involved as a Senior Ecologist on a significant range of energy infrastructure, commercial, national roads and private/public development projects. Within MKO John plays a large role in the management and confidence building of junior members of staff and works as part of a large multi-disciplinary team to produce EIS/EIAR Reports. John has project managed a range of strategy and development projects across Ireland and holds CIEEM membership.

Olivia O'Gorman, M.Sc. (Ecology), B.Sc

Olivia O' Gorman is an Ecologist with MKO with over 5 years of experience working in both consultancy and conservation. Olivia holds a Bachelor of Science degree (BSc) from the National University of Ireland, Galway, specialising in zoology and a Master's of Ecology in Ecological Assessment from University College Cork. Prior to taking up her position with MKO in November 2019, Olivia worked as an Ecologist/Ornithologist with Inis Environmental Ltd. and held previous posts with Birdwatch Ireland. Olivia's key strengths and areas of expertise including terrestrial mammal surveys, vegetation surveys, enhancement/management plan preparation and GIS mapping. Since joining MKO, Olivia has contributed in large parts to Appropriate Assessment Screening Reports, Nature Impact Statements and Ecological Impact Assessments while also being involved in invasive species surveys, management plans and carrying out site supervision as an Ecological Clerk of Works.

Audrey Williams BLA (Hons.)

Audrey Williams is a Landscape Architect and Landscape and Visual Impact Assessment Specialist with MKO. Audrey graduated in 2018 from the University of Guelph, Canada with a Bachelor of Landscape Architecture (BLA, Hons.) Audrey has a combined three and a half years of landscape design and project management experience from Ireland, Sweden and Canada, with a focus on residential and park planning design and renewable energy projects. Audrey specialises in preparing landscape and visual impact assessment reports for large-scale renewable energy projects including wind farms, solar farms, quarry extraction and strategic housing schemes, as well as preparing landscape masterplans for residential and commercial spaces. Prior to taking up her position with MKO, she worked in Sweden at SLU as a landscape architecture research assistant, responsible for organising and teaching several university level courses in both English and Swedish.

Owen Cahill B.Sc., M.Sc.

Owen is an Environmental Engineer with MKO with over 11 years of experience in the environmental management and construction industries. Owen holds BSc. (Hons) and MSc. in Construction Management and a Masters in Environmental Engineering. Prior to taking up his position with MKO in October 2013, Owen worked as an Environmental Officer with Kepak and prior to which he held a post with Pentland Macdonald Contaminated Land & Water Specialist in Northern Ireland. Prior to working in planning and environmental consultancy, Owen was employed within the construction industry where he gained significant experience on a variety of civil, residential and commercial projects. Owen's wide ranging multi sector experience has provided him with specialist knowledge and understanding of the challenges in the planning and delivery of developments with the minimum environmental impact and with practicality and constructability in mind. Owen's key strengths and areas of expertise are in project management, environmental impact assessment, wind energy & solar energy construction & environmental management planning and waste permit management. Since joining MKO Owen has been involved as a Project Manager on a range of energy infrastructure, commercial, residential, waste facility and quarry projects as well as managing the licensing requirements of a number of EPA licensed facilities. Within MKO Owen plays a large role in the management and confidence building of junior members of staff and works as part of a large multi-disciplinary team to produce EIS/EIAR Reports. Owen has project managed the Environmental Impact Assessment of a range of development projects across Ireland, holds Affiliate Membership with the Institute of Environmental Management & Assessment and is currently awaiting interview and assessment to become a Full Member and Chartered Environmentalist.

James Newell

James holds the position of CAD and Information Technology Technician with MKO since joining the Company in May 2006. Prior to joining MKO, he worked as a graphic designer and illustrator for over eight years. In recent years James' role has extended to include all wind farm visual modelling completed by the company. He is proficient in the use of MapInfo GIS software in addition to AutoCAD and other design and graphics packages.

Joseph O'Brien

Joseph O'Brien holds the position of CAD Technician. Joseph holds a BA Honours Level 8 Modelmaking, Design and Digital Effect, Institute of Art Design and Technology (IADT), Dun Laoghaire & City & Guilds Level 3 2D &3D AutoCAD certificates. Joseph's role entails various wind and solar farm projects which require various skills such as mapping, aerial registration and detailed design drawings for projects. Prior to joining us, Joseph worked as a free-lance Modelmaker and CAD Technician. His previous experience included designing various models and props through CAD and then making them for various conventions such as Dublin Comic Con and Arcade Con.

1.8.2.2 Hydro Environmental Services Ltd.

Michael Gill

Michael Gill is an Environmental Engineer with over ten years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms in Ireland. He has also managed EIA/EIAR assessments for infrastructure projects and private residential and commercial developments. In addition, he has substantial experience in wastewater engineering and site suitability assessments, contaminated land investigation and assessment, wetland hydrology/hydrogeology, water resource assessments, surface water drainage design and SUDs design, and surface water/groundwater interactions.

David Broderick

David Broderick is a hydrogeologist with over seven years' experience in both the public and private sectors. Having spent two years working in the Geological Survey of Ireland working mainly on groundwater and source protection studies. David moved into the private sector. David has a strong background in groundwater resource assessment and hydrogeological/hydrological investigations in relation to developments such as quarries and wind farms. David has completed numerous geology and water sections for input into EIAs for a range of commercial developments.

1.8.2.3 Gavin & Doherty Geosolutions

Laura Burke

Laura is a Chartered Engineer with nine years' experience in design, construction supervision and ground investigation for roads and onshore wind projects. She is the head of GDG's onshore renewables and geohazards department. Her main areas of expertise include geology, geohazards, environmental assessment, geotechnics and renewable energy. Laura has gained invaluable experience, working on onshore wind projects in peatlands across Scotland and Ireland. Geohazards projects of note include Curraglass renewable energy development peat landslide hazard risk assessment, Derryadd wind farm peat landslide hazard risk assessment, Geological Survey of Ireland landslide hazard pilot study and Landslide hazard and risk mapping - Guatemala. Other wind farm design projects of note in include Cloncreen windfarm, Beinn an Tuirc III Windfarm and Oweninny Windfarm.

1.8.2.4 AWN Consulting Ltd.

Dermot Blunnie

Dermot Blunnie (Senior Acoustic Consultant) holds a BEng. from the University of South Wales, a M.Sc. from the University of Derby and IOA Diploma in Acoustics and Noise Control from the Institute of Acoustics. He has over 11 years' experience as an acoustic consultant and is a member of the Institute of Acoustics. He has extensive knowledge and experience in relation to commissioning noise monitoring and impact assessment of wind farms as well as a detailed knowledge of acoustic standards and proprietary noise modelling software packages. He has commissioned noise surveys and completed noise impact assessments for numerous wind farm projects within Ireland.

Leo Williams

Leo Williams holds a BAI and MAI in Mechanical Engineering and has completed the Institute of Acoustics (IOA) Diploma in Acoustics and Noise Control. He has been working in the field of acoustics since 2014 and is a member of the Institute of Acoustics (MIOA). He is experienced in relation to commissioning noise monitoring and impact assessment of wind farms as well as a detailed knowledge of acoustic standards and proprietary noise modelling software packages. He has commissioned noise surveys and completed noise impact assessments for numerous wind farm projects within Ireland.

1.8.2.5 Tobar Archaeological Services

Tobar Archaeological Services is a Cork-based company in its 16th year in business. They offer professional nationwide services ranging from pre-planning assessments to archaeological excavation, and cater for clients in state agencies, private and public sectors.

Tobar's Directors, Annette Quinn and Miriam Carroll, are licensed by the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs to carry out excavations in Ireland and have carried out work directly for the National Monuments Services of the Department of the Environment, Heritage and Local Government. Tobar Archaeological Services has a proven track record and extensive experience in the wind farm industry from EIS/EIAR stage through to construction stage when archaeological monitoring is frequently required.

1.8.2.6 Alan Lipscombe Traffic and Transport Consultants

Alan Lipscombe (B.Eng. Hons.) MIHT

In January 2007, Alan Lipscombe set up an independent traffic and transportation consultancy providing advice for a range of clients in the private and public sectors. Prior to this Alan was a founding member of Colin Buchanan's Galway office having moved there as the senior transportation engineer for the Galway Land Use and Transportation Study. Since the completion of that study in 1999, Alan has worked throughout the West of Ireland on a range of projects including: major development schemes, the Galway City Outer Bypass, Limerick Planning Land-Use and Transportation Study, Limerick Southern Ring Road Phase II, cost benefit analyses (COBA) and various studies for the NUI Galway. Before moving to Galway in 1997, Alan was involved in a wide variety of traffic and transport studies for CBP throughout the UK, Malta and Indonesia. He has particular expertise in the assessment of development related traffic and transport modelling and is an accomplished analyst who has experience of a wide variety of modelling packages and methods.

1.9 Difficulties Encountered

There were no technical difficulties encountered during the preparation of this EIAR.

1.10 Viewing and Purchasing of the EIAR

Copies of this EIAR will be available online, including the Non-Technical Summary (NTS), on the dedicated project website.

- https://www.ballynagarewindfarm.ie/

This EIAR and all associated documentation will also be available for viewing at the offices of Kerry County Council. The EIAR may be inspected free of charge or purchased by any member of the public during normal office hours at the following address:

- Kerry County Council,
  Planning Department
  Rathass,
  Tralee,
  Co. Kerry

The EIAR will also be available to view online via the Department of Planning, Housing and Local Government's EIA Portal, which will provide a link to the planning authority's website on which the application details are contained. This EIA Portal was recently set up by the Department as an electronic notification to the public of requests for development consent which are accompanied by an EIAR. (https://www.housing.gov.ie/planning/environmental-assessment/environmental-impact-assessment-eia/eia-portal).

2. BACKGROUND TO THE PROPOSED DEVELOPMENT

This section of the Environmental Impact Assessment Report (EIAR) presents information on renewable energy and climate change policy and targets, the strategic, regional and local planning context for the proposed development, planning history, scoping and consultation, as well as setting out the nature of the cumulative impact assessment process undertaken.

2.1 Renewable Energy Policy and Targets

The Climate Action Plan, published by the Government in 2019, clearly sets out the importance of responding to climate change:

> *"The accelerating impact of greenhouse gas emissions on climate disruption must be arrested. The window of opportunity to act is fast closing, but Ireland is way off course.... The shift in climate is bringing profound shifts of desertification, rising sea levels, displaced population, profound challenges to the natural world, and economic and social disruption. We are close to a tipping point where these impacts will sharply worsen. Decarbonisation is now a must if the world is to contain the damage and build resilience in the face of such a profound challenge."*

Furthermore, the Programme for Government released in June 2020 also highlights the need for a clean and reliable supply of energy:

> *"Energy will play a central role in the creation of a strong and sustainable economy over the next decade. The reliable supply of safe, secure and clean energy is essential in order to deliver a phase-out of fossil fuels. We need to facilitate the increased electrification of heat and transport. This will create rapid growth in demand for electricity which must be planned and delivered in a cost-effective way."*

The primary driver behind the proposed development is the need to provide additional renewable energy to offset the use of fossil fuels within the electricity generating sector. Increasing electricity generation from wind power represents the most economical renewable option to reduce emissions within the power generation sector and is the most mature technology available to achieve national targets that have been established for decarbonisation. The proposed development will directly aid in meeting Ireland's energy and climate targets.

2.1.1 Renewable Energy Resources

Renewable energy resources include solar, wind, water (hydropower, wave and tidal), heat (geothermal) and biomass (wood, waste) energy. These sources are constantly replenished through the cycles of nature, unlike fossil fuels, which are finite resources that are becoming increasingly scarce and expensive to extract.

Renewable energy resources offer sustainable alternatives to our dependency on fossil fuels as well as a means of reducing greenhouse gas emissions and opportunities to reduce our reliance on imported fuels. These resources are abundantly available in Ireland, yet only a fraction has been tapped so far (Source: Sustainable Energy Authority of Ireland (SEAI) website, https://www.seai.ie/).

A gradual shift towards increasing our use of renewable energy resources would result in:

- Reduced carbon dioxide emissions;
- Secure and stable energy for the long-term;
- Reduced reliance on fuel imports;

- Investment and employment in our indigenous renewable energy projects; often in rural and underdeveloped areas.

Renewable energy development is recognised as a vital component of Ireland's strategy to tackle the challenges of combating climate change and ensuring a secure supply of energy. Ireland is heavily dependent on the importation of fossil fuels to meet its energy needs, with imported fossil fuels accounting for 66% of Ireland's dependency in 2017 at an estimated cost of €4 billion. The 'Energy in Ireland 2020 Report' by the Sustainable Energy Agency of Ireland noted that *"Oil has by far the largest share of final energy use at 57% in 2019, more than all other fuel types combined. Transport and home heating account for 86% of oil use.*" The most significant changes noted in the report in terms of fuels included:

- *Final energy consumption of electricity increased by 2% in 2019 to 2,444 ktoe (or 28,424 GWh). In 2019, electricity accounted for 19.7% of total final consumption.*
- *Final energy use of all renewable energy increased by 5% overall. Renewables accounted for 3.9% of final energy use.*

Electricity consumption grew, noting "*Final electricity demand peaked in 2008, at 2,294 ktoe before falling in the subsequent recession. It began to grow again in 2015 and in 2018 it surpassed the previous peak for the first time. In 2019 it grew by 2% to 2,444 ktoe (28,424 GWh), 6.6% higher than in 2008."*

The key targets for 2030 have been set out as follows:

- At least 40% cuts in greenhouse gas emissions (from 1990 levels)
- At least 32% share for renewable energy
- At least 32.5% improvement in energy efficiency

2.1.2 EU Policy and Targets

The 2030 Climate and Energy Policy Framework (adopted by The EU Council in October 2014) marks a further development of EU renewable energy policy. The Framework sets three key targets for the year 2030:

- A binding commitment at EU level of at least 40% domestic Greenhouse Gas reduction by 2030 compared to 1990;
- An EU wide, binding target of at least 27% renewable energy by 2030; and
- An indicative EU level target of at least 27% energy efficiency by 2030.

The European Commission published its proposal for an effort sharing regulation on the allocation of national targets for greenhouse gas emissions for the period 2021-2030 in July 2016. The proposal implements EU commitments under the Paris agreement on climate change (COP21) and marks an important milestone in the allocation to Member States of a package of climate targets that were formally adopted as part of the 2030 Climate and Energy Framework.

On the 27th of June 2018 EU ambassadors endorsed the provisional agreement reached by the Bulgarian Presidency on the revision of the renewable energy directive. The new regulatory framework is expected to pave the way for Europe's transition towards clean energy sources such as wind, solar, hydro, tidal, geothermal, and biomass energy. The agreement sets an increased headline target of 32% energy from renewable sources at EU level for 2030.

Additionally, Ireland supports the adoption of a net zero target by 2050 at the EU level. In this regard it should be noted that the Climate Change Advisory Council notes within their 2020 Annual Review that "*while the share of renewable electricity generation, particularly wind, is increasing [in Ireland], the [overall] pace of decarbonisation of the [electricity generation] sector needs to accelerate*" as it is not compatible with a low-carbon transition to 2050.

2.1.3 Progress on Targets

The overall share of renewables in primary energy stood at 11.2% in 2019 which is up from the 2018 figure of 10%, and 9.3% in 2017. As per the SEAI's *Energy in Ireland 2020 Update* (detailed here at Section 2.1.5), the contribution from renewables in 2019, has risen to 11% of the Gross Final Consumption (GFC). Total electrical output from wind in 2018 at 8,640GWh (not normalised) which was a 16% increase in the previous year. The SEAI's update goes on to note that wind generated 28% of all electricity in 2018 second only to gas.

In Ireland, it is widely acknowledged that the vast majority of the renewable electricity requirement is expected to be met through the development of indigenous wind power, as Ireland has a strong wind resource potential, with one of the best onshore wind speed averages in Europe ('The Value of Wind Energy to Ireland', Pőyry, 2014). Further, the SEAI *Energy In Ireland 2020 Update report staes that "Most of the growth in renewable energy has come from wind. Wind provided 55% of all renewable energy in 2018."*

The Climate Change Advisory Council (CCAC) notes within their *2020 Annual Review* that "*Full decarbonisation of the Electricity sector will be required by 2050 to support ambitious mitigation across the sectors. Eirgrid's commitment to 70% renewable generation on the transmission network by 2030 is an important next step, which is challenging but achievable. While the share of renewable electricity generation, particularly wind, is increasing, the pace of decarbonisation of the sector needs to accelerate." "Decarbonisation of electricity generation is a critical component of the transition to a low-carbon future. While progress has been made, much more is needed to meet ambitious national targets to 2030 and 2050."*

while the share of renewable electricity generation, particularly wind, is increasing in Ireland, the pace of decarbonisation of the electricity generation sector is not compatible with a low-carbon transition to 2050. As such, Ireland can continue to 'comply' with EU targets by purchasing emission allowances; however, the expenditure of public funds to do so would not result in any domestic benefit, and furthermore, would result in a more difficult and expensive challenge for the country to meet its future 2030 targets and beyond. The CCAC 2019 review concludes that continued and additional investment in capacity and technologies in the renewable energy sector is required to reach these said targets.

EirGrid in their '*All Island Generation Capacity Statement 2020 - 2029*' (August 2020), state that it is assumed that renewable targets will be largely achieved through the deployment of additional wind powered generation in Ireland. As per the latest statistics issued by IWEA new wind farms commissioned in Ireland have brought the total wind capacity to 4,235MW (https://www.iwea.com/about-wind/facts-stats).

The Statement also notes that, at a Median demand level there is not adequate generation capacity to meet demand from 2026 on an All-Island basis once Moneypoint closes at the end of 2025. Should any other plant close then this could give rise to earlier deficits. This is especially pertinent with regard to the recent closures of the peat-fired Shannonbridge and Lough Ree Power Stations. In this context, the importance of wind energy becomes more apparent as it is estimated that 1 MW of wind capacity can provide enough electricity to supply approximately 650 homes[1].

It is noted that the key driver for electricity demand in Ireland for the next number of years is the connection of new large energy users, such as data centres. The EirGrid 2020-2029 report notes that "*the demand forecast in Ireland continues to be heavily influenced by the expected growth of large energy users, primarily Data Centres*". In Ireland, the growth in energy demand for the next ten years varies between 23% in the low demand scenario, to 47% in the high scenario. The Median Forecast is generally aligned with EirGrid's Tomorrow Energy Scenarios in which EirGrid predict an overall

[1] *https://www.iwea.com/about-wind/faqs*

Energy Requirement for Ireland of approximately 41TWh by 2030. Accordingly, the proposed development will assist in meeting the increasing electricity demand.

An updated All-Island Generation Capacity Statement 2021-2030 has recently been published (September 2012) and) states that the national power system will require unprecedented change over this decade, "*a fundamental transition for our electricity sector",* in order to accommodate at least 70% of electricity from renewable sources by 2030. The retiring of traditional fossil fuel plant (coal, peat and oil-fired generators), c. 1,650MW of generation over the next 5-years within Ireland, further emphasises the need for a deliberate and swift transition to a low-carbon power system based on renewable energy, natural gas and ancillary supporting infrastructure. With regard to wind energy, the All Island Generation Capacity Statement 2021 – 2030 states that,"*It can be assumed that Ireland's renewable targets will be achieved largely through the deployment of additional wind powered generation."*

New onshore wind farms commissioned in Ireland in 2020 brought the total wind capacity to 4,300MW, contributing to the increase in overall RES percentage to 43.3%. This value is set to increase as Ireland endeavours to meet its 2030 renewable targets; specifically, the All Island Generation Capacity Statement 2021 – 2030 estimates that onshore wind energy will increase by 1,000MW between 2020 and 2025 (Table A-5).

2.1.4 SEAI Renewable Energy in Ireland 2020 Update

The SEAI's *Renewable Energy in Ireland 2020 Update* was published in April 2020. Section 5.2 of the report details the most recent updates with regards to wind energy, it is noted that the total electrical output from wind in 2018 (not normalised) was 8,640GWh. This was an overall increase of 16% when compared to 2017 figures. In 2018 it was found that energy generated by wind accounted for 28% of the gross electrical consumption, this was second to only natural gas.

Plate 2-2 below depicts the annual growth in installed wind-generation capacity and overall cumulative capacity since 2000. It should be highlighted that in 2018 258MW of wind capacity was installed within Ireland, furthermore an additional 461MW was installed in 2019 bringing the total installed capacity to 4,137MW.

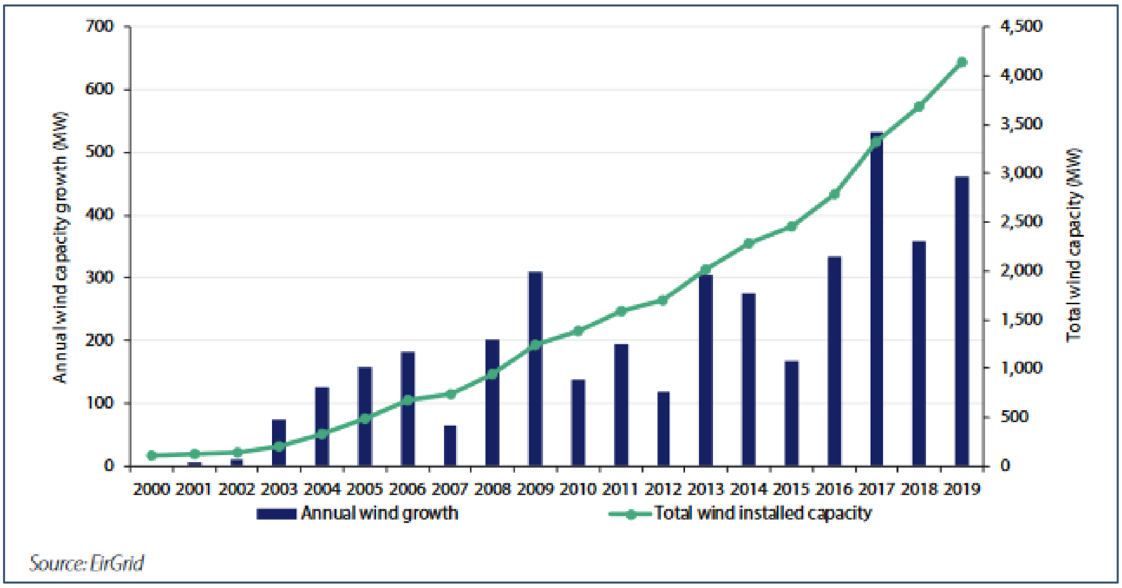


Plate 2.1 Installed wind-generation capacity 2000 to 2019)

In relation to renewable electricity as is depicted in Plate 2-3 below Ireland was 12th out of the EU-28 at 33.2%, above the EU-28 average of 32.1%. The report notes that the top performing countries tend to have large hydropower resources, including Austria and Sweden. Furthermore, it is noted that Ireland had the second highest share of wind-generated electricity in 2018 at 28.1%.

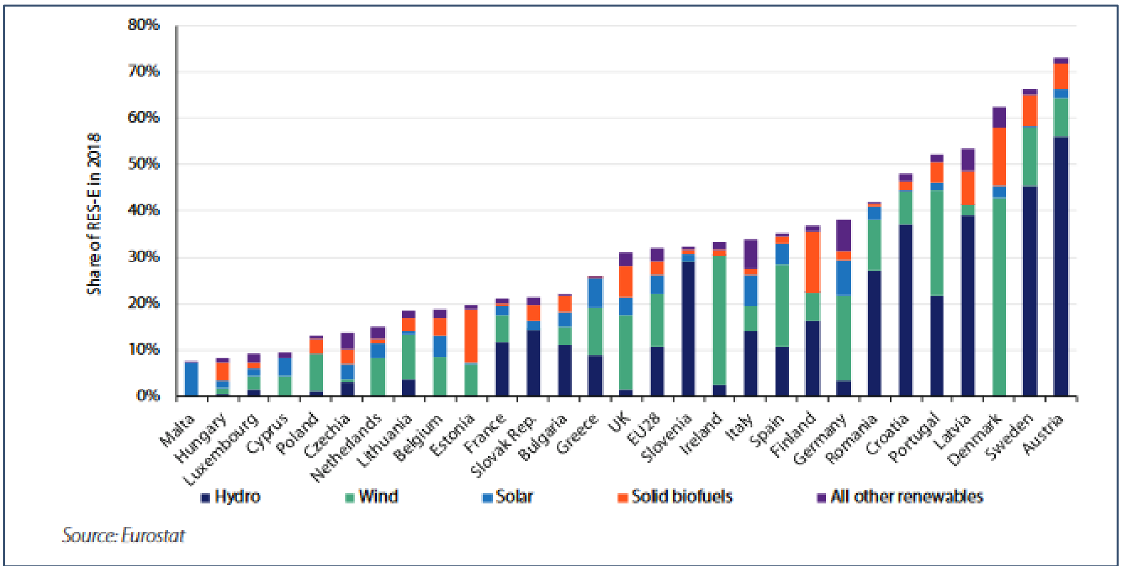


Plate 2.3 Renewable Electricity Share in 2018 for EU Member States

2.1.5 SEAI Energy in Ireland 2020 Report

In December 2020 the SEAI produced the *Energy in Ireland 2020* Report which provides figures from 2019 in relation to energy production and consumption in Ireland. The annual publication from SEAI presents national energy statistics on energy use in Ireland over the period 2005 to 2019. In the context of 2020, it has been noted that due to the global health crisis and measures deployed to mitigate its effects, the way that energy is used has changed. It is noted that:

> *"We have seen large reductions in transport energy use in particular, and after an initial decrease in electricity use, we saw all time high levels of demand following the recent easing of restriction leading into Christmas 2020."*

Within the 2020 reflections it is set out that while overall energy use in Ireland in 2019 was at almost the same level as in 2001, the CO2 emissions from energy are down by almost one fifth with the economy one and a half times larger. Further to the above, with regards to electricity, the 2020 Report states that in April and May electricity use was initially down somewhat on 2019, but from late summer on electricity use has been up on the previous year. A new all-time peak in demand of 5,357MW was set which was 245 MW higher than the previous record set in 2010.

In terms of final energy demand this fell by 0.6%, primary energy demand also fell by 1.2% with the use of fossil fuels also decreasing by 3% in 2019. Renewables made up 12.0% of gross final consumption (the 2020 target was 16%), it is noted that this avoided 5.8 million tonnes of CO2 emissions and over €500 million of fossil fuel imports. The share of electricity generated from renewable sources increased from 33.2% in 2018 to 36.5% in 2019 (the 2020 target was 40%). Wind generation accounted for 32% of all electricity generated and avoided 3.9 million tonnes of CO2 emissions.

Section 2.6 of the 2020 Report provides updates surrounding electricity and notes that final electricity demand peaked in 2008 (2,295ktoe) and began falling in the years following this. However, demand started to grow again in 2015, in 2019 demand grew by 2% and surpassed the 2008 record by 6.6% at 2,444ktoe.

Primary energy is the total amount of energy required, including all the energy that is consumed for energy transformation processes such as electricity generation and oil refining. Primary energy is considered by fuel, sector and mode. The following are the main trends in primary energy:

- Fossil fuels accounted for 87% of all the energy used in Ireland in 2019. Demand for fossil fuels fell by 3% in 2019, and was 17% lower than in 2005.
- Coal use decreased by 53% in 2019 and its share of total primary energy requirement fell to 2.6%, down from 10.5% in 2015. Since 2005, coal demand has fallen by 80% (10.8% per annum).
- Total renewable energy increased by 10.3% during 2019. Hydro and wind increased by 28% and 16% respectively. Biomass use fell by 3.9% in 2019 and other renewables increased by 15%. The overall share of renewables in primary energy stood at 11.2% in 2019, up from 10% in 2018.
- Ireland returned to being a net importer of electricity in 2019 for the first time since 2015, importing 55 ktoe.

In terms of energy generation in 2019, the share of renewables in the generation fuel mix increased to 25.7%, compared with 22.3% in 2018 due, mainly, to increased wind generation. In 2019, electricity generated from renewable sources amounted to 11,780 GWh, accounting for 37.6% of gross electricity consumption (compared with 33% in 2018). Wind again accounted for the largest renewable energy generator, furthermore wind energy was the second largest source of electricity generated in 2019 after natural gas.

Wind accounted for 57% of the contribution towards Ireland's renewable energy target in 2019. The peak recorded wind power output was 3,337 MW, delivered on 21 February 2020, this represented 73% of demand at that time. Furthermore, wind also accounted for 85% of normalised renewable energy in 2018. Plate 2-4 below shows the annual growth in installed wind generation capacity and overall cumulative capacity since 2000.

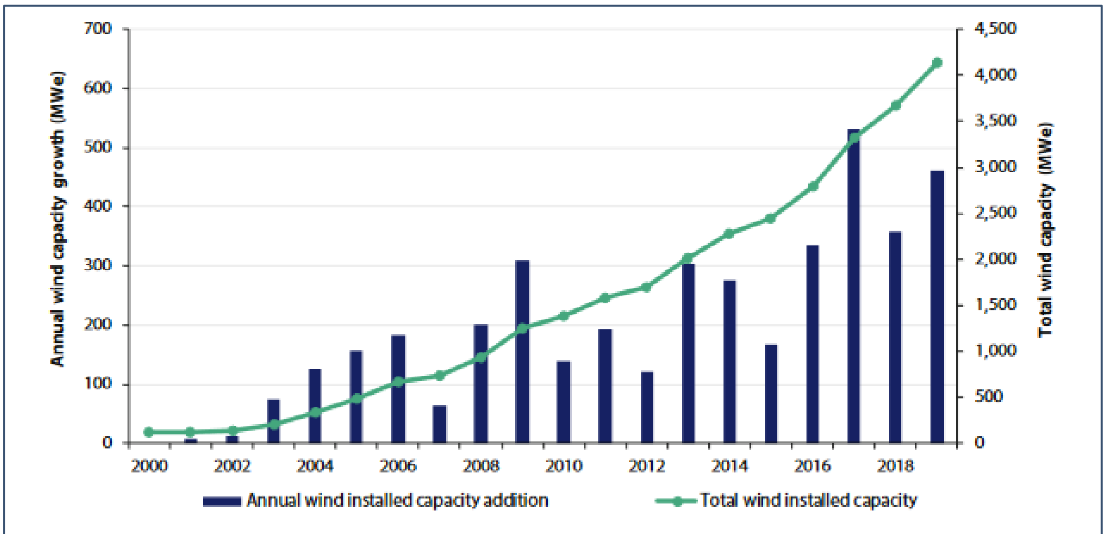


Plate 2.4 Installed Wind Generating Capacity 2000-2019

2.1.6 All-Island Generation Capacity Statement 2020-2029 – EirGrid

The All-Island Generation Capacity Statement 2020-2029 was published by EirGrid in August 2020. Within the key message of the statement it is highlighted that the overall demand is set to increase and is forecast to increase significantly due to the expansion of large energy users including data centres. In Ireland, the growth in electricity demand for the next ten years varies between 33% in the median demand scenario, to 50% in the high scenario. The Median Forecast is generally aligned with EirGrid's Tomorrow Energy Scenarios which predict an overall Energy Requirement for Ireland of approximately 41TWh by 2030.

The statement notes that within the Republic of Ireland new wind farms commissioned in 2019 brought the total wind capacity to 4,127 MW contributing to the increase in overall RES-E percentage to 35.7%. The Statement goes on to noted that:

> *"It can be assumed that Ireland's renewable targets will be achieved largely through the deployment of additional wind powered generation."*

2.1.7 Summary of Compliance with Renewable Energy Policy and Targets

At present Ireland faces significant challenges through efforts to meet its EU targets for renewable energy by 2030 and its commitment to transition to a low carbon economy by 2050. The proposed development can significantly aid towards Ireland meeting its energy and climate targets along with addressing the country's over-dependence on imported fossil fuels.

2.2 National Policy

2.2.1 Introduction

This section of the EIAR provides a breakdown of national policy with regards to the proposed development. Under the national policy section the following are discussed:

- National Renewable Energy Action Plan, 2010;
- White Paper on Energy Policy in Ireland 2015-2030;
- Ireland's Transition to a Low Carbon Energy Future 2015-2030;
- Electricity Support Schemes: I-SEM Arrangements Decision Paper, 2017;
- Draft National Energy & Climate Plan 2021-2030;
- Renewable Electricity Support Scheme RESS 2020; and,
- Programme for Government 2020.

National policy has developed in line with European and International policies, targets and commitments, in that the importance and urgency of decarbonising the energy generation sector, the economy in general and reducing greenhouse gas emissions has become increasingly more apparent. The proposed development complies with the nationally stated need to provide a greater amount of renewable energy onto the national grid and will further reduce the national reliance on fossil fuels for electricity generation.

2.2.2 National Renewable Energy Action Plan

Article 4 of the Renewable Energy Directive on renewable energy required each Member State to adopt a national renewable energy action plan (NREAP) to be submitted to the European Commission.

In relation to wind energy, the NREAP states:

> *"..., Ireland has immense potential for the development of renewable energy particularly wind energy, both on and offshore and wave energy. The development and expansion of the use of renewable energy, together with measures aimed at a reduction and more efficient use of energy are important as regards meeting our climate change objectives and priorities, both nationally and at European level. At a high level a significant increase in renewable energy and the protection of the environment are thus mutually reinforcing goals."*

2.2.3 White Paper on Energy Policy in Ireland 2015-2030

On 12th May 2014, *'The Green Paper on Energy Policy in Ireland'* was launched, opening the way for a public consultation process on the future of energy policy in Ireland for the medium to long-term. The paper acknowledged that energy is an integral part of Ireland's economic and social landscape; and that a secure, sustainable and competitive energy sector is central to Ireland's ability to attract and retain Foreign Direct Investment and sustain Irish enterprise. The three key pillars of energy policy are to focus on security, sustainability and competitiveness.

A Government White Paper entitled *'Ireland's Transition to a Low Carbon Energy Future 2015-2030'* was published in December 2015 by the then Department of Communications, Energy and Natural Resources (DCENR). This Paper provides a complete energy update and a framework to guide policy up to 2030. The Paper builds upon the White Paper published in 2007 and takes into account the changes that have taken place in the energy sector since 2007.

The White Paper states that onshore wind continues to be the main contributor of renewable energy, - 18.2% of total generation and 81% of renewable electricity (RES-E) in 2014. The impacts of climate change in the context of EU and national policy refers to the change in climate that is attributable to human activity arising from the release of greenhouse gases into the atmosphere and which is additional to natural climate variability (Department of the Environment, Heritage and Local Government, 2006). In 2008, the Environmental Protection Agency (EPA) published the results of a study entitled 'Climate Change – Refining the Impacts for Ireland', as part of the STRIVE (Science, Technology, Research and Innovation) Programme 2007 – 2013. This report states that mean annual temperatures in Ireland have risen by 0.7o Celsius (C) over the past century. Mean temperatures in Ireland relative to the 1961 to 1990 averages are likely to rise by 1.8 to 4.0o C by the 2050s and by in excess of 2oC by the end of the century due to climate change.

The policy framework sets out a vision for a low carbon future that maintains Ireland's competitiveness and ensures a supply of affordable energy. The paper advises that a range of policy measures will be employed to achieve this vision and will involve amongst many things, generating electricity from renewable sources of which there are plentiful indigenous supplies and increasing the use of electricity and bio energy to heat homes and fuel transport.

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

The policy framework set out in this Paper was developed to guide policy and actions that the Irish Government intends to take in the energy sector up to 2030 and also reaching out to 2050 to ensure a low carbon future that maintains Ireland's competitiveness and ensures a supply of affordable energy. The Energy Vision 2050, as established in the White Paper, describes a 'radical transformation' of Ireland's energy system which will result in greenhouse gas (GHG) emissions from the energy sector reducing by between 80% and 95%, compared to 1990 levels. The paper advises that a range of policy measures will be employed to achieve this vision and will involve amongst many things, generating electricity from renewable sources of which there are plentiful indigenous supplies and increasing the use of electricity and bio energy to heat homes and fuel transport.

In this White Paper, the then DCENR confirmed that onshore wind is the cheapest form of renewable energy in Ireland, stating:

> *"Onshore wind continues to be the main contributor (18.2% of total generation and 81% of RES-E in 2014). It is a proven technology and Ireland's abundant wind resource means that a wind generator in Ireland generates more electricity than similar installations in other countries. This results in a lower cost of support."*

2.2.5 Electricity Support Scheme: I-SEM Arrangements Decision Paper, 2017

The Department of Communications, Climate Action and Environment (DCCAE) has updated its existing electricity support schemes supported by the Public Service Obligation (PSO) Levy (primarily for renewable energy). In May 2017, DCCAE published an information paper which outlined a number of options being considered as part of this decision-making process and set out the Department's emerging thinking on the optimal outcome. Having sought stakeholder views in relation to the options being considered (as set out in the May 2017 document) and drawing on the supporting analysis provided by the EirGrid modelling, the DCCAE published its final decisions on these matters in June 2018. The Departments final decisions are set out below. It should however be noted that the DCCAE has reserved the right to periodically review the impact of the decisions.

- *Decision 1: The market revenue calculation for the purposes of calculating the PSO levy for supported wind generation (Alternative Energy Requirement (AER), Renewable Energy Feed In Tariff (REFIT) 1 and 2) will be amended to adapt to the Integrated Single Electricity Market (ISEM). The market revenue calculation for wind generators will, for the energy component, be based on the lower of a blend of 80% of the Day Ahead Market Price and 20% of the Balancing Market Price, and the Day Ahead Market Price for all supported wind generators above 5MW capacity. For supported wind generators below 5 MW, the market revenue calculation will, for the energy component, be based on the lower of a blend of 70% of the Day Ahead Market Price and 30% of the Balancing Market Price, and the Day Ahead Market Price.*
- *Decision 2: The market revenue calculation for the purposes of calculating the PSO levy for other supported generation (under REFIT 1, REFIT 2, REFIT 3 and the Peat PSO Scheme) will be amended to adapt to the Integrated Single Electricity Market. For these generators (peat, hydro and biomass) supported under the PSO levy, the market revenue calculation for the energy component will be based on the Day Ahead Market Price.*
- *Decision 3: The market revenue calculations for the purposes of calculating the PSO levy for all supported generation will take into account only capacity market revenues and not capacity market costs.*

In summary, at national level it is clear that there remains ongoing promotion of the use of energy from renewable sources in line with EU Directives. Furthermore, Ireland's wind resource is expected to play a pivotal role in this. As such, the proposed development will directly contribute to these policy targets and requirements.

2.2.6 Draft National Energy and Climate Plan (NCEP) 2012-2030, December 2019

A first Draft National Energy & Climate Plan (NECP) 2021-2023 was published by the Government of Ireland in December 2018, with a second being released in 2019. The NECP has been prepared in accordance with the Governance of the Energy Union and Climate Action Regulation.

The NECP sets out how EU Countries (including Ireland) intend to address energy and climate related issues :

- energy efficiency
- renewables
- greenhouse gas
- emissions reductions
- interconnections
- research and innovation

The second Draft incorporates all planned policies and measures that were identified up to the end of 2019 and which collectively aim to deliver a 30% reduction by 2030 in non-ETS greenhouse gas emissions from those levels experienced in 2005.

The NECP was drafted before the Programme for Government was released, therefore it will need to be updated in due course to align with the provisions of that Programme, discussed in more detail below.

2.2.7 Renewable Electricity Support Scheme RESS

The Climate Action Plan, published in June 2019, is the Government's plan to give Irish people a cleaner, safer and more sustainable future. The Plan sets out actions across every sector which will ensure we meet our future climate commitments. A key part of the Plan is a move to 70% renewable electricity by 2030, a measure which will be driven by the introduction of the Renewable Electricity Support Scheme ('RESS').

The RESS is an auction-based scheme which invites renewable electricity projects to bid for capacity and receive a guaranteed price for the electricity they generate. Terms and Conditions for the first competition (RESS 1:2020) was published in February 2020 and will provide support to renewable electricity projects in Ireland. It is intended that the RESS will deliver, amongst other policy objectives:

> *"An ambitious renewable electricity policy to 2030 increasing energy security, energy sustainability and ensuring the cost effectiveness of energy policy"*

The preliminary results of the RESS 1 auction were published on the 4th of August 2020. EirGrid ran the auction in on the 28th of July 2020 and of the 108 projects who submitted an offer price, 82 projects have been deemed to be provisionally successful while 26 were considered to be unsuccessful. The successful projects constitute a mix of on-shore wind and solar.

The Auction Scheme and the ECP framework has now been established and is operational and will facilitate and provide a pathway to realise the renewable electricity (RES-E) ambition of up to 70% by 2030, that has been established.

2.2.8 Programme for Government 2020

The Programme for Government 2020 was published in June 2020. In relation to climate change the programme recognises that the next ten years are a critical period in addressing the climate crisis. It is an ambition of the programme to more than halve carbon emissions over the course of the decade (2020-2030). The programme notes that the government are committed to reducing greenhouse gas emissions by an average 7% per annum over the next decade in a push to achieve a net zero emissions by the year 2050. The programme also recognises the severity of the climate challenge as it clarifies that *"climate change is the single greatest threat facing humanity"*.

With regards to energy, the programme notes that the government will implement a new National Energy Efficiency Action Plan to reduce energy use, including behavioural and awareness aspects of energy efficiency such as building and data management. Further, the government are also committed to the rapid decarbonisation of the energy sector, along with this it is noted that the necessary steps will be taken to deliver at least 70% of renewable electricity by the year 2030.

2.3 Climate Change Policy and Targets

2.3.1 Introduction

This section of the EIAR presents the various policies and targets which relate to climate change. The below headings and sub-headings explore climate change in the context of EU and national policy and are broken down into the following sections:

- Impacts on Climate Change;
- International Policy;
  - United Nations Framework Convention on Climate Change;
  - Kyoto Protocol Targets;
  - Doha Amendment to the Kyoto Protocol;
  - Conference of Parties (COP) 21– Paris Agreement
  - COP 25 Madrid – Current Progress
  - Emissions Projections;
- National Policy;
  - National Climate Change Adaptation Framework 2012;
  - National Policy Position on Climate Action and Low Carbon Development, 2014;
  - Climate Action and Low Carbon Development Act 2015;
  - National Adaptation Framework -Planning for a Climate Resilient Ireland 2018;
  - Report of the Joint Committee on Climate Action Climate Change: A Cross-Party Consensus for Action, March 2019;
  - Climate Action Plan, 2019; and,
  - Draft Climate Action and Low Carbon Development (Amendment) Bill 2020.

International and national policy consistently identifies the need to reduce greenhouse gas (GHG) emissions and stresses the importance of reducing global warming. The context of international policy has altered over the last 30 years from being of a warning nature to the current almost universally accepted belief that we are in a climate crisis. The current proposed development, as a generator of renewable energy, will contribute to the decarbonisation of the energy sector and reduce harmful emissions. In this regard, it is in broad compliance with national and international climate change policy and targets.

An EPA report titled *Irish Climate Futures: Data for Decision-making"* (June 2019) notes that should business as usual continue the Earth's average temperature is likely to increase by between 2.6°C and 4.8°C above today's levels. For Ireland, the changes listed (extreme events and sea level rise) would probably mean more frequent wet winters, dry summers and hot summers. It is acknowledged that this would pose challenges for water and flood risk management, agriculture and tourism.

2.3.1.1 Impacts on Climate Change

Climate change, in the context of EU and national policy, refers to the change in climate that is attributable to human activity arising from the release of greenhouse gases into the atmosphere and which is additional to natural climate variability (Department of the Environment, Heritage and Local Government, 2006). In 2008, the Environmental Protection Agency (EPA) published the results of a study entitled 'Climate Change – Refining the Impacts for Ireland', as part of the STRIVE (Science, Technology, Research and Innovation) Programme 2007 – 2013. This report stated that mean annual temperatures in Ireland have risen by 0.7 Celsius (C) over the past century. Mean temperatures in Ireland relative to the 1961 to 1990 averages are likely to rise by 1.4 to 1.8ºC by the 2050's and by more than 2ºC by the end of the century due to climate change.

Future precipitation changes are less certain to project than temperature but constitute the most important aspect of future climate change for Ireland. The study projects that winter rainfall in Ireland by the 2050's will increase by approximately 10%, while summer rainfalls will reduce by 12 – 17%. Lengthier heatwaves, much reduced number of frost days, lengthier rainfall events in winter and more intense downpours and an increased propensity for drought in summer are also projected. The STRIVE report on climate change impacts states that Ireland can and must adapt to the challenge of climate change. It notes that:

> *"Barriers to this, both scientific and socio-economic, are required to be identified and addressed in order that Ireland can be optimally positioned to thrive in a changing world."*

Most recently the Intergovernmental Panel on Climate Change (IPCC) have released their special report (August 2021) on the impacts of global warming of 1.5 ˚C above pre-industrial levels and related global greenhouse gas emission pathways. The importance of limiting global warming to 1.5˚C is stressed. Under all scenarios presented in the report, the threshold is reached by 2040. For any chance of meeting the goal seen as essential to the survival of some vulnerable communities and ecosystems, drastic reductions in CO2 would be needed this decade and net zero emissions by 2050.

2.3.2 International Policy

2.3.2.1 United Nations Framework Convention on Climate Change

In 1992, the United Nations Framework Convention on Climate Change (UNFCCC), was adopted as a framework for international efforts to combat the challenge posed by climate change. The UNFCCC has over 197 signatory countries and has almost universal membership from the international community. The UNFCCC seeks to limit average global temperature increases and the resulting climate change. In addition, the UNFCCC seeks to cope with impacts that are already inevitable. It recognises that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. The framework sets no binding limits on greenhouse gas emissions for individual countries and contains no enforcement mechanisms. Instead, the framework outlines how specific international treaties (called "protocols" or "Agreements") may be negotiated to set binding limits on greenhouse gases.

2.3.2.2 Kyoto Protocol Targets

Ireland is a Party to the Kyoto Protocol, an international agreement that sets limitations and reduction targets for greenhouse gases for developed countries. It came into effect in 2005, as a result of which, emission reduction targets agreed by developed countries, including Ireland, are now binding.

Under the Kyoto Protocol, the EU agreed to achieve a significant reduction in total greenhouse gas emissions of 8% below 1990 levels in the period 2008 to 2012. Ireland's contribution to the EU commitment for the period 2008 – 2012 was to limit its greenhouse gas emissions to no more than 13% above 1990 levels.

2.3.2.3 Doha Amendment to the Kyoto Protocol

In Doha, Qatar, on 8th December 2012, the *"Doha Amendment to the Kyoto Protocol"* was adopted. The amendment includes:

- New commitments for Annex I Parties to the Kyoto Protocol who agreed to take on commitments in a second commitment period from 1st January 2013 to 31st December 2020;
- A revised list of greenhouse gases (GHG) to be reported on by Parties in the second commitment period; and
- Amendments to several articles of the Kyoto Protocol which specifically referenced issues pertaining to the first commitment period and which needed to be updated for the second commitment period.

During the first commitment period, 37 industrialised countries and the European Community committed to reduce GHG emissions to an average of 5% against 1990 levels. During the second commitment period, Parties committed to reduce GHG emissions by at least 18% below 1990 levels in the eight-year period from 2013 to 2020; however, the composition of Parties in the second commitment period is different from the first.

Under the protocol, countries must meet their targets primarily through national measures, although market-based mechanisms (such as international emissions trading) can also be utilised.

2.3.2.4 Conference of Parties (COP) 21 – Paris Agreement

Every year since 1995, the Conference of Parties (COP) has gathered the 196 Parties (195 countries and the European Union) that have ratified the UNFCCC to evaluate its implementation and negotiate new commitments. COP21 was organised by the United Nations in Paris and held from 30th November to 12th December 2015. Of significance, the COP21 closed with the adoption of the first international climate agreement (concluded by 195 countries and applicable to all). The 12-page text, made up of a preamble and 29 articles, provides for a limitation of the global average temperature rise to well below 2°C above pre-industrial levels and to limit the increase to 1.5°C. It is flexible and takes into account the needs and capacities of each country. It is balanced as regards adaptation and mitigation, and durable, with a periodical ratcheting-up of ambitions.

2.3.2.5 COP 25 Madrid – Current Progress

COP25, the 25th session of the COP and the most recent convention at the time of writing this report, was held between the 2nd and 13th of December 2019 in Madrid. The conference was characterised by repeated warnings from civil society (NGOs and corporates) on emerging evidence and scientific consensus on climate change risk. Specifically, as indicated above, it is noted that there are only '*10 years left*' before the opportunity of limiting global warming to 1.5°C is no longer feasible. As such, the only scenario that makes achieving this curtailment of rising global temperature possible is a '*7.6% reduction of global GHG emissions every year between 2020 and 2030, and to reach net zero emissions by 2050*'. However, there was no consensus achieved between States to finalise the operating rules of the Paris Agreement and ensure that it became operational by 2020. Three issues which emerged between States from the COP25 are summarised below:

- There was no uniform consensus between States to raise countries' climate ambitions, e.g. to make increased commitments in light of growing climate change data. Some States were opposed to imposing any obligation on countries to submit enhanced pledges next year, arguing it should be each country's own decision. All states must submit a review of their commitments for COP 26 in 2021. At the current level of climate targets, within a decade, the objective of the Paris Agreement will no longer be achievable;
- There was no agreement on finalising Article 6, the foundations for international cooperation to combat climate change. The aim was to establish the rules for new international mechanisms for financing and transferring GHG emission reductions; and
- There was no agreement on financing (Green Climate Fund); specifically, relating to both loss and damage caused by climate change.

Despite the lack of consensus to the above challenges, the COP25 did achieve more limited success in the introduction of the "*San Jose Principles for High Ambition and Integrity of International Carbon Markets*", which sets out the framework on which a robust carbon market should be built. These principles include, but are not limited to:

- Ensures environmental integrity and enables the highest possible mitigation ambition;
- Delivers an overall mitigation in global emissions, moving beyond zero-sum offsetting approaches to help accelerate the reduction of global greenhouse gas emissions;
- Prohibits the use of pre-2020 units, Kyoto units and allowances, and any underlying reductions toward Paris Agreement and other international goals; and

- Ensures that double counting is avoided and that all use of markets toward international climate goals is subject to corresponding adjustments.

These principles were supported by 23 EU, including Ireland, and Latin American countries, 5 no. pacific islands and 2 no. countries in the Caribbean.

In addition, the European Union's *Green Pact* was introduced on the 11th of December 2019 with agreement of the European Council and all Member States (except Poland) on the ambition of climate neutrality in 2050, supported by a financing plan of €1,000 billion over 10 years.

2.3.3 Emissions Projections

In July 2020 the Environmental Protection Agency (EPA) published *Irelands' Greenhouse Gas Emissions Projections 2019-2040*. The report provides an updated assessment of Ireland's total projected greenhouse gas emissions out to 2040 which includes an assessment of progress towards achieving its emission reduction targets out to 2030 set under the EU Effort Sharing Decision and Effort Sharing Regulation.

The EPA has utilised two scenarios in preparing the report – With Existing Measures (WEM) and With Additional measures (WAM) – being:

- WEM: assumes that no additional policies and measures beyond those already in place by the end of 2018 are implemented. This is the cut off point for which the latest national greenhouse gas emission inventory data is available.
- WAM: assumes implementation of the With Existing Measures scenario in addition to implementation of planned government policies and measures adopted after the end of the 2018. Importantly, this includes Ireland's 2019 Climate Action Plan.

These 2020-2040 projections show total emissions decreasing from the 2018 levels by 2% by 2030 under the With Existing Measures scenario and by 23% under the With Additional Measures scenario.

The WEM projected that Ireland reaches "*approximately 37.6% of electricity consumption from renewable energy by 2020. Renewable electricity generation capacity is dominated by wind energy. In 2030 it is estimated that renewable energy generation increases to approximately 55% of electricity consumption."* Under the With Additional Measures (WAM) scenario it is projected that in 2030 *"renewable energy generation increases to approximately 70% of electricity consumption. This is mainly a result of further expansion in wind energy (comprising 3.5 GW offshore and approximately 8.2 GW onshore). Expansion of other renewables (e.g. solar photovoltaics) also occurs under this scenario"*

Amongst the Key findings of the Projections are: (inter alia)

- "*Climate Action Plan: These projections show that full implementation of the 2019 Climate Action Plan will result in a reduction in Ireland's total greenhouse gas emissions by up to 23% by 2030 compared to the most recent greenhouse gas inventory levels (2018).*
- *Almost 3% per year annual emissions reduction: Implementation of the "With Additional Measures" scenario" (including the impact of the 2019 Climate Action Plan) is projected to save 79 Mt CO2 eq over the period 2021-2030 compared to the "With Existing Measures" scenario. This represents an average annual reduction of 2.9% over the period.*
- *Potential to meet our EU obligations for 2030: Ireland is projected to meet non-ETS EU targets over the period 2021 to 2030. This assumes full implementation of the 2019 Climate Action Plan and the use of flexibilities in relation to land use, land use change and forestry.*
- *Full and early implementation of the Climate Action Plan essential: Full and early implementation of the 2019 Climate Action Plan is needed if the savings projected are to materialise. The scale and pace of the changes needed are significant, requiring much greater reliance on renewables, cross-cutting measures such as an €80 per tonne of CO2 carbon tax by*

2030 and further ambitious measures in sectors such as transport, agriculture and power generation.

- *Decarbonising electricity generation: A 70% contribution of renewable energy in electricity generation by 2030 will be achieved by approximately tripling the 2018 renewable generation capacity, while phasing out coal and peat use. Increased renewables, and greater interconnection, are projected to result in energy industries emissions decreasing by over 34% by 2030 compared to the most recent figures in 2018."*

The EPA's emission projections were in part collaborated by the Sustainable Energy Authority of Ireland (SEAI)'s *Report on Energy-related CO2 Emissions in Ireland 2005 – 2018* (February 2020). The Report highlights that CO_2 emissions from electricity generation fell in 2018 despite the increase in electricity use. This reduction in CO_2 intensity of electricity was contributed to by a 44% decrease in coal used for electricity generation and a 16% increase in wind generated electricity. On the latter point, the Report notes that wind generated electricity alone avoided 3.1 million tonnes of CO_2. The SEAI concludes the report with the following overview of the outstanding challenges associated with the emerging CO2 trends and, relevant to the proposed development, a clear directive for further action:

> *"This report shows us once again the challenges we face in reducing our CO_2 emissions from energy use. CO_2 emissions from travel and heating our homes and businesses increased again in 2018. While emissions from electricity decreased, we have a hill to climb if we are to make meaningful inroads in the other sectors. The data in this report pre-dates the release of the Government's Climate Action Plan. The ambitious course of action plotted in that plan has the potential to turn these trends around."*

As such, there is a strong precedent for granting the proposed development in order to facilitate greater penetration of renewable energy on to the grid and assist with national decarbonisation efforts.

2.3.4 National Policy

2.3.4.1 Climate Action and Low Carbon Development Act 2015

The Climate Action and Low Carbon Development Act 2015 was signed into law on 10th December 2015. The Act provides for the establishment of a national framework with the aim of achieving a low carbon, climate resilient, and environmentally sustainable economy by 2050, referred to in the Act as the "national transition objective".

The Act provides the tools and structures to transition towards a low carbon economy and it anticipates that it will be achieved through a combination of:

- A National Mitigation Plan (to lower Ireland's greenhouse gas emissions levels); - see below
- A National Adaptation Framework (to provide for responses to changes caused by climate change);
- Tailored sectoral plans (to specify the adaptation measures to be taken by each Government ministry); and
- Establishment of the Climate Change Advisory Council to advise Ministers and the Government on climate change matters.

2.3.4.2 National Adaptation Framework- Planning for a Climate Resilient Ireland 2018

Ireland's first statutory National Adaptation Framework (NAF) was published on 19th January 2018. The NAF sets out the national strategy to reduce the vulnerability of the country to the negative effects of climate change and to avail of positive impacts. The NAF was developed under the Climate Action and Low Carbon Development Act 2015.

The NAF, on the basis of evolving climate change literature within recent years, identifies a number of key facts which will need to be considered when designing adaptation measures and addressing climate change going into the future:

- Climate change will have diverse and wide-ranging impacts on Ireland's environment, society, economic development, including managed and natural ecosystems, water resources, agriculture and food security, human health and coastal infrastructures and zones;
- Sufficient robust information exists nationally to further progress the process of implementing adaptation actions and increasing social, economic and environmental resilience to climate change;
- Uncertainties exist in relation to the extent and rate of future climate change. Addressing uncertainties is a challenge, but should not be read as an excuse for inaction as there is overall agreement on the robustness of trends and projections; and
- The impacts and risks of climate change can be reduced and managed through mitigation and adaptation actions.

The Framework acknowledges that, as per the Intergovernmental Panel on Climate Change (IPCC, 2013), there is at least a 95% probability that the global warming of the last 50 years is a result of human activities. Specifically, the main contribution to this warming has come from the burning of fossil fuels. The Framework provides a number of guiding principles for adaptation at national level, regardless of how successful efforts to mitigate greenhouse gas (GHG) emissions prove to be, as the impact of climate change will continue over the coming decades due to the delayed impacts of past and current emissions. In this regard, the Framework states that:

> *"Adaptation not only depends on action by all levels of government but also on the active and sustained engagement of all stakeholders, including sectoral interests, the private sector, communities and individuals. Everybody has a role to play in making sure Ireland is taking appropriate adaptation action to achieve a climate resilient future. This is a joint responsibility where "climate proofing" our country is an undertaking for which all of society is responsible and everyone has a role to play."*

The Framework concludes that there is limited choice in the context of climate change other than to implement adaptation measures simultaneously with on-going mitigation measures (e.g. the continued development and integration of renewable energy infrastructure) to deal with the unavoidable climate change impacts and associated economic, environmental and social costs.

2.3.4.3 Report of the Joint Committee on Climate Action Climate Change: A Cross-Party Consensus for Action, March 2019

In March 2019, the Joint Committee on Climate Action Change released a report detailing a cross party consensus for action. The report in its introduction notes that *"Irelands performance in meeting international obligations has to date been poor".* The Committee places concern that predictions of emissions indicate that the state is off track in meeting its 2020 and 2030 targets under the Kyoto protocol and the EU Directives.

The committee recommended that new climate change legislation be enacted by the Oireachtas in 2019. The following recommendations have been listed:

1. A target of net zero economy wide GHG emissions by 2050.
2. A provision for a 2030 target, consistent with the GHG emissions reduction pathway to 2050 to be set by 2020 by Statutory Instrument requiring the formal approval of both Houses of the Oireachtas following receipt of advice from the Climate Action Council.

3. Provision for five-yearly carbon budgets, consistent with the emissions reduction pathway to 2030 and 2050 targets, to be set by Statutory Instrument requiring the formal approval of both Houses of the Oireachtas following receipt of advice from the Climate Action Council.
4. A target for the renewable share of electricity generation of 70% by 2030.

Further to this the committee acknowledged that the measures which are currently in place along with the measures suggested within the report will not be sufficient in meeting Ireland's targets.

Chapter 7 of the report outlines the committee's recommendations for developing Ireland's capacity in renewable energies and renewable electricity in particular. It is noted that the transformation of Ireland's energy system will be required for the country to meet its GHG emission targets. To reach net zero emissions by 2050 the report recognises that the country will be required to fully decarbonize electricity generation. Section 7.5 relates to onshore renewable energy generation.It is acknowledged that onshore wind energy is currently the primary source of renewable electricity within Ireland, accounting for 84% of renewable power generated in 2017. 'It is also detailed that, 'onshore wind alone will not supply Ireland with sufficient electricity to become self-sufficient, it is evident that it must be used alongside other sources of renewable energy'.

Under its recommendations, the Committee encourages the upgrading of existing onshore wind turbines where this will yield additional potential. While acknowledging that there are challenges in relation to securing additional on-shore wind generated renewable energy, the Report fully supports the increased provision of on-shore wind farm development at appropriate locations (such as that of the current proposal) and acknowledges that on-shore wind has a pivotal role to play in achieving climate action targets.

2.3.4.4 Climate Action Plan 2019

The Climate Action Plan 2019 (CAP) was published on the 1st of August 2019 by the Department of Communications, Climate Action and Environment. The CAP sets out an ambitious course of action over the coming years to address the impacts which climate may have on Ireland's environment, society, economic and natural resources. This Plan clearly recognises that Ireland must significantly step up its commitments to tackle climate disruption.

Chapter 1 of the CAP sets out the nature of the challenge which Ireland faces over the coming years. The CAP notes that the evidence for warming of our climate system is beyond dispute with observations showing that global average temperatures have increased by more than 1°C since pre-industrial times. These changes will cause extensive direct and indirect harm to Ireland and its people, as well as to other countries more exposed and less able than we are to withstand the associated impacts, which are predicted to include:

- Rising sea-levels threatening habitable land and particularly coastal infrastructure,
- Extreme weather, including more intense storms and rainfall affecting our land, coastline and seas,
- Further pressure on our water resources and food production systems with associated impacts on fluvial and coastal ecosystems,
- Increased chance and scale of river and coastal flooding,
- Greater political and security instability,
- Displacement of population and climate refugees,
- Heightened risk of the arrival of new pests and diseases,
- Poorer water quality,
- Changes in the distribution and time of lifecycle events of plant and animal species on land and in the oceans, and
- It is also recognised within the Plan that, in addition to the above, many of the pollutants associated with climate change are also damaging to human health.

It is the ambition of the CAP to deliver a step-change in our emissions performance over the coming decade, so that we will not only meet our EU targets for 2030 but will also be well placed to meet our mid-century decarbonisation objectives.

Plate 2.4 below depicts Irelands decarbonisation pathway up to the year 2030. The below will be used to manage Ireland's decarbonisation pathway and details the path for the various sectors:

	Technology	NDP 2030	Uptake to meet 2030 targets (Based on MACC analysis) 2025	2030
Electricity	**Total RES in Generation mix[4], %**	**55**	**52**	**70**
	• Onshore wind, GW	~7	~6.5	~8.2
	• Offshore wind, GW	1.8	~1.0	~3.5
	• Solar PV, GW	1.5	~0.2	~0.4
Transport	**Electric Vehicles, #**	**498,000**	**181,500**	**936,000**
	• Passenger EVs, #	355,000	57,000	550,000
	• Passenger PHEVs, #	118,000	94,000	290,000
	• Electric delivery vans, #	19,000	30,000	61,000
	• Electric trucks, #	n.a	0	34,000
	• Electric buses, #	1,250	500-600	1,000-1,200
	Bioethanol blend, Volume	**E10**	**E10**	**E10**
	Biodiesel blend, Volume	**B12**	**B12**	**B12**
Built Environment	**Retrofitted homes[1], cumulative 2021-30, #**	**450,000**	**300,000**	**500,000**
	Electric heating sources, total residential, #	**370,000**	**350,000**	**600,000**
	• New buildings, #	200,000	50,000	200,000
	• Existing buildings, #	170,000	300,000	400,000
	Electric heating sources, total commercial, #	**15,000[3]**	**15,000**	**25,000**
Enterprise	**Emissions, $MtCO_2eq.$**	**9**	**8**	**8**
	• Alternative fuels in cement fuel mix, %	N/A	65%	80%
	• CO2-neutral heat generation in food industry[2], %	N/A	~70%	~80%
Agriculture	**Emissions, $MtCO_2eq.$**	**21**	**19**	**18**
	• Fertilizers CAN replacement, %	N/A	40%	50%
	• Trailing-shoe slurry spreading, %	N/A	30%	50%
Other (e.g. waste)	**Emissions, $MtCO_2eq.$**	**3.2**	**3.2**	**3.2**

" Solar PV, some electrification of buses, and biofuel blending are identified in 2030 the NDP scenario but are not showing as cost-effective in MACC. Despite MACC analysis these technologies may remain in plan given other factors (e.g., exchequer cost, ease of implementation, need for public sector leadership)

1 Retrofit to B2 BER fabric equivalent
2 Includes biomass and electricity
3 Not specified in NDP, estimated based on residential ratio
4 RESS competitive auction determines the final mix

Plate 2.2 Irelands Decarbonisation Pathway Dashboard to 2030

Chapter 7 of the CAP details the views surrounding electricity. The CAP notes that as of 2017 electricity accounted for 19.3% of Ireland's greenhouse gases which was down from the 2016 figure of 20.4%. With regards to electricity the following is detailed:

> *"It is important that we decarbonise the electricity that we consume by harnessing our significant renewable energy resources. By doing this we will also become less dependent on imported fossil fuels."*

In Ireland, in 2017 a total of 30.1% of electricity produced came from renewable sources, the target to be achieved by 2020 is set at 40%. The CAP goes on to note that *'given our 40% target is based on a percentage of total energy demand, this rising demand makes meeting our 2020 target even more challenging and latest forecasts indicate we may miss this target by 3 to 4 percentage points'*. Further to this, while decarbonising electricity is a key aspect of the strategy it is noted that this is against the background of rapid projected growth in electricity demand. The CAP notes that it is expected that demand for electricity is forecast to increase by 50% above existing capacity in the next decade. The CAP recognises that:

> *"Ensuring we build renewable, rather than fossil fuel, generation capacity to help meet this demand is essential."*

The CAP goes on to note that policy measures to date will not achieve the level of decarbonisation required in the electricity sector to meet the 2030 emissions reduction targets, as such it is listed that *'we must 'reduce our electricity sector emissions to 4-5 Mt in 2030'*. In relation to emissions the following is noted:

"In 2017, emissions from electricity were 12 Mt and in 2030, despite implementation of Project Ireland 2040 measures, emissions are projected to be 8 Mt. This clearly demonstrates the need for a significant step-up in ambition over existing policy, not only to meet our 2030 targets, but to set us on course to deliver substantive decarbonisation of our economy and society by 2050."

In the electricity sector, reaching a 70% share of renewable electricity would require 50-55% emissions reduction by 2030. Under Section 7.2 of the CAP, the following targets have been set out:

- Reduce CO2 eq. emissions from the sector by 50–55% relative to 2030 Pre-National Development Plan (NDP) projections.
- Deliver an early and complete phase-out of coal- and peat-fired electricity generation.
- Increase electricity generated from renewable sources to 70%, indicatively comprising:
  - at least 3.5 GW of offshore renewable energy;
  - up to 1.5 GW of grid-scale solar energy; and
  - **up to 8.2 GW total of increased onshore wind capacity**.
- Meet 15% of electricity demand by renewable sources contracted under Corporate PPAs.

Achieving 70% renewable electricity by 2030 will involve phasing out coal- and peat-fired electricity generation plants, increasing our renewable electricity, reinforcing our grid (including greater interconnection to allow electricity to flow between Ireland and other countries) and putting systems in place to manage intermittent sources of power, especially from wind.

Section 7.2 of the CAP notes the 'Measures to deliver targets' in which efforts to meet the 2030 ambitions are set out which includes increased harnessing of renewable energy. As seen in Plate 2.5 below, CAP identifies a need for 8.2GW of onshore wind generation and states that in 2017 there was 3.3GW in place, therefore Ireland needs to more than double its installed capacity of wind generation. Accordingly, the 2019 CAP presents clear and unequivocal support for the provision of additional renewable energy generation and presents yet further policy support for increased onshore wind energy. It is noted that at the time of writing the 2021 Climate Action Plan is being developed, focusing on the commitment of the Programme for Government to achieve an average 7% per annum reduction in overall greenhouse gas emissions from 2021 to 2030 (a 51% reduction over the decade), to achieving net zero emissions by 2050. The public call for evidence on the revised Plan closed in May 2021.

2.3.4.5 Programme for Government

The Programme for Government 2020 was published in June 2020. In relation to climate change the programme recognises that the next ten years are a critical period in addressing the climate crisis. It is an ambition of the programme to more than halve carbon emissions over the course of the decade (2020-2030). The programme notes that the government are committed to reducing greenhouse gas emissions by an average 7% per annum over the next decade in a push to achieve a net zero emissions by the year 2050.

With regards to energy the programme notes that the government will implement a new National Energy Efficiency Action Plan to reduce energy use, including behavioural and awareness aspects of energy efficiency such as building and data management. Further, the government are also committed to the rapid decarbonisation of the energy sector. Along with this it is noted that the necessary steps will be taken to deliver at least 70% of renewable electricity by the year 2030. The measures to achieve this will include the following:

- *"Hold Renewable Electricity Support Scheme (RESS) auctions each year from 2020 onwards*
- *Produce a whole-of-government plan setting out how at least 70% renewable electricity generation by 2030 will be delivered and how the necessary skills base, supply chains, legislation, and infrastructure to enable it will be delivered. This new plan will make recommendations for how the deployment of renewable electricity can be speeded up.*

- *Finalise and publish the Wind Energy Guidelines, having regard to the public consultation that has taken place.*
- *Continue Eirgrid's programme 'Delivering a Secure, Sustainable Electricity System' (DS3).*
- *Strengthen the policy framework to incentivise electricity storage and interconnection.*"

2.3.4.6 Climate Action and Low Carbon Development (Amendment) Bill 2021

The Climate Action and Low Carbon Development (amendment) Bill 2021 was published by the Irish Government in March 2021. The Bill supports Ireland, in law, to move to a climate resilient and climate neutral economy by 2050. It will establish a legally binding framework with clear targets and commitments set in law, and ensure the necessary structures and processes are embedded on a statutory basis to ensure we achieve our national, EU and international climate goals and obligations in the near and long term. The Bill significantly strengthens the framework for governance of climate action by the State in order to achieve national, EU and international climate goals and obligations.

The Bill includes the following elements:

- Places the commitment to achieve a climate neutral economy no later than 2050 on a statutory basis. Introduces system of successive 5-year, economy-wide carbon budgets starting in 2021;
- Strengthens the role of the Climate Change Advisory Council in proposing carbon budgets;
- Provides that the first two carbon budgets proposed by the Climate Change Advisory Council should equate to a total reduction of 51% in emissions over the period to 2030;
- Introduces a requirement to annually revise the Climate Action Plan and prepare, at least once every five years, a National Long Term Climate Action Strategy;
- Introduces a requirement for all Local Authorities to prepare individual Climate Action Plans which will include both mitigation and adaptation measures, to be updated every five years. Local Authority Development Plans must also align with their Climate Action Plan;
- Gives a stronger oversight role for the Oireachtas through an Oireachtas Committee.

2.3.5 Summary of Compliance with Climate Change Policy

The proposed development will generate renewable electricity and make it available to the national grid while making more sustainable use of existing infrastructure and resources (the connecting substation and grid connection route already being consented and in place). The proposed development will therefore increase the amount of renewable energy that will be available on the national grid and will contribute to Ireland's efforts and stated policy to decarbonise the economy. The proposed renewable energy will help Ireland address the challenge of decarbonising electricity generation as well as addressing the country's over-dependence on imported fossil fuels.

Furthermore, as noted within the CAP it is an ambition to deliver a step-change in our emissions performance over the coming decade, so that we will not only meet our EU targets for 2030 but will also be well placed to meet our mid-century decarbonisation objectives. It is recognised that to achieve the 2030 target of 70% renewable electricity a number of steps including phasing out coal- and peat-fired electricity generation plants, reinforcing the grid and increasing renewable electricity will be required. The CAP identifies that Ireland will essentially need to more than double its installed capacity of wind generation over the coming years. The proposed development can aid in increasing the installed capacity of wind energy within the country and aid in Ireland moving towards meeting both the 2030 target and targets further down the line.

2.4 Strategic Planning Context

2.4.1 Introduction

This section of the EIAR Provides the strategic planning context of the proposed development. As is set out below, the proposed development is in line with national, regional and local policies, frameworks, guidelines and plans. This section has been broken down to the following sections:

- National Planning Framework 2018,
  - Key Sustainability Elements of National Planning Framework
- Regional Policy
  - Regional Spatial and Economic Strategy for the Southern Region- Regional Spatial and Economic Strategy
- Local Policy
  - Kerry County Development Plan 2015-2021
- Other Relevant Guidelines
  - DoEHLG Wind Energy Guidelines 2006
  - Interim Guidelines for Planning Authorities on Statutory Plans, Renewable Energy and Climate Change 2017
  - Department Circular PL5/2017
  - Draft Revised Wind Energy Development Guidelines 2019
  - IWEA Best Practice Guidelines for the Irish Wind Energy Industry 2012
  - IWEA Best Practice Principles in Community Engagement and Community Commitment 2013
  - Code of Practice for Wind Energy Development in Ireland - Guidelines for Community Engagement 2016
  - IWEA Community Engagement Strategy 2018
  - Commission for Regulation of Utilities: Grid Connection Policy
  - Renewable Energy Support Scheme (RESS)
  - Forest Service Guidelines

As a renewable energy project the current proposal is broadly consistent with the overall national policy objectives to increase penetration and deployment of renewable energy resources and has been designed in the context of the relevant wind energy and other guidelines. The specific compliance with the County Development Plan provisions are dealt with in detail in the County Development Plan section below.

2.4.1.1 National Planning Framework, 2018-2024

The National Planning Framework (NPF), published in February of 2018, forms the top tier of the national planning policy structure which establishes the policy context for the Regional Spatial and Economic Strategies (RSES) and local level development plans. In an effort to move away from developer led development to one informed by the needs and requirements of society up to 2040, a number of objectives and policies have been put in place in order for the country to grow and develop in a sustainable manner.

- Developing a new region-focused strategy for managing growth;
- Linking this to a new 10-year investment plan, the Project Ireland 2040 National Development Plan 2018-2027;
- Using state lands for certain strategic purposes;
- Supporting this with strengthened, more environmentally focused planning at local level;

and

- Backing the framework up in law with an Independent Office of the Planning Regulator.

The NPF notes that the manner in which we plan for potential issues is important in the context of sustainability of our environment.

> *"While the overall quality of our environment is good, this masks some of the threats we now face. Key national environmental challenges include the need to accelerate action on climate change, health risks to drinking water, treating urban waste water, protecting important and vulnerable habitats as well as diminishing wild countryside and dealing with air quality problems in urban areas. It is also important to make space for nature into the future, as our population increases."*

A key aspect of the NPF surrounds the long-term sustainability of the environment, it aims to ensure that decisions that are made today meet our future needs in a sustainable manner.

> *"The manner in which we plan is important for the sustainability of our environment. Our planning system has influence across a wide range of sectors, both directly and indirectly and interacts with many common issues related to effective environmental management, including water services, landscape, flood risk planning, protection of designated sites and species, coastal and marine management, climate mitigation and adaptation, and land use change."*

In order to meet legally binding targets agreed at EU level, it is a national objective for Ireland to make a transition and become a competitive low carbon economy by the year 2050. To aid in meeting these targets the National Planning Framework notes that the Government will aim to support the following objectives:

- Integrating climate considerations into statutory plans and guidelines. In order to reduce vulnerability to negative effects and avoid inappropriate forms of development in vulnerable areas.
- More energy efficient development through the location of housing and employment along public transport corridors, where people can choose to use less energy intensive public transport, rather than being dependent on the car.

The NPF highlights that Ireland's national energy policy is focused on three pillars: (1) sustainability, (2) security of supply and (3) competitiveness. Furthermore, it is noted that *"The Government recognise that Ireland must reduce greenhouse gas emissions from the energy sector by at least 80% by 2050, compared to 1990 levels, while at the same time ensuring security of supply of competitive energy sources to our citizens and businesses."* The NPF notes that our transition to a low carbon energy future requires:

- A shift from predominantly fossil fuels to predominantly renewable energy sources.
- Increasing efficiency and upgrades to appliances, buildings and systems.
- Decisions around development and deployment of new technologies relating to areas such as wind, smartgrids, electric vehicles, buildings, ocean energy and bio energy.
- Legal and regulatory frameworks to meet demands and challenges in transitioning to a low carbon society.

The transition towards a low carbon and climate resilient society is identified as one of the national strategic outcomes to guide the implementation of the NPF. **National Policy Objective 55** of the NPF specifically relates to renewable energy, stating it is an objective to:

> *"Promote renewable energy use and generation at appropriate locations within the built and natural environment to meet national objectives towards achieving a low carbon economy by 2050".*

National Strategic Outcome 8-Transition to a Low Carbon and Climate Resilient Society seeks to *"reinforce the distribution and transmission network to facilitate planned growth…"* It aims to *"Deliver 40% of our electricity needs from renewable sources by 2020 with a strategic aim to increase renewable deployment in line with EU targets and national policy objectives out of 2030 and beyond."*

The NPF further emphasises that new energy systems and transmission grids will be necessary for a more distributed, more renewables focused energy generation system to harness the considerable on-shore and off-shore potential from energy sources such as wind, wave and solar and *"connecting the* *richest sources of that energy to the major sources of demand".* The NPF recognises that the development of on-shore and off-shore renewable energy is critically dependent on the development of enabling infrastructure including grid facilities to connect to major sources of energy demand.

The NPF emphasises that the Southern Region will have an important role in promoting a sustainable and renewable energy supply, which is identified as a key future planning and development priority. It notes that,

> *"harnessing the potential of the regions in renewable energy terms across the technology spectrum from wind and solar to biomass and, where applicable, wave energy, focusing in particular on the extensive tracts of publicly owned peat extraction areas in order to enable a managed transition of the local economies of such areas in gaining the economic benefits of greener energy"*

2.4.2 Regional Policy

2.4.2.1 Regional Spatial and Economic Strategy for the Southern Region

The Regional Spatial and Economic Strategy (RSES) for the Southern Region came into effect on 31st January 2020. The RSES seeks to achieve balanced regional development and full implementation of Project Ireland 2040 – the National Planning Framework. It will be implemented in partnership with local authorities and state agencies to deliver on this vision and build a cohesive and sustainable region. The RSES sets out a vision for the Southern Region to:

- Nurture all our places to realise their full potential
- Protect, and enhance our environment
- Successfully combat climate change
- Achieve economic prosperity and improved quality of life for all our citizens
- Accommodate expanded growth and development in suitable locations
- Make the Southern Region one of Europe's most creative, innovative, greenest and liveable regions

The RSES provides the framework through which the NPF's vision and the related Government policies and objectives will be delivered for the region.

With regards to climate change the RSES notes that:

> *"Climate Change represents the most serious threat to human life and the environment. If action is not taken on a global scale, global warming will continue to change weather patterns, cause sea levels to rise, threaten the future of entire nations and pose wider risks in terms of degradation of biodiversity, and threaten the planet's ability to provide adequate food and shelter for the human population."*

As noted and recognised by the RSES, Ireland and the EU are signatories to the Paris Agreement, a legally binding international agreement to restrict global temperature rises to below 2°C above pre-industrial levels, and to limit any increase to 1.5°C to significantly reduce the risks and impacts of climate change. It is further noted that *'Ireland's international commitments also extend to the UN's Sustainable Development Goal 13, to 'take action to combat climate change and its impacts."*

Chapter 5 of the RSES notes detail's the regions plans and objectives with regards to the environment. The RSES underlines the need to:

"Safeguard and enhance our environment through sustainable development, transitioning to a low carbon and climate resilient society."

The observed and predicted climate changes for Ireland include the following:

- An increase in average temperatures of 0.8% between 1900 and 2011 with projected increases across all seasons 0.9% -1.7% to 2050;
- Observed increases in rainfall with projected reductions in average levels for 3 seasons, but a substantial increase in frequency of heavy precipitation events;
- A projected increase in the number and intensity of storms in the North Atlantic;
- Sea levels rising at approximately 3.5cm per decade, continuing to rise up to 0.8m per decade;
- An increase in sea surface temperatures by 0.7C since 1850 with a projected warming of 1.9c by the end of the century.

The following objectives have been listed with regards to the decarbonisation of energy:

- **RPO 87- Low Carbon Energy Future**
  The RSES is committed to the implementation of the Government's policy under Ireland's Transition to a Low Carbon Energy Future 2015-30 and Climate Action Plan 2019. It is an objective to promote change across business, public and residential sectors to achieve reduced GHG emissions in accordance with current and future national targets, improve energy efficiency and increase the use of renewable energy sources across the key sectors of electricity supply, heating, transport and agriculture.
- **RPO 88- National Mitigation and National Adaption Framework**
  The RSES is committed to the implementation of the National Mitigation Plan and National Adaptation Framework: Planning for a Climate Resilient Ireland to enable the Region transition to a low carbon, climate resilient and environmentally sustainable economy. It is an objective to ensure effective co-ordination of climate action with the Climate Action Regional Offices and local authorities to implement the National Mitigation Plan and the National Adaptation Framework in the development and implementation of long-term solutions and extensive adaptation measures.

Further, the following objectives have been put in place with regards to climate resilience:

- **RPO 89- Building Resilience to Climate Change**
  a) It is an objective to support measures to build resilience to climate change throughout the Region to address impact reduction, adaptive capacity, awareness raising, providing for nature-based solutions and emergency planning;
  b) Local Authorities and other public agencies shall continue to work with the Office of Public Works to implement the Flood Risk Management Plans and address existing and potential future flood risks arising from coastal, fluvial, pluvial, groundwater and potential sources of flood risk.

In relation to wind energy the RSES recognises and supports the many opportunities for onshore wind as a major source of renewable energy. It is noted that *'opportunities for both commercial and community wind energy projects should be harnessed, having regard to the requirements of DoHPLG Guidelines on Wind Energy'*. It is recognised that wind energy, with current and future developments in technology, has an important role in delivering value and clean electricity for Ireland.

The following policies relating to wind energy development have been included in the RSES:

- **RPO 95- Sustainable Renewable Energy Generation**
  It is an objective to support implementation of the National Renewable Energy Action Plan (NREAP), and the Offshore Renewable Energy Plan and the implementation of

mitigation measures outlined in their respective SEA and AA and leverage the Region as a leader and innovator in sustainable renewable energy generation.

- **RPO 96- Integrating Renewable Energy Sources**
  It is an objective to support the sustainable development, maintenance and upgrading of electricity and gas network grid infrastructure to integrate a renewable energy sources and ensure our national and regional energy system remains safe, secure and ready to meet increased demand as the regional economy grows.
- **RPO 97- Power Stations and Renewable Energy**
  It is an objective to support the sustainable technology upgrading and conversion of power stations in the Region to increase capacity for use of energy efficient and renewable energy sources.
- **RPO 98- Regional Renewable Energy Strategy**
  It is an objective to support the development of a Regional Renewable Energy Strategy with relevant stakeholders.
- **RPO 99- Renewable Wind Energy**
  It is an objective to support the sustainable development of renewable wind energy (on shore and off shore) at appropriate locations and related grid infrastructure in the Region in compliance with national Wind Energy Guidelines.
- **RPO 100- Indigenous Renewable Energy Production and Grid Injection**
  It is an objective to support the integration of indigenous renewable energy production and grid injection.

The RSES sets out a number of infrastructural RPOs, relevant to the proposed development proposals which indicate that the Region is open to, and ready to invest in, renewable energy generation:

- **RPO 219 New Energy Infrastructure:** It is an objective to support the sustainable reinforcement and provision of new energy infrastructure by infrastructure providers (subject to appropriate environmental assessment and the planning process) to ensure the energy needs of future population and economic expansion within designated growth areas and across the Region can be delivered in a sustainable and timely manner and that capacity is available at local and regional scale to meet future needs.

- **RPO 221 Renewable Energy Generation and Transmission Network-** A) Local Authority City and County Development Plans shall support the sustainable development of renewable energy generation and demand centres such as data centres which can be serviced with a renewable energy source (subject to appropriate environmental assessment and the planning process) to spatially suitable locations to ensure efficient use of the existing transmission network.

- **RPO 222 Electricity Infrastructure:** It is an objective to support the development of a safe, secure and reliable supply of electricity and to support and facilitate the development of enhanced electricity networks and facilitate new transmission infrastructure projects that might be brought forward in the lifetime of this plan under EirGrid's (2017) Grid Development Strategy (subject to appropriate environmental assessment and the planning process) to serve the existing and future needs of the Region and strengthen all-island energy infrastructure and interconnection capacity.

The RSES supports the Southern Region as a Carbon Neutral Energy Region. This policy instrument, if implemented correctly, could assist in facilitating a more consistent approach to renewable energy / wind strategies at the county level. At present, the RSES notes that the Region has more renewable energy generation than demand which indicates a strategic role for the region's energy assets in national energy generation and transmission. With projected increases in population and economic growth, the demand for energy is set to increase in the coming years. In the context of transitioning to a more energy efficient society and increasing renewable sources of energy, the RSES notes that there is a need to set a policy approach which addresses meeting national targets for renewable electricity generation, climate change and security of energy supplies, both regionally and nationally.

2.4.3 Local Policy

2.4.3.1 Kerry County Development Plan 2015-2021

The Kerry County Development Plan 2015-2021 (KCDP) incorporates the aims, objectives, policies and guidelines to provide for the proper planning and sustainable development of County Kerry. The (KCDP) is a spatial planning framework that gives effect to the delivery of sustainable and planned economic and social development in a manner consistent with higher level plans and strategies.

The following are key objectives provisions of the KCDP in relation to renewable energy relevant to the proposed development.

- EP-1:
  "Support and facilitate the sustainable provision of a reliable energy supply in the County, with emphasis on increasing energy supplies derived from renewable resources whilst seeking to protect and maintain biodiversity, archaeological and built heritage, the landscape and residential amenity."
- EP-2
  "Promote energy conservation through reduced consumption and incorporating renewable energy technology into building design standards."
- EP-3:
  "Facilitate sustainable energy infrastructure provision, so as to provide for the further physical and economic development of the County."
- EP-7:
  "Facilitate the sustainable development of additional electricity generation capacity throughout the region/county and to support the sustainable expansion of the network. National grid expansion is important in terms of ensuring adequacy of regional connectivity as well as facilitating the development and connectivity of sustainable renewable energy resources."

The KCDP also acknowledges that the renewable energy sector is expanding rapidly and is a growing source of employment and investment. To facilitate the sustainable growth of renewable energies Kerry County Council prepared and adopted a Renewable Energy Strategy in 2012, the KCDP states the following in relation to the Renewable Energy Strategy 2012.

> *"This strategy sets out the development criteria, development management standards and objectives for the development of renewable energy in the County and will be used in the assessment of all planning applications for such development."*

Furthermore objective EP-11 and EP-12 of the KCDP states that it is an objective of the Council to:

- EP-11:
  "Implement the Renewable Energy Strategy for County Kerry (KCC 2012)"

- EP-12
  "Not to permit the development of windfarms in areas designated "open to consideration" in the Tralee and Listowel Municipal Districts until 80% of the turbines with permissions in those areas, on the date of adoption of the Plan, have either been erected or the relevant permission has expired or a combination of both and the cumulative affect of all permitted turbines in the vicinity of the proposal has been fully assessed and monitored."

With regards to the provisions of EP-12 this is further discussed under Section 2.4.3.1.1 below.

2.4.3.1.1 Kerry County Council Renewable Energy Strategy

Kerry County Council adopted its current Renewable Energy Strategy (RES) as the 8th variation of the County Development Plan (2009-2015) on the 5th November, 2012. The planning authority recognises the importance of exploiting renewable energy sources in order to contribute to achieving national targets in relation to reductions in fossil fuel dependency and greenhouse gas emissions. The document recognises wind energy as the most suitable form of renewable energy to meet national targets for the consumption of electricity and continues to support the development of Wind Energy. In doing so, it identifies appropriate locations for the development of wind energy based on environmental, technical, landscape and economic considerations enabling developers to identify appropriate sites for wind energy development.

The RES's lists strategic objectives for the development of the renewable energy sector which include the following:

- **NR 7-21**
  "To maximise the development of all renewable energies at appropriate locations in a manner consistent with the proper planning and sustainable development of the county. This will include requirements and considerations in relation to: landscape; cultural heritage; Natura 2000 sites and the Habitats & Birds Directive; the objectives of the Water Framework Directive; Flood Directive; Sustainable Forestry Management; and Best Practices in the production of energy crops"
- **NR 7-22**
  "To promote the sustainable development of renewable energy types and technologies with the capacity to store energy which can be released at times of peak demand."
- **NR 7-24**
  "To secure the maximum potential for the generation of electricity from wind energy resources that is consistent with proper planning and sustainable development of the county. This will include requirements and considerations in relation to: landscape; cultural heritage; Natura 2000 sites and the Habitats & Birds Directive; the objectives of the Water Framework Directive; Flood Directive; electricity infrastructure; settlement patterns; and wind energy potential."

When identifying key areas for wind development, a methodology of identifying environmental, landscape, technical and economic criteria were developed with a Geographical Information System (GIS). This identified four types of wind deployment zones.

- **Strategic Site Search Area** - A Strategic Area can accommodate tall turbines laid out in relatively large wind farms, within which, wind developments can benefit from economies of scale in both construction and operation. To achieve their potential these areas must be developed in a co-ordinated way. Proposals must consider the possibility of shared infrastructure and the siting of turbines in any development must consider the need to maximise the development potential of the area as a whole.
- **Open to Consideration** - Site searches within these areas will identify sites with wind energy capacity and the environmental and infrastructural capacity to support wind development. They differ from Strategic Areas in that there are fewer suitable sites. It is recommended that during the site search process, developers consult with the Planning Authority. Again the capacity of these areas has limits and the cumulative impact of wind development in these areas will be monitored
- **Areas which currently lack grid infrastructure** - These areas are within, and adjacent to the Dingle, Iveragh and Beara peninsulas. This designation will be kept under review and amended to reflect any development in grid infrastructure.
- **Unsuitable** - These areas have not been identified in the legend of the Wind Deployment Zones Map, however, these are areas that are not considered suitable for wind farm

development due to their overall sensitivity, arising from landscape, ecological, recreational and/or cultural and built heritage reasons and are taken to be the areas of Kerry not identified as being in any of the previously listed areas. The HDA and SEA process has informed the identification of these areas.

Based on Map 7.6 'Renewable Energy Strategy' the proposed development site is located within an area classified as 'Open to Consideration'. The following policies have been listed under the Kerry Wind Energy Strategy in relation to 'Open to Consideration':

- **Objective NR 7-33**
  "Proposals shall demonstrate conformity with existing and approved wind farms to avoid visual clutter and how they have taken regard of potential cumulative effects, where appropriate."
- **Objective NR 7-34**
  "Projects shall be designed and developed in line with the Wind Energy Development Guidelines, Guidelines for Planning Authorities (DoEHLG, 2006) and any update of these guidelines in terms of siting, layout and environmental studies. Any proposed development of on-shore wind adjacent to Natura 2000 sites will have to ensure a suitable buffer zone exists between the development and the Natura 2000 boundary. The Stacks to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (Site Code 004161) will require a buffer zone of at least 250m between the SPA boundary and operating wind turbines."
- **Objective NR 7-35**
  "Applications shall be accompanied by a Natura Impact Statement under Article 6 of the Habitats Directive if the site is located in close proximity to a (candidate) Special Area of Conservation or Special Protection Area or if the site is within the catchment of a (candidate) Special Area of Conservation. Only proposals where a Habitats Directive Article 6 Assessment concludes that there will be no adverse effects on the integrity of Natura 2000 sites shall be permitted."
- **Objective NR 7-36**
  "All applications must comply with the objectives and development standards of this strategy and the provisions of the Kerry county Development Plan 2009-2015. This will include requirements and considerations in relation to: landscape; cultural heritage; Natura 2000 sites and the Habitats & Birds Directive; the objectives of the Water Framework Directive; Flood Directive; electricity infrastructure; settlement patterns; and wind energy potential."
- **Objective NR 7-37**
  "Applications for wind development shall be accompanied by a technical assessment in relation to the slope stability, landslide susceptibility of the development site and the proposed project. This assessment shall incorporate slope stability mapping and groundcover assessment in the context of potential cumulative effects arising from multiple developments and consider potential impacts on slope stability in relation to climate change impacts, particularly flash floods and changing weather conditions."

The following is another key objective in the RES that is of particular relevance to the proposed development:

- **NR-7**
  "Powerlines - Ensure that in sensitive landscapes powerlines connecting windfarms to the national grid will be required to be laid underground, as considered appropriate by the Planning Authority, insofar as such infrastructure will not significantly affect European sites and is in compliance with the objectives of this plan and relevant legislation."

The above provision has also been brought into the KCDP through objective EP-8 which states that it is an objective of the Council to:

- **EP-8**
  "Ensure that the siting of electricity power lines is managed in terms of the physical and visual impact of these lines on both the natural and built environment, the conservation value of Natura 2000 sites and especially in sensitive landscape areas. When considering the siting of powerlines in these areas the main technical alternatives considered should be set out, with particular emphasis on the undergrounding of lines, and the identification of alternative routes at appropriate locations. It should be demonstrated that the development will not have significant, permanent, adverse effects on the environment including sensitive landscape areas and the ecological integrity of Natura 2000 sites."

In relation to the above provision of the KCDP the EIAR for this project will consider all potential impacts arising from 2 different underground electric cable routes to connect the proposed development to the national grid.

2.4.3.1.2 Objective EP-12

In relation to Objective EP-12 reference must be made to the consideration of An Bord Pleanála in relation to its consideration of the Ballylongford Wind Farm applications (initial application, Pl. Ref. 17/902, ABP -3006368-17 refused by both the Planning Authority and the Board, and the second application Pl. Ref. 19/381, ABP-304807-19 refused by the Planning Authority and granted permission by the Board).

Under this application it has been noted and accepted by both the Board and the Planning Authority that the threshold established under SP-12 (i.e. 80% of turbines being constructed or permissions expired) has been reached. The principle of the 80% threshold being satisfied was accepted during the consideration of the 2019 applications by the Board. Under the consideration of EP-12 in ABP-3006368-17 the Boards inspector states the following in his report dated October 2018:

> *"Under Objective EP-11, the current CDP undertakes to continue to implement the Renewable Energy Strategy for County Kerry (RESCK), which was adopted in 2012. Under Map 7.6 of the RESCK, wind deployment zones are shown, i.e. Strategic Site Search Areas, Open-to-Consideration, and Unsuitable. The application site lies within an Open-to-Consideration wind deployment zone. Objectives NR 7-33 to 37 are applicable, across the County, to wind farm proposals within this zone. Additionally, Objective EP-12 of the CDP is applicable to such proposals within the Tralee and Listowel Municipal Districts. .... A Table on Page13 of the said* [applicant's First Party] *grounds* [of appeal] *sets out details of the 2 permissions that had been granted when the current CDP was adopted. Of the 18 wind turbines thereby permitted, 16 are in situ, a figure that represents 89% of the total, which is excess of the relevant 80% threshold......*
>
> *...... I consider that the reasonableness of this Objective may be open to question. Thus, in its essence, it is in danger of requiring either a SEA type exercise that would accompany a review of the CDP/LAP or a re-run of cumulative assessments that would normally form part of the assessment of individual applications for wind farms and the basis for the selection of the threshold cited is unclear. ....*
>
> *........ I conclude that from the evidence before me, it is not clear that the proposal would contravene Objective EP-12 of the CDP ..."*

In the subsequent application for the Ballylongford Wind Farm (PL. Ref. 19/381, ABP-304807-19), Kerry County Council's planning report acknowledges that the 80% figure has been reached, and states the following in relation to EP-12

> *"It has now been established that this 80% figure has been reached ...."*

While the planner's report proceeds to recommend that permission be refused for the proposed development, the basis of the Planning Authority's concern in relation to EP-12 for the Ballylongford wind farm was centred on the second part of the policy relating to the need for cumulative assessment of the project in the context of other permitted and operational wind turbines in the vicinity.

In the An Bord Pleanála inspector's report (dated November 2019) in relation to the appeal on the 2019 application (ABP-304807-19), the following is noted in regard to policy EP-12 (Sections 8.4 and 8.41 of the Inspectors Report refers):

> *"I note the Planning Authority's first reason for refusal, namely that the proposed development contravenes Objective EP-12 of the County Development Plan. As noted above, this objective seeks to permit development in open for consideration zones in the Tralee and Listowel Municipal Districts, only where "80% of the turbines with permissions in those areas.....have either been erected or the relevant permission has expired or a combination of both and the cumulative effect of all permitted turbines [in the vicinity of the proposal has been fully assessed and monitored."].*
>
> *The Planning Authority's planning report states that it has been established that the 80% threshold has been reached but that the cumulative effect has not been assessed. I am satisfied that the comprehensive assessment of cumulative impacts in the EIAR adequately satisfies the requirements of policy EP12."*

Accordingly it has been established and accepted by both An Bord Pleanála and Kerry County Council, that 80% of the turbines with permissions on the date of the adoption of the plan in the "open to consideration" areas within the Tralee and Listowel Municipal Districts have either been erected or the relevant permission has expired. Similar to the above this EIAR presents a robust and comprehensive review of potential cumulative impacts that could arise between the proposed development and all consented and extant turbines in the area. Accordingly, the proposed development complies in full with the provisions of EP-12.

2.4.3.2 Landscape Policy

Sections 12.1 to 12.3 of the Development Plan contain the objectives and policies of the Plan in relation to landscape and development. Regarding landscape protection, the plan sets out the following objective:

- **Objective ZL 1**
  "Protect the landscape of the county as a major economic asset as well as for its invaluable amenity which contributes to the quality of people's lives."

The plan states that a Landscape Character Assessment is required for the county, which would have three distinct elements:

- Identification and Classification of Landscape Types.
- Landscape Character Areas.
- Landscape Value and Sensitivity to Development.

Kerry County Council has to date not completed its landscape character assessment, but states as an objective:

- **Objective ZL 2**
  "Prepare a Landscape Character Assessment of the County following the publication of the proposed National Landscape Strategy. This assessment will include capacity studies for different forms of development and will involve consultation with adjoining local authorities."

Within the RES, forty-six Landscape Character Areas (LCAs) were identified. All of the proposed turbines are located within LCA 3 - Cashen River.

LCA 3 – Cashen River is categorised as a 'Hilly and Flat Farmland, Coastal' Landscape Character Type. Its overall capacity for wind farm development is as follows:

> *"Capacity in the area, constraints include visual impact on this open landscape and proximity to Natura 2000 site. Flooding may be an issue."*

The RES details the landscape character of LCA-3 Cashen River from two viewpoint locations within the LCA. The viewpoint at Knockercreeveen is in closest proximity to the proposed development site and the description and assessment best represents the landscape character of the proposed development site and the immediate surrounding area. The development capacity for the 'Knockercreeveen' area within the Cashen River LCA local to the proposed development is reported below:

> *"There is a high density of population in parts of the area. An area has been identified as having some capacity for wind development. This area includes lands on either side of the Crompaun River, River Brick, Cashen River and Galey River. The reason this area is considered to have capacity for wind development is that it would have less population than the remainder of the area, and the land is also marginal. The view from the Ferry Bridge is protected in the Kerry County Development Plan 2009-2015, which should be considered as a constraint rather than a barrier to wind development. Given the flat and open nature of the landscape turbine heights in excess of 50-75m would be overly dominant and have an adverse impact on the amenity of the local population. There is the possibility of flooding in the area, which may act as a constraint to wind development. It is therefore zoned as being Open to Consideration."*

No explicit landscape value or sensitivity ratings are detailed in the RES for this area of the LCA, however, no amenity areas, scenic areas or dominant features were identified within the landscape, and the area is not regarded as a landscape of national importance.

The Development Plan recognises that the sensitivity of a landscape is a measure of its ability to accommodate change or intervention without suffering unacceptable effects to its character. On this basis, the KCDP sets out the following policy in regard to zoning of lands in rural areas:

- **Objective: ZL-3**
  Determine the zoning of lands in rural areas having regard to the sensitivity of the landscape as well as its capacity to absorb further development.

There are three categories of rural area zoning designations; Rural Prime Special Amenity, Rural Secondary Special Amenity and Rural General, as indicated in Maps 12.1 (a) to 12.1 (u) of the KCDP (Volume 3). A description of the two most sensitive zoning types as defined by the KCDP and their capacity for accommodating new development in consideration of landscape sensitivity and value are reported below:

> *Rural Prime Special Amenity: "are those landscapes which are very sensitive and have little or no capacity to accommodate development. In these areas all development will be prohibited, other than normally exempted development in accordance with Section 4, Planning and Development Act 2000-14, Schedule 2 of the Planning & Development Regulations 2001-2013 and Chapter 3.3.2, which will be open to consideration, subject to satisfactory integration into the landscape and compliance with the proper planning and sustainable development in the area."*

Rural Secondary Special Amenity: "The landscape of areas in this designation is sensitive to development. Accordingly, development in these areas must be designed so as to minimise the effect on the landscape. Proposed developments should, in their designs, take account of the topography, vegetation, existing boundaries and features of the area, as set out in the Building a House in Rural Kerry Design Guidelines (Kerry County Council 2009). Permission will not be granted for development which cannot be integrated into its surroundings. Development will only be permitted where it is in accordance with the provisions of Chapter 3.3.2."

The proposed development is not located in an area of Rural Primary Special Amenity or Rural Secondary Special Amenity.

2.4.3.3 Summary Conclusion on Compliance with Development Plan

In summary the County Development Plan fully recognises the importance of combating climate change and deriving more energy from renewable sources. It is the intention of Kerry County Council to support and facilitate the sustainable provision of a reliable energy supply in the County, with emphasis on increasing energy supplies derived from renewable resources. It is acknowledged that the renewable energy sector is expanding rapidly and is a growing source of employment and investment. As noted in the above section the proposed development is located within an area which under the County Development Plan is classified as 'Open to Consideration'. Furthermore, there is a range of policy in place which supports the development of renewable energy. The Biodiversity and Landscape sections of this EIAR demonstrate that the proposal will not give rise to significant adverse impacts on natural heritage, landscape or visual amenity. The Noise and Shadow Flicker assessments also show that the proposed development will not give rise to significant adverse impacts on residential amenity. Accordingly the proposed development is compliant with the relevant provisions of the Kerry County Development Plan 2015-2021.

2.4.4 Other Relevant Guidelines

2.4.4.1 DoEHLG Wind Energy Guidelines 2006

In June 2006, the then Department of Environment, Heritage and Local Government (DoEHLG) published '*Wind Energy Development Guidelines for Planning Authorities'* (the Guidelines) under Section 28 of the Planning and Development Act, 2000. The aim of these guidelines was to assist the proper planning of wind power projects in appropriate locations around Ireland. The Guidelines highlight general considerations in the assessment of all planning applications for wind energy. They set out advice to planning authorities on planning for wind energy through the development plan process and in determining applications for planning permission. They contain guidelines to ensure consistency of approach throughout the country in the identification of suitable locations for wind energy development.

Each wind project has its own characteristics and defining features, and it is therefore impossible to write specifications for universal use. Guidelines should be applied practically and do not replace existing national energy, environmental and planning policy. The Department of the Environment, Community and Local Government published proposed revisions to the guidelines in December 2013 as part of a targeted review relating to Noise, Proximity and Shadow Flicker for discussion. The Department is continuing this review and Draft Revised Guidelines were published in December 2019.

As demonstrated in the following chapters of this EIAR, the installation and operation of Ballynagare Wind Farm will not result in any significant effects on shadow flicker, noise, visual impact/landscape, traffic and transport, ecology, population/human health, water, soils or cultural heritage. The turbines and their associated ancillary infrastructure will be constructed and operated with an appropriate suite of mitigation measures and will not have a significant adverse impact on the environment.

2.4.4.2 Interim Guidelines for Planning Authorities on Statutory Plans, Renewable Energy and Climate Change 2017

In July 2017, the Department of Housing, Planning, Community and Local Government (DoHPCLG) published '*Interim Guidelines for Planning Authorities on Statutory Plans, Renewable Energy and Climate Change'* under Section 28 of the Planning and Development Act 2000. Planning authorities are obliged to have regard to guidelines issued pursuant to Section 28 in the performance of their functions under the Planning and Development Act 2000 (as amended).

The Guidelines state that it is a specific planning policy requirement under Section 28(1C) of the Act that, in making a development plan with policies or objectives that relate to wind energy developments, a Planning Authority must:

1. *"Ensure that overall national policy on renewable energy as contained in documents such as the Government's 'White Paper on Energy Policy - Ireland's Transition to a Low Carbon Future', as well as the 'National Renewable Energy Action Plan', the 'Strategy for Renewable Energy' and the 'National Mitigation Plan', is acknowledged and documented in the relevant development plan or local area plan;*
2. *Indicate how the implementation of the relevant development plan or local area plan over its effective period will contribute to realising overall national targets on renewable energy and climate change mitigation, and in particular wind energy production and the potential wind energy resource (in megawatts); and*
3. *Demonstrate detailed compliance with item number (2) above in any proposal by them to introduce or vary a mandatory setback distance or distances for wind turbines from specified land uses or classes of land use into their development plan or local area plan. Such a proposal shall be subject to environmental assessment requirements, for example under the SEA and Habitats Directives. It shall also be a material consideration in SEA, when taking into account likely significant effects on climatic factors, in addition to other factors such as landscape and air, if a mandatory setback or variation to a mandatory setback proposed by a planning authority in a development plan or local area plan would create a significant limitation or constraint on renewable energy projects, including wind turbines, within the administrative area of the plan."*

2.4.4.3 Department Circular PL5/2017

On the 3rd of August 2017, the Department of Housing, Planning and Local Government issued Circular PL5/2017 to provide an update on the review of the wind energy and renewable policies in development plans, and the advice contained within a previous Departmental Circular PL20-13. Circular PL20-13 advised that local authorities should defer amending their existing Development Plan policies in relation to wind energy and renewable energy generally as part of either the normal cyclical six-yearly review or plan variation processes and should instead operate their existing development plan policies and objectives until the completion of a focused review of the Wind Energy Development Guidelines 2006. The new circular (PL05/2017) reconfirms that this continues to be the advice of the Department.

The Department circular also sets out the four key aspects of the preferred draft approach being developed to address the key aspects of the review of the 2006 Wind Energy guidelines as follows:

- The application of a more stringent noise limit, consistent with World Health Organisation noise standards, in tandem with a new robust noise monitoring regime, to ensure compliance with noise standards;
- A visual amenity setback of 4 times the turbine height between a wind turbine and the nearest residential property, subject to a mandatory minimum distance of 500 metres between a wind turbine and the nearest residential property;
- The elimination of shadow flicker; and

- The introduction of new obligations in relation to engagement with local communities by wind farm developers along with the provision of community benefit measures.

2.4.4.4 IWEA Best Practice Guidelines for the Irish Wind Energy Industry 2012

The Irish Wind Energy Association (IWEA) published updated Wind Energy Best Practice Guidelines for the Irish Wind Industry in 2012. The guidelines aim to encourage and define best practice development in the wind energy industry, acting as a reference document and guide to the main issues relating to wind energy developments. The purpose of the guidelines is to encourage responsible and sensitive wind energy development, which takes into consideration the concerns of local communities, planners, and other interested groups. The guidelines outline the main aspects of wind energy development with emphasis on responsible and sustainable design and environmental practices, on aspects of development which affect external stakeholders, and on good community engagement practices. In approaching the development of IWEA's guidelines the aim was to be complementary to the Department of the Environment Heritage and Local Government's 'Wind Energy Development Guidelines' (2006).

2.4.4.5 IWEA Best Practice Principles in Community Engagement 2013

Following on from the IWEA Best Practice Guidelines in March 2012, the Association extended its guidance with the publication of this Best Practice in Community Engagement and Commitment. IWEA and its members support the provision of financial contributions by wind farm operators to local communities and have sought to formulate best practice principles for the provision of a community commitment. The document sets out IWEA's best practice principles for delivering extended benefits to local communities for wind farm developments of 5 Megawatts (MW) or above. Best Practice Principles of community engagement when planning the engagement strategy and preparing associated literature are also outlined in the document. The aim of these guidelines is to ensure that the views of local communities are taken into account at all stages of a development and that local communities can share in the benefits.

Further details on the community engagement that has been undertaken as part of the proposed development are presented in Section 2.6.3 below.

2.4.4.6 Code of Practice for Wind Energy Development in Ireland-Guidelines for Community Engagement 2016

In December 2016, the Department of Communications, Climate Action and Environment (DCCAE) issued a Code of Practice for wind energy development in relation to community engagement. The Code of Good Practice is intended to ensure that wind energy development in Ireland is undertaken in adherence with the best industry practices, and with the full engagement of local communities. Community engagement is required through the different stages of a project, from the initial scoping, feasibility and concept stages, right through construction to the operational phase. The methods of engagement should reflect the nature of the project and the potential level of impact that it could have on a community. The guidelines advise that ignoring or poorly managing community concerns can have long-term negative impacts on a community's economic, environmental or social situation. Not involving communities in the project development process has the potential to impose costly time and financial delays for projects, or prevent the realisation of projects in their entirety. Community engagement in relation to the proposed development is discussed in full in Section 2.9 below.

2.4.4.7 Commission for Regulation of Utilities: Grid Connection Policy 2018

The Commission for Regulation of Utilities (CRU) (previously the Commission for Energy Regulation (CER)) launched a new grid connection policy in March 2018 for renewable and other generators, known as ECP-1, which seeks to allow *"shovel ready"* projects that already have a valid planning permission, connect to the electricity networks. The principal objective which guides this decision is to allow those projects to have an opportunity to connect to the network, along with laying the foundations for future, more regular batches for connection. Applicants for new connection capacity under ECP-1 was published in August 2019 and under ECP-2 published in September 2020. Round ECP-2.2 is due to be published in September 2021, and ECP-2.3 in September 2022.

The enduring connection policy regime replaces the previous 'Gate' system of grid connection applications. The grid connection application window under ECP-1 was the first time since 2007 that certain renewable energy projects including wind farms had an opportunity to secure a new grid connection offer.

With the ECP2 ruleset now published and with a timeline set for the next three rounds of applications there is a clear pathway for the Project to secure a grid connection in a timely manner, subject to receipt of planning permission.

2.4.4.8 Renewable Energy Support Scheme (RESS)

The Climate Action Plan, published in June 2019, is the Government's plan to give Irish people a cleaner, safer and more sustainable future. The Plan sets out actions across every sector which will ensure we meet our future climate commitments. A key part of the Plan is a move to 70% renewable electricity by 2030, a measure which will be driven by the introduction of the Renewable Electricity Support Scheme ('RESS').

The RESS is an auction-based scheme which invites renewable electricity projects to bid for capacity and receive a guaranteed price for the electricity they generate. Terms and Conditions for the first competition (RESS 1:2020) was published in February 2020 and will provide support to renewable electricity projects in Ireland. It is intended that the RESS will deliver, amongst other policy objectives:

> *"An ambitious renewable electricity policy to 2030 increasing energy security, energy sustainability and ensuring the cost effectiveness of energy policy."*

The Auction Scheme and the ECP framework has now been established and is operational and will facilitate and provide a pathway to realise the renewable electricity (RES-E) ambition of up to 70% by 2030, that has been established.

2.4.4.9 Draft Guidelines

2.4.4.9.1 *DoEHLG Wind Energy Guidelines 2006 (Revisions)*

Further to Section 2.3.5.2 it should be acknowledged that the Department of the Environment, Community and Local Government published proposed revisions to the guidelines in December 2013 as part of a targeted review relating to Noise, Proximity and Shadow Flicker for discussion. Revisions to the Wind Energy Guidelines continue to be considered and draft revisions were published in December 2019, these are further discussed below.

2.4.4.9.2 *Draft Revised Wind Energy Development Guidelines, December 2019*

The Department of Housing, Planning and Local Government published the *Draft Wind Energy Guidelines* (referred to as the Draft Revised Guidelines) in December 2019 and these Draft Guidelines were under public consultation until 19th February 2020. Following the previous 2013 consultation and subsequent detailed engagement between the relevant Government Departments, a "preferred draft approach" to inform and advance the conclusion of the review of the 2006 guidelines was announced in June 2017.

In line with the previously stated "preferred draft approach", the 2019 Draft Guidelines primarily focus on addressing a number of key aspects including, but not limited to:

- Acceptable noise thresholds and monitoring frameworks;
- Visual amenity setback and spacing;
- Control of shadow flicker;
- Compliance with Community consultation and dividend requirements, as included within the obligatory Community Report; and
- Consideration of the siting, route and design of the proposed grid connection as part of the whole project.

The design of the proposed project has taken account of the "preferred draft approach" as articulated by the Department in June 2017, and accordingly, has been developed with the provisions of the current Draft Guidelines in mind. At the time of writing the revised wind energy development guidelines have yet to be published as a final document and have yet to be adopted.

It is therefore not known what the final version of the updated Guidelines will be, and the relevant guidelines remain those published in 2006. Notwithstanding this, however, where possible the Draft Guidelines have been used to inform the design of the Proposed Development. In this regard it should be noted that no turbine is proposed within 4-times tip height of any third party dwelling, furthermore both potential shadow flicker and noise impacts have been assessed in detail within this EIAR, and both these phenomena can be controlled through the operational stages to ensure compliance with any relevant standards.

2.5 Planning History

This Section of the EIAR sets out the relevant planning history of the proposed development site, planning applications in the vicinity of the site and other wind energy applications within the wider area. For the purposes of reviewing and stating the relevant planning history for this project the following methodology/criteria has been adopted:

1. All planning applications which overlap or are within the red line planning application boundary of the current Proposed Development have been identified (listed in Table 2-1 below).
2. A buffer zone of 20 kilometres was established from the site of the Proposed Development in order to identify other wind farm sites in the wider area. For the purposes of this EIAR the planning history was extended to this wide range for wind farm developments due to the nature of the projects, potential for visual and cumulative affects to arise with the Proposed Development.
3. Non-wind energy related planning applications within 2km of the application site are set out in **Appendix 2-1** of this chapter of the EIAR.
4. Finally, planning applications within a 200m radius of the preferred grid connection route are set out in **Appendix 2-2** of this chapter of the EIAR.

2.5.1 Applications within the Site

Planning applications which are recorded as being within the application redline boundary are set out in Table 2-1 below.

Table 2-1: Applications within the Application Site

Pl.Ref	Description	Decision
94/1484	Erect a dormer dwelling	Granted by KCC 03/02/1995
05/1608	2 no. dwellings, septic tanks and percolation areas	Granted by KCC 21/10/2005
05/2036	Build a house and domestic garage/storage area together with all associated site works	Granted by KCC 12/09/2005
05/3509	Build a house and domestic garage / store area together with all associated site works.	Granted by KCC 24/01/2006
06/264	Build a storey and a half dwelling house and domestic garage and to install a septic tank and percolation area on our site	Granted by KCC 09/10/2006
06/550	Construct a storey and a half style dwelling house, septic tank and percolation area and separate garage and all associated site works	Granted by KCC 31/07/2006
07/879	1) construct an easy feed wintering unit for live stock incorporating underground slurry tanks and ancillary concrete. (2) construct a milking parlour and dairy complex wit ancillary concrete. (3) demolish 2 no. existing slurry pits on my lands	Granted by KCC 01/06/2007
08/1431	Permission consequent on the grant of outline permission to build a dwelling house with septic tank and percolation area on our site (planning ref no. 05/1608)	Granted by KCC 10/09/2008

2.5.2 Wind Energy Applications Within 20km Site Radius

The planning history of other relevant wind farm developments in the general vicinity of the Proposed Development are listed below, where there are ancillary applications related to renewable energy, details of these have also been provided in the interests of completeness. The wind farm development applications listed below are all within a 20-kilometre radius of the site of the current proposal.

Table 2-2 Wind Energy Applications within 20km of the Development Site

Pl.Ref	Description	Decision and status
Ballylongford Wind Farm		
17/902	Construct a windfarm consisting of 8 wind turbines, battery units, and all associated works.	Refused by KCC Refused by An Bord Pleanála (300368-17) 08/01/2019
19/381	Construct a windfarm consisting of six wind turbines include battery units, and all associated works.	Refused by KCC Granted by An Bord Pleanála (304807-19) 06/01/2020 Not constructed.
Shronowen Wind Farm		
SID 08.309156	12 wind turbines, substation, grid connection and ancillary site works.	New Application
Tullahennel Wind Farm (made up of Tullahennel South, Tullahennel North and Larha wind farm)		
08/2086	Construct a wind farm of two wind turbines, and all associated works.	Granted by KCC 11/05/2009 2 turbines constructed.
08/2500	Erect an electricity generating windfarm consisting of two (2) wind turbines of hub height and all associated works	Granted by KCC 29/09/2009 2 turbines constructed.
09/1175	Construct a wind farm consisting of 9 no. wind turbines, control building, access roads, electrical sub-station, anemometer and ancillary works	Granted by KCC 04/05/2010 9 turbines constructed.
15/679	Modify the operational period of the permitted wind farm under planning reg. no. 08/2500 from a period of 10 years to a period of 25 years	Granted by KCC 28/10/2015

Pl.Ref	Description	Decision and status
15/725	Modification of 20-year operational period of wind farm permitted under 09/1175 to 25 years	Refused by KCC 12/10/2015
17/1146	Extend the operational life of the existing wind farm from 20 to 25 years. the permission relates to the continuance of use of the existing wind farm granted under planning ref 09/1175 and 15/725 for a further period of five years.	Granted by KCC 22/02/2018
Tylagh Wind Farm		
02/2123	Erect a windfarm consisting of 4no. wind turbines, a meteorological mast, associated access road and control building.	Granted 21/11/2003 4 turbines constructed.
02/92123	Extension of duration for 02/2123.	Granted 10th November 2008 4 no turbines constructed
12/169	Construct two (2 no.) wind turbines extension (maximum hub height of 55.6 metres, maximum rotor blade diameter of 48 metres, maximum blade tip height of 79.6 metres) and all associated works.	Granted by KCC Granted by ABP on appeal (08.241171) 01/05/2013 No turbines constructed.
Ballincollig Hill		
02/3135	Construct a wind farm consisting of 15 wind turbines (50m hub height and 52m blade diameter, with a total height not exceeding 76m).	Granted by KCC Granted by ABP (08.204645) 18/06/2004 8 turbines constructed.
02/93135	Extension of duration for 02/3135.	Granted by KCC 08/06/2009
Stacks Mountain		
03/1749	Four no. wind turbine generators, meteorological tower, one control building, a control building compound and associated access roads.	Granted by KCC 09/01/2004 4 turbines constructed.
03/91749	Extension of duration for 03/1749.	Granted by KCC 08/01/2009
Knocknagoum/Maghanknockane		
03/886	Construction of a wind farm consisting of 7no.2 mw turbines (78 meters hub height and 80 meters rotor blade diameter).	Granted by KCC 24/02/2004 Not constructed
03/2676	Construct a wind farm consisting of 6 no. 2mw turbines (78metres hub height and 80 metres rotor blade diameter).	Granted by KCC 28/07/2004 Not constructed
03/9886	Extension of duration for 03/886.	Granted by KCC 07/04/2009
03/92676	Extension of duration for 03/2676	Granted by KCC 17/09/2009
10/874	Construction of 9 turbines and ancillary works	Granted by KCC 05/07/2011 Not constructed
11/912	Construct a wind farm consisting of 15 turbines and ancillary works	Granted by KCC 06/06/2012 15 turbines constructed.
Beennageeha		
98/487	A wind farm comprising of 6 turbines and ancillary works	Granted by KCC 26/04/2016 Operational
Pallas/Clahane Wind Farm		
01/2720	To construct a windfarm comprising of 26 turbines and ancillary works	Granted by KCC Granted by An Bord Pleanála (08.130918) 17/04/2003

Pl.Ref	Description	Decision and status
		26 turbines constructed.
01/92720	Extension of duration for 01/2720	Granted by KCC 22/02/2008.
01/82720	Second extension of duration to a wind farm granted under Pl. Ref: 01/2720	Granted by KCC 21/06/2013
08/471	Construct a wind turbine with a hub height of 65 metres and a rotor diameter of 72 metres, connecting road and all associated ancillaries.	Granted by KCC 28/05/2008
08/1461	Construct three no. wind turbines with a hub height of 65 metres and a rotor diameter of 72 metres, connecting roads and all associated ancillary site works	Granted by KCC 22/05/2009
11/571	Relocate proposed wind turbine to new location, 127 metres west (planning reg. no. 08/471)	Granted by KCC 19/01/2012
Beale Hill		
97/2365	Construct a wind-farm incorporating a) 7 turbines, b) a control house, c) an anemometer station, d) service road	Granted by KCC 19/10/1998 6 turbines constructed.
99/30	Change turbine no. 7 to a 1.65 megawatt wind turbine from that granted under previous planning	Granted by KCC 05/03/1999
04/1065	Erect two vestas v52 wind turbines and construct an extra sub-station on existing wind farm	Granted by KCC 09/06/2004
04/91065	Extension of duration for 04/1065.	Granted by KCC 17/07/2009
09/689	2no. Vestas V52 wind turbines with 55m towers and substation.	Granted by KCC 09/11/2009 2 turbines constructed.
09/9689	Extension of duration for 09/689.	Granted by KCC 17/11/2014
14/163	Erect 2 no. wind turbines (vestas v52) having a maximum ground to blade tip height of 91m (with a tower height of 65m)	Refused 23rd May 2014
Cahercullanagh		
03/1284	To construct a windfarm consisting of 17 turbines and ancillary works	Granted by KCC 17/02/2004 11 turbines constructed
03/91284	Extension of duration for 03/1284.	Granted by KCC 30/03/2009
03/991284	Second extension of duration to the permission granted under Pl. Ref. 03/1284	Granted by KCC 08/10/2012
05/1961	Construct wind farm consisting of 5 turbines vestas v52 and all ancillary works.	Granted by KCC 25/10/2006 Not constructed
05/3286	Construction of a wind farm consisting of 1 turbine vestas v52 (65m hub height, 52 metres rotor blade diameter and a power installed of 0.85mw).	Granted by KCC 31/01/2007 Not constructed
05/991961	Extension of duration for 05/1961	Granted by KCC 25/10/2006
07/595	Construct a wind farm consisting of 2 wind turbines (65mm hub height, 52 metres rotor blade diameter) and ancillary works	Granted by KCC 16/05/2007
07/9595	Extension of duration for 07/595.	Granted by KCC 19/12/2011
Muingnaminane		
01/635	Windfarm with 21 turbines, service roadways, construction of transformer/control housing compound and 50-metre anemometer mast	Granted by KCC Granted by An Bord Pleanála (08.130019) 05/11/2002 18 turbines constructed
01/9635	Extension of duration for 01/635	Granted by KCC 08/01/2008
Wind Farm at Urlea		

Pl.Ref	Description	Decision and status
98/3014	Erect a wind farm consisting of four wind turbines, associated roads and electrical/control buildings.	Refused by KCC Refused by An Bord Pleanála (08.119245) 27/11/2000
Single Turbine at Aghamore North		
15/341	Erect a single electricity generating wind turbine with a hub height of up to 65m and a rotor diameter of up to 55m giving an overall tip height of up to 92.5m and all ancillary works.	Granted by KCC Granted by An Bord Pleanála (08.245921) 07/07/2016 Not constructed
Dromadda Beg		
01/2719	Erect 3 no 1mw wind turbines, service roadways and control house.	Granted by KCC 19/06/2002
01/92719	Extension of duration for 01/2719	Granted by KCC 09/09/2007
01/992719	Extension of duration for 01/2719	Granted by KCC 20/07/2012
13/544	Construction of a wind farm comprising of 3 no. turbines and ancillary work	Granted by KCC Granted by An Bord Pleanála (08.243573) 8/12/2014 Under construction
Dromadda More		
04/2947	Erect 10 no. 2MW wind turbines with a hub height of 82m and a rotor diameter of 82m maximum. 1 no. 60m wind monitoring mast (temporary), associated hardstanding areas, access roadways and control house.	Granted by KCC 11/11/2005
04/92947	Extension of duration for 04/2947.	Granted by KCC 04/10/2010
10/571	Construct 10 no. wind turbine generators with a maximum hub height of 90m, a maximum rotor diameter of 112m and a maximum overall height of 145m, an electrical substation and all associated works.	Granted by KCC 20/05/2011 10 turbines constructed.
10/692	Construction of wind farm comprising 28 turbines with a maximum hub height of 90m, maximum rotor diameter of 90m and maximum overall height of 135m and ancillary works.	Refused by KCC Granted by An Bord Pleanála (08.239473) 11/05/2012
12/623	An extension of one turbine to 10/692	Granted by KCC 22/11/2012 1 turbine constructed
Wind Farm at Knocknacaheragh		
03/562	To construct a wind farm consisting of 2 turbines (67 metres hub height and 80 metres rotor blade diameter) and all ancillary works.	Granted by KCC 22/12/2003 2 turbines constructed.
Moyvane Wind Farm		
11/293	Erect 2 no. 500 kw wind turbines	Refused by KCC 7th June 2011
13/106	Erect 2 no. 500kw wind turbines (hub height 45.00m) and the construction of a 25.00 sq.m. electrical sub-station, site access road and ancillary works	Grant by KCC Grant by An Bord Pleanála (08.242798) 30/04/2014 1 turbine constructed
13/9106	Extension of Duration for 13/106	Granted by KCC 26/03/2019
Beennanaspuck		
14/571	Develop a wind farm, the development will consist of three (3) no. wind turbines (with a maximum height of up to 125m), provision of two (2) no. new site entrances, the provision of new	Granted Granted by An Bord Pleanála (08.245464) 09/09/2015

Pl.Ref	Description	Decision and status
	and upgraded internal site service roads, underground cabling and all associated infrastructure	3 turbines constructed
Kilathmoy-Toberatooreen		
12/431	Develop a wind farm including seven (7) no. wind turbines (with a maximum height of up to 125m), one (1) no. permanent meteorological mast, one (1) no. substation, provision of two (2) no. new site entrances, the provision of new and upgraded internal site service roads, underground cabling and all associated infrastructure, a ten-year planning permission is being sought to construct the development. An Environmental Impact Statement and Natura Impact Statement have been prepared and submitted as part of this application.	Granted by KCC 13/06/2013 Granted by An Bord Pleanála (08.242170) 12/11/2013 4 turbines constructed
Wind Farm located at Curraghderrig		
06/3997	Erect an electricity generating windfarm consisting of two (2) wind turbine generators of hub height 64m and rotor diameter 71m, a control building, 2 car park spaces and associated site roads and site works.	Refused by KCC Granted by An Bord Pleanála (08.221493) 01/10/2007
06/93997	Extension of duration for 06/3997	Granted by KCC 27/11/2012 2 turbines constructed
Wind Farm at Cloghaneleskirt		
02/2011	Erect 5 no. wind turbines, 40m wind monitoring mast (temporary), service roadways and control house.	Refused by KCC 03/10/2002
03/1264	Construct 5 no. 2mw wind turbines 1 no. 60m wind monitoring mast (temporary) service roadways and control house	Granted by KCC 15/12/2003 5 turbines constructed
03/991264	Extension of duration for 03/1264	Granted by KCC 07/10/2015
Tursillagh 1		
97/1865	Construction of a wind farm comprising of 23 turbines and ancillary works	Granted by KCC Granted by An Bord Pelanála (08.105339) 14/07/2998 23 turbines constructed
Tursillagh 2		
01/390	Construction of a wind farm comprising of 8 turbines and ancillary works	Granted by KCC Granted by An Bord Pleanála (08.126623) 09/05/2002 8 turbines constructed
Leanamore		
11/299	Erect (9) no. wind turbines with a maximum height of up to 125m, one (1) no. permanent meteorological mast, one (1) no. substation, provision of three (3) no. new site entrances, the provision of new and upgraded internal site service road, and all underground cabling and associated infrastructure.	Refused by KCC Granted by An Bord Pleanála (08.239233) 10/11/2011 9 turbines constructed
Toberatooreen		
12/431	Develop a wind farm including seven (7) no. wind turbines (with a maximum height of up to 125m) and all associated infrastructure.	Granted by KCC Granted by An Bord Pleanála (08.242170) 12/11/2013 4 turbines constructed. (3 turbines omitted under ABP decision)
Ballyhorgan Wind Farm		
14/13	Provision of a total of 10 no. wind turbines, having a maximum ground to blade tip height of up to 156.5 metres and all ancillary works.	Refused by KCC Granted by An Bord Pleanála (08.244066)

Pl.Ref	Description	Decision and status
		Subsequently quashed following judicial review and currently under the consideration of An Bord Pleanála under 08.301852.
Meenbannivane		
11/771	Construct one wind turbine generator and ancillary works.	Refused 10/11/2011
Cloghboola		
00/4099	Construct a wind farm comprising 24 wind turbines, service roadways, swithgear/ transformer compound, borrow pit, control house and meteorological mast	Granted by KCC 10/06/2002
00/84099	Extension of duration 00/4099	Granted by KCC 05/05/2010
00/94099	Extension of duration for 00/4099	Granted by KCC 12/01/2007
00/994099	Extension of duration for 00/4099	Granted by KCC 12/01/2007
08/1454	Erect 20 no. wind turbine generators of 125m overall height, extension of existing site roads and construction of a windfarm control building as an amendment to planning ref. no. 00/4099	Refused by KCC 01/07/2009
10/616	Erect twenty (20) wind turbines of 125 metre overall height, 110kv sub-station/compound and control buildings, extension of existing site roads, associated drainage and site works as an amendment to planning reference no. 00/4099	Granted by KCC 30/03/2011 16 turbines constructed.
Breehva (Co.Clare)		
00/2417	Build a wind farm comprising 4 no. wind turbine generators with towers not exceeding 52m & ancillary equipment for generator of electricity & control building.	Granted by CCC Granted by An Bord Pleanála 03/09/2004 2 turbines constructed.
09/911	Extension of duration for 00/2417.	Granted by CCC 13/10/2009

2.5.3 Applications within the Vicinity of the Wind Farm

There have been a number of planning applications (i.e. non-wind farm applications) lodged within the general setting of the proposed wind farm. In general the planning applications identified following a review of the Kerry County Council planning portal appear to be for the development of housing, agriculture and community facilities. The applications identified within 2km of the site can be viewed under **Appendix 2-1**.

2.5.4 Applications Within the Vicinity of the Grid Connection

There have been a number of planning applications lodged within the vicinity of the proposed grid route connection. The applications relate in the main to one off housing and agricultural developments. The applications which have been identified within 200 meters of the grid route can be viewed under **Appendix 2-2.**

2.6 Scoping and Consultations

2.6.1 Scoping

Scoping is the process of determining the content, depth and extent of topics to be covered in the environmental information to be submitted to a competent authority for projects that are subject to an Environmental Impact Assessment (EIA). This process is conducted by contacting the relevant authorities and Non-Governmental Organisations (NGOs) with interest in the specific aspects of the environment with the potential to be affected by the proposal. These organisations are invited to submit comments on the scope of the EIAR and the specific standards of information they require. Comprehensive and timely scoping helps ensure that the EIAR refers to all relevant aspects of the proposed development and its potential effects on the environment and provides initial feedback in the early stages of the project, when alterations are still easily incorporated into the design. In this way scoping not only informs the content and scope of the EIAR, it also provides a feedback mechanism for the proposal design itself.

A scoping document was issued in relation to the proposed development in December 2020. The scoping responses from that scoping exercise are listed and the relevant responses included as **Appendix 2-3** of this EIAR. These have been taken into account in the preparation of the EIAR for this development.

2.6.2 Scoping Responses

Table 2.3 below lists the responses received from the bodies to the scoping document circulated in February 2020. Copies of all scoping responses received by 24th September 2021 are included in **Appendix 2-3** of this EIAR. If further responses are received, the comments of the consultees will be considered in the construction and operation of the proposed development in the event of a grant of planning permission. The recommendations of the consultees have informed the scope of the assessments undertaken and the contents of the EIAR.

Table 2-3 Scoping Responses

No.	Consultee	Response
1	2rn (RTÉ Transmission Network Ltd.)	2RN have no fixed linking that would that would be affected by this site. There is however a risk of interference to the DTT viewers in the area receiving from our sites at Knockmoyle and Cnoc An Oir. We would therefore request that the Protocol be signed between the Developer and 2RN should the site go ahead.
2	AI Bridges	No response received at the time of writing
3	An Taisce	No response received at the time of writing
4	Broadcasting Authority of Ireland (BAI)	No response received at the time of writing
5	Bat Conservation Ireland	No comment
6	BirdWatch Ireland	The final planning application should be supported by ornithological and ecological surveys that address the potential direct, indirect and cumulative impacts of the project on: • Wintering Whooper Swans. The data from the last swan census (ISC2020) and from the I-

No.	Consultee	Response
		WeBS database. Has identified three important Whooper Swan subsites in the immediate vicinity of the site: 0KS05 Ballynagare Bridge, 0KS03 Lixnaw, 0KS02 Ballyouneen. • Water Quality impacts on the Lower River Shannon SAC, Cashen River Estuary NHA. • Breeding raptors - Hen harrier, Buzzard, Kestrels, Barn owl. • Wintering wildfowl - Golden plovers and Curlews. • The ecology surveys should also assess whether the site supports Marsh fritillary, Otter, Bats etc. • The habitat survey should identify the presence of any raised bog or degraded raised bog on site as well as any Annex I Habitats under the Habitats Directive.
7	Butterfly Conservation Ireland (BCI)	No capacity to comment
8	Commission for Regulation of Utilities Water and Energy	No response received at the time of writing
9	Computer Zone Ltd	No response received at the time of writing
10	Department of Agriculture, Food and the Marine	No response received at the time of writing
11	Department of Culture, Heritage and the Gaeltacht	Archaeology: All proposed development and strategies should be in compliance with the National Monuments Acts 1930 to 2004 and with the national policy on protection of archaeological heritage – 'Framework and Principles for the Protection of the Archaeological Heritage' published in 1999. General Guidance: 1. All areas of archaeological heritage should be addressed, including; a) Immovable cultural heritage e.g. monuments and ancient field boundaries. b) Underwater cultural heritage. c) Movable cultural heritage e.g. loose carved stones, sculptures, architectural fragments etc. 2. All impacts which may impinge on the archaeological heritage should be assessed by a suitably qualified archaeologist.

No.	Consultee	Response
		3. Where appropriate, specialists in the field of archaeological heritage should be consulted throughout the process, from design through to implementation. 4. All surveys pertaining to archaeological heritage must be of a high standard in order to allow informed decisions to be taken. 5. All impacts must be assessed, to include ground disturbance, impacts on the setting of the monuments and visual impacts. These should include direct, indirect, temporary and cumulative impacts. 6. Mitigation of impacts, identified through consultation, should be taken into account within the development at the earliest possible stages. Various approaches should be considered, such as avoidance, design modification and relocation where appropriate. 7. Where there are no archaeological monuments present but the development is large in scale, e.g., over 0.5 hectares in area and over 1 kilometre in length, it is recommended that an archaeological assessment should be undertaken, unless there are substantial grounds to show that it is not necessary. Refer to Framework and Principles for the Protection of the Archaeological Heritage 1999, in particular section 3.6.6 in regard to Environmental Impact Assessment (EIA).
12	Department of Communications, Climate Action & Environment	No response received at the time of writing
13	Department of Defence-Property Management	We wish to acknowledge receipt of your e-mail below and attached documentation. We will confer with our Military colleagues on the proposed Ballynagare Windfarm and revert with any comments/observations in due course.
14	Department of Defence-Aviation	Observations: 1. All turbines should be illuminated by high intensity obstacle lights allowing the hazard to be identified and avoided by aircraft in flight. 2. 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 850nanometres (nm) of wavelength. Light intensity to be of similar value to that emitted in the visible spectrum of light.

No.	Consultee	Response
15	Department of Media, Tourism, Arts, Culture, Sport and the Gaeltacht	No response received at the time of writing
16	Department of Transport	No response received at the time of writing
17	Development Applications Unit	I acknowledge receipt of your recent consultation.In the event of observations, you will receive a co-ordinated heritage-related response by email from Development Applications Unit (DAU). The normal target turnaround for pre-planning and other general consultations is six weeks from date of receipt. In relation to general consultations from public bodies under the European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004 to 2011, the Department endeavours to meet deadline dates, where requested. No further comments received.
18	Eircom Ltd.	No response received at the time of writing
19	Eirgrid	No response received at the time of writing
20	Eir	No transmission services in or near the project boundary; our nearest is over 5km away and poses no risk to the network.
21	EMR Integrated Solutions	EMR Integrated Solutions do not have any links in the shaded area of the map, but have links from Knockanore high site which is in the north of the circled area (east of Ballybunion). Please send through turbine locations when these have been determined so that a final assessment can be completed.
22	Enet Telecommunications	One link crosses western edge of site at an elevation of approximately 300m OD. Enet confirmed that approx. 100m buffer distance from turbines usually sought therefore no issue envisaged.
23	EOBO Ltd.	No response received at the time of writing
24	ESB Telecoms	No response received at the time of writing
25	Fáilte Ireland	Refer to Fáilte Ireland's Guidelines for the Treatment of Tourism in an EIA. These guidelines are non-statutory and act as supplementary advice to the EPA EIAR Guidelines outlined in section 2.
26	Geological Survey of Ireland	Geoheritage:

No.	Consultee	Response
		The CGSs for County Kerry remain unaudited and as such there is limited detailed information on each site available publicly. Records show that there is an unaudited CGS in the vicinity of the proposed windfarm development: • Lixnaw Quarry, Co. Kerry (GR 90620, 129760), under IGH theme: IGH 8 Lower Carboniferous. A working quarry in striped Carboniferous limestone of Visean age. This is an unusual and distinctive rock type. With the current plan, there are no envisaged impacts on the integrity of current CGSs by the proposed development. <u>Groundwater</u>: Recommend using National Aquifer, Vulnerability and Recharge maps. Recommend using GWFlood tools. <u>Geological Mapping:</u> Review datasets of bedrock and subsoils geological mapping. Geohazards should be taken into consideration. <u>Natural resources (minerals/aggregates):</u> Use of the Aggregate Potential Mapping viewer to identify areas of High to Very High source aggregate potential within the area. Should development go ahead. GSI request copy of all reports detailing site investigations.
27	Health Service Executive	Set out a range of documents that should be taken into consideration when preparing the Environmental Impact Assessment Report. Recommendation that a number of documents should be considered in preparing the EIAR. Recommendations surrounding public consultations. EIAR should detail information surrounding decommissioning including eventual fate of materials. EIAR should include map and description of proposed turbine locations.

No.	Consultee	Response
		The proposed development should be assessed with a view of including health gains. Recommendations surrounding noise assessment within the EIAR. Recommend that a shadow flicker assessment is carried out. Measures surrounding air quality during construction works are recommended. Drinking water sources should be identified. Any potential impacts should be assessed. Assessment of current ground stability and all proposed mitigation measures should be detailed in the EIAR. EIAR should detail the location of on site facilities. HSE South Emergency Management function does not have any specific observations to make with respect to this application but set out several recommendations.
28	Imagine Networks Services	Based on the information provided Imagine have 5 active links in the search area, none of these are within the proposed wind farm location.
29	Inland Fisheries Ireland – South Western RBD	No response received at the time of writing
30	Irish Aviation Authority	30-days notice to IAA in advance of erection of structure. Data to be supplied to the IAA once construction is planned or commenced. Should consent be granted the planning conditions should be attached.
31	Irish Peatland Conservation Council	No response received at the time of writing
32	Irish Red Grouse Association	No response received at the time of writing
33	Irish Raptor Study Group	No response received at the time of writing
34	Irish Sports Council	No response received at the time of writing
35	Irish Water	Suggested scope in relation to water services set out, which is not project specific. It also notes:

No.	Consultee	Response
		• The Confirmation of Feasibility from IW, to the applicant, should be issued prior to applying for planning permission. • Irish Water will not accept new surface water discharges to combined sewer networks
36	Irish Wildlife Trust	No response received at the time of writing
37	Ivertec Ltd	Customers could lose service as a clear line of sight is required to provide a reliable wireless connection. The customer base includes large and small businesses, national schools under contract from the department of education, homes, farmers and tele-workers.
38	Kerry County Council – Heritage Officer	No response received at the time of writing
39	Kerry County Council - Environment Department	No response received at the time of writing
40	Kerry County Council - Roads Department	No response received at the time of writing
41	Meteor Mobile Communications	Confirmed that they have no transmission services in or near the project boundary, with the nearest service being over 5km away and poses no risk to the network.
42	MP&E Trading Company Ltd	Confirmed that they do not have any links in the shaded area of the map, but do have links from Knockanor high site which is in the north of the area shown in their response (east of Ballybunion). Request that turbine locations, once determined, are issued for final assessment to take place.
43	NPWS	Provided GIS data on rare and threatened species in vicinity of the project.
44	Office of Public Works	No response received at the time of writing
45	PermaNET Ltd	No response received at the time of writing
46	Raidio Ciarrai Teoranta Ltd	One link intersecting the telecoms study area and the edge of the windfarm boundary.
47	Shannon Airport	Siting of wind turbines in this location may have implications for the operations of the communication, navigation and surveillance systems used by Air Traffic Control. Regard to the IAA's Obstacles to Aircraft Flight Order, 2002 (S.I Nno.14 of 2002) as amended.

No.	Consultee	Response
		Seek views of IAA. Should permission be granted, ask developer to deploy the appropriate obstacle avoidance lighting in accordance with *Chapter Q-Visual Aids for Denoting Obstacles* CS ADR-DSN.Q.851/GM1 ADR-DSN.Q.851 *Marking and Lighting of wind turbines* contained in the EASA Easy Access Rules for Aerodromes (Regulation (EU)No.139/2014)
48	Southern Regional Assembly	No response received at the time of writing
49	The Heritage Council	No response received at the time of writing
50	Transport Infrastructure Ireland	General guidance only set out. The developer should have regard to: 1. As outlined in the Spatial Planning and National Roads Guidelines, it is in the public interest that, in so far as is reasonably practicable, the national road network continues to serve its intended strategic purpose. The EIAR should identify the methods/techniques proposed for any works traversing/in proximity to the national road network in order to demonstrate that the development can proceed complementary to safeguarding the capacity, safety and operational efficiency of that network. 2. Consultations should be had with the relevant local authority/national road design office with regard to locations of existing and future national road schemes. 3. In relation to cabling and potential connection routing, the scheme promoter should note locations of existing and future national road schemes and develop proposals to safeguard proposed road schemes. As outlined above, please consult with the local authority/national road design office in relation to any schemes in planning in the area. Proposals should be developed to safeguard proposed road schemes as TII will not be responsible for costs associated with future relocation of cable routing where proposals are catered for in an area of a proposed national road scheme. In that regard, consideration should be given to routing options, use of existing crossings, depth of cable laying, etc In the context of existing national roads, alternatives to the provision of cabling along the national road network, such as alternative routing or the laying of cabling in private lands adjoining the national road, should be considered in the interests of safeguarding the investment in and the potential for future upgrade works to the national road network. The cable routing should avoid all impacts to existing TII infrastructure such as traffic counters, weather stations, etc. and works required to such infrastructure shall only be undertaken in

No.	Consultee	Response
		consultation with and subject to the agreement of TII, with any costs attributable borne by the applicant/developer. The developer should also be aware that separate approvals may be required for works traversing the national road network. 4. Clearly identify haul routes proposed and fully assess the network to be traversed. Separate structure approvals/permits and other licences may be required in connection with the proposed haul route and all structures on the haul route should be checked by the applicant/developer to confirm their capacity to accommodate any abnormal load proposed. 5. Where appropriate, subject to meeting the appropriate thresholds and criteria and having regard to best practice, a Traffic and Transport Assessment (TTA) be carried out in accordance with relevant guidelines, noting traffic volumes attending the site and traffic routes to/from the site with reference to impacts on the national road network and junctions of lower category roads with national roads. TII's TTA Guidelines (2014) should be referred to in relation to proposed development with potential impacts on the national road network. The scheme promoter is also advised to have regard to Section 2.2 of the TII TTA Guidelines which addresses requirements for sub-threshold TTA. 6. TII Standards should be consulted to determine the requirement for Road Safety Audit (RSA) and Road Safety Impact Assessment (RSIA). 7. Assessments and design and construction and maintenance standards and guidance are available at TII Publications that replaced the NRA Design Manual for Roads and Bridges (DMRB) and the NRA Manual of Contract Documents for Road Works (MCDRW). 8. The developer, in conducting Environmental Impact Assessment, should have regard to TII Environment Guidelines that deal with assessment and mitigation measures for varied environmental factors and occurrences. In particular: a) TII's Environmental Assessment and Construction Guidelines, including the Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (National Roads Authority, 2006), b) The EIAR should consider the Environmental Noise Regulations 2006 (SI 140 of 2006) and, in particular, how the development will affect future action plans by the relevant competent authority. The developer may need to consider the incorporation of noise barriers to reduce

No.	Consultee	Response
		noise impacts (see Guidelines for the Treatment of Noise and Vibration in National Road Schemes (1st Rev., National Roads Authority, 2004))
51	Three Ireland	3Ireland do not have any microwave links traversing or that will be affected.
52	Viatel Ireland Ltd	No response received at the time of writing
53	Virgin Media Ireland Ltd	This will have no impact on Virgin Media radio links in the area
54	Vodafone Ireland	One link crosses western edge of site at an elevation of approximately 300m OD. Enet needs a minimum buffer of 30m from 1st Fresnel zone. MKO to provide turbine locations once decided.
55	Waterways Ireland	No response received at the time of writing

Table 2.4 overleaf presents the key points from the scoping responses received and identifies where such points have been addressed in this EIAR.

Table 2-4 Scoping Responses Received and Relevant EIAR Section

No.	Consultee	Response	Action Required	Discussed within EIAR (where applicable)
1	Birdwatch Ireland	The final planning application should be supported by ornithological and ecological surveys that address the potential direct, indirect and cumulative impacts of the project on: • Wintering Whooper Swans. The data from the last swan census (ISC2020) and from the I-WeBS database has identified three important Whooper Swan subsites in the immediate vicinity of the site: 0KS05 Ballynagare Bridge, 0KS03 Lixnaw, 0KS02 Ballyouneen. • Water Quality impacts on the Lower River Shannon SAC, Cashen River Estuary NHA. • Breeding raptors - Hen harrier, Buzzard, Kestrels, Barn owl. • Wintering wildfowl - Golden plovers and Curlews. • The ecology surveys should also assess whether the site supports Marsh fritillary, Otter, Bats etc. The habitat survey should identify the presence of any raised bog or degraded raised bog on site as well as any Annex I Habitats under the Habitats Directive.	Consider the points raised in the relevant Ornithology chapter of the EIAR (Chapter 7) and Biodiversity chapter (Chapter 6),	Chapter 6: Biodiversity Chapter 7: Ornithology
2	Department of Culture, Heritage, and the Gaeltacht (includes National Parks & Wildlife Service, National Monuments Service)	<u>Archaeology</u>: All proposed development and strategies should be in compliance with the National Monuments Acts 1930 to 2004 and with the national policy on protection of archaeological heritage –	Consider the points raised in the relevant cultural heritage chapter of the EIAR (Chapter 12)	Chapter 12: Cultural Heritage

No.	Consultee	Response	Action Required	Discussed within EIAR (where applicable)
		'Framework and Principles for the Protection of the Archaeological Heritage' published in 1999. General Guidance: 1. All areas of archaeological heritage should be addressed, including; a) Immovable cultural heritage e.g. monuments and ancient field boundaries. b) Underwater cultural heritage. c) Movable cultural heritage e.g. loose carved stones, sculptures, architectural fragments etc. 2. All impacts which may impinge on the archaeological heritage should be assessed by a suitably qualified archaeologist. 3. Where appropriate, specialists in the field of archaeological heritage should be consulted throughout the process, from design through to implementation. 4. All surveys pertaining to archaeological heritage must be of a high standard in order to allow informed decisions to be taken. 5. All impacts must be assessed, to include ground disturbance, impacts on the setting of the monuments and visual impacts. These should include direct, indirect, temporary and cumulative impacts.		

No.	Consultee	Response	Action Required	Discussed within EIAR (where applicable)
		6. Mitigation of impacts, identified through consultation, should be taken into account within the development at the earliest possible stages. Various approaches should be considered, such as avoidance, design modification and relocation where appropriate. 7. Where there are no archaeological monuments present but the development is large in scale, e.g., over 0.5 hectares in area and over 1 kilometre in length, it is recommended that an archaeological assessment should be undertaken, unless there are substantial grounds to show that it is not necessary. Refer to Framework and Principles for the Protection of the Archaeological Heritage 1999, in particular section 3.6.6 in regard to Environmental Impact Assessment (EIA).		
3	Department of Defence - Aviation	Observations: 1. All turbines should be illuminated by high intensity obstacle lights allowing the hazard to be identified and avoided by aircraft in flight. 2. 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 850nanometres (nm) of wavelength. Light intensity to be of similar value to that emitted in the visible spectrum of light.	Comments noted.	Chapter 14: Material Assets

No.	Consultee	Response	Action Required	Discussed within EIAR (where applicable)
4	Eir.	No transmission services in or near the project boundary; our nearest is over 5km away and poses no risk to the network.	N/A	Chapter 14. Material Assets
5	EMR Integrated Solutions	EMR Integrated Solutions do not have any links in the shaded area of the map, but have links from Knockanore high site which is in the north of the circled area (east of Ballybunion). Please send through turbine locations when these have been determined so that a final assessment can be completed.	Turbine locations to be issued to EMR.	Chapter 14: Material Assets
6	Enet Telecommunications	One link crosses western edge of site at an elevation of approximately 300m OD. Enet confirmed that approx. 100m buffer distance from turbines usually sought therefore no issue envisaged.	Buffer sought can be accommodated.	Chapter 14: Material Assets
7	Failte Ireland	Refer to Fáilte Ireland's Guidelines for the Treatment of Tourism in an EIA. These guidelines are non-statutory and act as supplementary advice to the EPA EIAR Guidelines outlined in section 2.	The noted document has been considered in the preparation of the EIAR.	Chapter 6: Human Beings
8	Geological Survey Ireland	Geoheritage: The CGSs for County Kerry remain unaudited and as such there is limited detailed information on each site available publicly. Records show that there is an unaudited CGS in the vicinity of the proposed windfarm development: • Lixnaw Quarry, Co. Kerry (GR 90620, 129760), under IGH theme: IGH 8 Lower Carboniferous. A working quarry in	GSI Map Viewer consulted Geohazards considered	Chapter 8: Geology and Soils Chapter 9: Hydrology and Hydrogeology

No.	Consultee	Response	Action Required	Discussed within EIAR (where applicable)
		striped Carboniferous limestone of Visean age. This is an unusual and distinctive rock type. With the current plan, there are no envisaged impacts on the integrity of current CGSs by the proposed development. Groundwater: Recommend using National Aquifer, Vulnerability and Recharge maps. Recommend using GWFlood tools. Geological Mapping: Review datasets of bedrock and subsoils geological mapping. Geohazards should be taken into consideration. Natural resources (minerals/aggregates): Use of the Aggregate Potential Mapping viewer to identify areas of High to Very High source aggregate potential within the area. Should development go ahead. GSI request copy of all reports detailing site investigations.		
9	Health Service Executive	Recommendation that a number of documents should be considered in preparing the EIAR.	The noted documents have been considered in the preparation of this EIAR.	Chapter 2: Background Chapter 4: Description

No.	Consultee	Response	Action Required	Discussed within EIAR (where applicable)
		Recommendations surrounding public consultations. EIAR should detail information surrounding decommissioning including eventual fate of materials. EIAR should include map and description of proposed turbine locations. The proposed development should be assessed with a view of including health gains. Recommendations surrounding noise assessment within the EIAR. Recommend that a shadow flicker assessment is carried out. Measures surrounding air quality during construction works are recommended. Drinking water sources should be identified. Any potential impacts should be assessed. Assessment of current ground stability and all proposed mitigation measures should be detailed in the EIAR. EIAR should detail the location of on site facilities.	The applicant team have carried out detailed public consultations as part of the proposals. Decommissioning considered in chapter. Locations included. Noise assessed in Chapter 10. Shadow flicker assessed in Chapter 5. Construction mitigation considered in EIAR. Water assessed in EIAR Chapter 9. Ground stability assessed in EIAR Chapter 8 Impacts on sensitive receptors assessed within the EIAR. A full cumulative assessment of all wind farm developments has been included in EIAR within the relevant sections as appropriate	Chapter 2: Background; Chapter 6: Human Beings Chapter 8: Geology and Soils Chapter 9: Hydrology and Hydrogeology Chapter 11: Noise Construction Environmental Management Plan

No.	Consultee	Response	Action Required	Discussed within EIAR (where applicable)
		HSE South Emergency Management function does not have any specific observations to make with respect to this application but set out several recommendations.		
10	Imagine Networks Services	Based on the information provided Imagine have 5 active links in the search area, none of these are within the proposed wind farm location.	N/A	Chapter 14: Material Assets
11	Irish Aviation Authority	30-days notice to IAA in advance of erection of structure. Data to be supplied to the IAA once construction is planned or commenced. Should consent be granted the planning conditions should be attached.	The request, and any IAA lighting requirements will be complied with should the proposed development receive a grant of planning permission.	Chapter 14: Material Assets
12	Irish Water	Suggested scope in relation to water services set out, which is not project specific. It also notes: • The Confirmation of Feasibility from IW, to the applicant, should be issued prior to applying for planning permission. • Irish Water will not accept new surface water discharges to combined sewer networks	N/A	N/A
13	Ivertec Ltd	Customers could lose service as a clear line of sight is required to provide a reliable wireless connection. The customer base includes large and small businesses, national schools under	EMI Impact Assessment Study Commissioned. Concluded that no impact likely. Set of mitigation	Chapter 14: Material Assets

No.	Consultee	Response	Action Required	Discussed within EIAR (where applicable)
		contract form the department of education, homes, farmers and tele-workers.	measures identified in the event of interference	
14	Meteor Mobile Communications	Confirmed that they have no transmission services in or near the project boundary, with the nearest service being over 5km away and poses no risk to the network.	N/A	N/A
15	MP&E Trading Company Ltd	Confirmed that they do not have any links in the shaded area of the map, but do have links from Knockanor high site which is in the north of the area shown in their response (east of Ballybunion). Request that turbine locations, once determined, are issued for final assessment to take place.	Information to be issued by MKO	N/A
16	National Parks and Wildlife Service	NPWS provided GIS data for rare and threatened species in the vicinity of the proposed development	N/A	N/A
17	Raidio Ciarrai Teoranta	One link intersecting the telecoms study area and the edge of the windfarm boundary.	N/A	Chapter 14. Material Assets
18	Shannon Airport	Siting of wind turbines in this location may have implications for the operations of the communication, navigation and surveillance systems used by Air Traffic Control. Regard to the IAA's Obstacles to Aircraft Flight Order, 2002 (S.I Nno.14 of 2002) as amended. Seek views of IAA. Should permission be granted, ask developer to deploy the appropriate obstacle avoidance lighting in accordance with	MKO engage with IAA. Consideration be given to Order as requested. Obstacle lighting to be implemented should planning permission be granted.	Chapter 14: Material Assets

No.	Consultee	Response	Action Required	Discussed within EIAR (where applicable)
		Chapter Q-Visual Aids for Denoting Obstacles CS ADR-DSN.Q.851/GM1 ADR-DSN.Q.851 Marking and Lighting of wind turbines contained in the EASA Easy Access Rules for Aerodromes (Regulation (EU)No.139/2014)		
19	Transport Infrastructure Ireland	General guidance only set out. The developer should have regard to: 1. As outlined in the Spatial Planning and National Roads Guidelines, it is in the public interest that, in so far as is reasonably practicable, the national road network continues to serve its intended strategic purpose. The EIAR should identify the methods/techniques proposed for any works traversing/in proximity to the national road network in order to demonstrate that the development can proceed complementary to safeguarding the capacity, safety and operational efficiency of that network. 2. Consultations should be had with the relevant local authority/national road design office with regard to locations of existing and future national road schemes. 3. In relation to cabling and potential connection routing, the scheme promoter should note locations of existing and future national road schemes and develop proposals to safeguard proposed road schemes. As outlined above, please consult with the local authority/national road design office in relation to any schemes in planning in the area. Proposals should be developed to safeguard proposed road schemes as TII will not be responsible for costs associated with future relocation of cable	The methods/techniques to be employed are set out in full in the EIAR at Chapter 14: Material Assets, Chapter 9: Hydrology and Hydrogeology, and the CEMP included in the EIAR. Pre-Application engagement with Kerry County Council. Addressed in the above-noted EIAR Chapters and in the accompanying planning drawings.	Chapter 4: Material Assets Chapter 9: Hydrology and Hydrogeology CEMP Chapter 2: Background

No.	Consultee	Response	Action Required	Discussed within EIAR (where applicable)
		routing where proposals are catered for in an area of a proposed national road scheme. In that regard, consideration should be given to routing options, use of existing crossings, depth of cable laying, etc In the context of existing national roads, alternatives to the provision of cabling along the national road network, such as alternative routing or the laying of cabling in private lands adjoining the national road, should be considered in the interests of safeguarding the investment in and the potential for future upgrade works to the national road network. The cable routing should avoid all impacts to existing TII infrastructure such as traffic counters, weather stations, etc. and works required to such infrastructure shall only be undertaken in consultation with and subject to the agreement of TII, with any costs attributable borne by the applicant/developer. The developer should also be aware that separate approvals may be required for works traversing the national road network.	Chapter 3 of the EIAR contains an assessment of alternatives.	Chapter 3: Reasonable Alternatives
		4. Clearly identify haul routes proposed and fully assess the network to be traversed. Separate structure approvals/permits and other licences may be required in connection with the proposed haul route and all structures on the haul route should be checked by the applicant/developer to confirm their capacity to accommodate any abnormal load proposed.	Any approvals/permits/licences required will be obtained. Refer to Chapter 14: Materials Assets of the EIAR.	Chapter 14: Material Assets
		5. Where appropriate, subject to meeting the appropriate thresholds and criteria and having regard to best practice, a Traffic and Transport Assessment (TTA) be carried out in accordance with relevant guidelines, noting traffic volumes attending the site and traffic routes to/from the site with reference to impacts on the national road network and junctions of lower	A TTA has been carried out and is included in Chapter 14	Chapter 14: Material Assets

No.	Consultee	Response	Action Required	Discussed within EIAR (where applicable)
		category roads with national roads. TII's TTA Guidelines (2014) should be referred to in relation to proposed development with potential impacts on the national road network. The scheme promoter is also advised to have regard to Section 2.2 of the TII TTA Guidelines which addresses requirements for sub-threshold TTA.		
		6. TII Standards should be consulted to determine the requirement for Road Safety Audit (RSA) and Road Safety Impact Assessment (RSIA).	A RSA and RSIA have not been undertaken but will be undertaken as part of the detailed design stage.	Chapter 14: Material Assets
		7. Assessments and design and construction and maintenance standards and guidance are available at TII Publications that replaced the NRA Design Manual for Roads and Bridges (DMRB) and the NRA Manual of Contract Documents for Road Works (MCDRW).	Noted.	
		8. The developer, in conducting Environmental Impact Assessment, should have regard to TII Environment Guidelines that deal with assessment and mitigation measures for varied environmental factors and occurrences. In particular:	Noted.	
		a) TII's Environmental Assessment and Construction Guidelines, including the Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (National Roads Authority, 2006),	Matters relating to air quality are assessed at Chapter 10 of the EIAR	Chapter 10: Air and Climate
		b) The EIAR should consider the Environmental Noise Regulations 2006 (SI 140 of 2006) and, in particular, how the development will affect future action plans by the relevant		

No.	Consultee	Response	Action Required	Discussed within EIAR (where applicable)
		competent authority. The developer may need to consider the incorporation of noise barriers to reduce noise impacts (see Guidelines for the Treatment of Noise and Vibration in National Road Schemes (1st Rev., National Roads Authority, 2004))	Noise is addressed in full at Chapter 11 of the EIAR	Chapter 11: Noise and Vibration
20	Three Ireland	3Ireland do not have any microwave links traversing or that will be affected.	N/A	Chapter 14: Material Assets
21	Virgin Media Ireland Ltd	This will have no impact on Virgin Media radio links in the area	N/A	Chapter 14: Material Assets
22	Vodafone Ireland Ltd	One link crosses western edge of site at an elevation of approximately 300m OD. Enet needs a minimum buffer of 30m from 1st Fresnel zone. MKO to provide turbine locations once decided.	The buffer requested will be implemented.	Chapter 14: Material Assets

2.6.3 Planning Consultation and Process

2.6.3.1 Strategic Infrastructure Meeting with An Bord Pleanála

Pre-application consultation took place with An Bord Pleanála as part of the Strategic Infrastructure Development process. This matter was considered by the Board under their reference 309013-20. The consultation process commenced on the 17th of December 2020 when the applicants requested to enter into pre-application consultations under the provisions of Section 37B of the Planning and Development Act, 2000 (as amended).

As part of this process a pre-application consultation meeting was held on the 2nd of February 2021. Attendees at the meeting on behalf of An Bord Pleanála were:

- Brendan Wyse (Assistant Director of Planning)
- Mairead Kenny (Senior Planning Inspector) and
- Kieran Somers (Executive Officer)

On behalf of the Applicant, the following were in attendance:

- Alexander Kelly (EMPower),
- Mark McLoughlin (EMPower),
- Thomas Blackwell (MKO) and
- Meabhann Crowe (MKO).

During the meeting a presentation of the proposed development was given by the applicant team in which the principle of the proposed development was discussed. This included design, planning history, policy along with the receiving setting. Further aspects such as the proposed grid connection, community consultation and community benefit were also discussed.

The Board issued minutes of that meeting on the 4th February 2021. As noted in that minute, it was the Board's preliminary view that the development was SID in nature.

A second meeting was held on the 9th of March 2021. Attendees were per those listed above, with the addition of Michael O'Connor from EMPower.

The Applicant and team presented a power-point presentation to the Board the purpose of which was to inform them of some design changes which had taken place since the last meeting, namely the confirmation of turbine locations within the site. The Applicant and team updated the Board also on feedback from scoping consultees and progress of site survey work.

The Board issued minutes of that meeting on the 12th of March 2021. As noted in that minute, the Board highlighted the unassigned status of the River Brick vis a vis the Water Framework Directive and advised the Applicant to be cognisant of this.

The Board reiterated its preliminary view that the proposed development would constitute SID. The Board further noted that it was satisfied that the main planning topics have been raised under the instant pre-application consultation.

The prospective Applicant reiterated its view that the layout for the proposed wind farm as presented in the power-point presentation was unlikely to change to a significant extent and so formal close out of the consultation process may follow. The Applicant formally requested to close the consultation process with the Board on the 16th June 2021. The Board confirmed on the 26th July 2021 that the proposed development no longer met the SID thresholds and as such any planning application should be made directly to the Planning Authority.

2.6.3.2 Pre-Planning Consultations with Kerry County Council

A pre-application meeting was held with Kerry County Council on the 2nd of June 2021 following the reduction in the number of turbines proposed as part of the proposed development, meaning the proposal no longer constituted a Strategic Infrastructure Development (SID).

The meeting was held virtually via MS Teams with the following attendees:

- Michael Lynch – Senior Executive Engineer, Kerry County Council
- Alexander Kelly – Ballynagare Wind Farm (the Applicant)
- Michael O'Connor - Ballynagare Wind Farm (the Applicant)
- Mark McLoughlin - Ballynagare Wind Farm (the Applicant)
- Thomas Blackwell - MKO Environment
- Jimmy Green – MKO Planning
- Meabhann Crowe - MKO Planning

The Area Planner issued their minute of the meeting on the 20th September 2021 (copy enclosed with the Planning Application pack) and noted the following:

MKO made a presentation in relation to the proposed development which comprised 7 no. wind turbines and associated works including a borrow pit

It was noted that the application site is zoned as 'Open to Consideration' for wind energy development in the Kerry County Development Plan 2015-2021. The Council noted that a draft Development Plan was expected to be published in autumn 2021 and a change of zoning could occur with regards the proposed project location.

It was confirmed that an EIA and NIS would be lodged with the application

It was confirmed that while consultation had previously taken place with An Bord Pleanála under the Strategic Infrastructure Development (SID) process, the design iterations which had taken place since resulted in the proposed development no longer meeting the SID thresholds. It was noted to the Authority following receipt of the meeting minute that the Board had formally confirmed the proposal no longer constituted SID and any application should be made directly to the Planning Authority.

Following the presentation, the following main planning issues were identified by the Planning Authority and discussed:

- Visual impact
- Archaeology
- Geotechnical
- Borrow pit
- Grid connection
- Ecology

2.6.3.3 Community Consultations

As part of the proposed development the applicants placed an emphasis on community engagement with community participation and stakeholder engagement of utmost importance to EMPower. The objectives of our community consultation process are to;

- Provide information to all sections of the local community;
- Contribute to the collection and sharing of information related to the potential environmental, economic, social, and health effects of the project;

- Ensure that EMPower understands the views of the local community so that they can be considered during the development process; and,
- Identify and grow a list of interested stakeholders and local communities that EMPower will proactively consult with.

At an early stage the applicants appointed a Community Liaison Officer (CLO) who would act as the direct contact for the local community. The contact details of the CLO were made available to the public who were free to contact the CLO with any questions, comments or queries which the community may have had with regards to the proposed development.

As part of the community engagement process the applicants established a project website which was designed to inform the community and greater public of the planning application. The website (https://www.ballynagarewindfarm.ie/) presented a wide range of information which included details on who the applicants are and what the project entailed along with providing ongoing updates over the course of the project. Details including contact information of the CLO along with facilities to submit a comment were also provided as part of the website to allow the community the opportunity to inform the development.

The applicants as part of the community consultation process facilitated and hosted a webinar on the 2nd of December 2020 in order to engage with the community and facilitate the opportunity to comment and discuss the project in a live forum while observing public health guidance and restrictions surrounding COVID-19. Under the webinar the applicants discussed aspects including the design of the development, details surrounding the community fund, and EIA activities. A questions and answers opportunity was facilitated within the webinar.

A second webinar took place on the 24th of March 2021.

In the period between the webinars being held the Applicant maintained individual consultation over email with stakeholders and local community groups.

A virtual consultation room was launched in March 2021 also which facilitated all stakeholders to interact with the project.

A public webinar was held on the 29th September 2021 to highlight design changes, the inclusion of the grid connection in the planning application and the progress in terms of the EIAR assessments.

2.7 Cumulative Impact Assessment

The EIA Directive and associated guidance documents state that as well as considering any indirect, secondary, transboundary, short-, medium-, and long-term, permanent and temporary, positive and negative effects of the project (all of which are considered in the various chapters of this EIAR), the description of likely significant effects should include an assessment of cumulative impacts that may arise. The factors to be considered in relation to cumulative effects include population and human health, biodiversity, land, soil, water, air, climate, material assets, landscape, and cultural heritage as well as the interactions between these factors.

2.7.1 Methodology for the Cumulative Assessment of Projects

To gather a comprehensive view of cumulative impacts on the above environmental considerations and to inform the EIA process being undertaken by the consenting authority, each relevant chapter within the EIAR addresses the potential for cumulative effects to arise.

The potential cumulative impact of the proposed and other relevant developments has been carried out with the purpose of identifying what likely significant effect the proposed development will have on the surrounding environment when considered cumulatively and in combination with relevant permitted, proposed, and constructed projects in the vicinity of the proposed site.

The cumulative impact assessment of projects has three principle aims:

- To establish the range and nature of existing projects within the cumulative impact study area of the proposed development.
- To summarise the relevant projects which have a potential to create cumulative impacts.
- To identify the projects that hold the potential for cumulative interaction within the context of the proposed development and discard projects that will neither directly or indirectly contribute to cumulative impacts.

Assessment material for this cumulative impact assessment was compiled on the relevant developments within the vicinity of the proposed development. The material was gathered through a search of relevant online Planning Registers, reviews of relevant EIAR (or historical EIS) documents, planning application details and planning drawings, and served to identify past and future projects, their activities and their environmental impacts.

2.7.2 Projects Considered in Cumulative Assessment

The projects considered in relation to the potential for cumulative impacts arising from construction, operational and decommissioning phases of the proposed development and for which all relevant data was reviewed include those listed below.

Other Wind Turbines

There are a number of other wind farm developments located within a 20 kilometre radius of the proposed development site. The other wind farm developments have been listed and included under Section 2.5 of this chapter of the EIAR. The other wind farm developments have been considered under the overall cumulative assessment of the proposed development. Any cumulative affects arising are considered in the relevant chapters of this EIAR.

Other Developments/Landuses

The review of the Kerry County Council planning register documents relevant general development planning applications in the vicinity of the proposed site of the wind farm and all its associated works, most of which relate to the provision and/or alteration of housing, agriculture-related structures and community facilities, as described previously under Section 2.5. These applications (which include those listed previously above in Section 2.5) have also been taken account in describing the baseline environment and in the relevant assessments.

Furthermore, the cumulative impact assessments carried out in each of the subsequent chapters of this EIAR consider all potential significant cumulative effects arising from all land uses in the vicinity of the proposed development. Overall the proposed development has been designed to mitigate impacts on the environment and particularly water, and a suite of mitigation measures is set out within the EIAR. The mitigation measures set out in this EIAR have been developed to ensure that significant cumulative affects do not arise during construction, operational or decommissioning phases of the proposed development. Additional detail in relation to the potential significant cumulative effects arising and, where appropriate, the specific suite of relevant mitigation measures proposed are set out within each of the relevant chapters of this EIAR.

3. CONSIDERATION OF REASONABLE ALTERNATIVES

3.1 Introduction

Article 5(1)(d) of Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (codification) as amended by Directive 2014/52/EU (the EIA Directive) requires that the EIAR prepared by the developer contains *"a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment."*

Article 5(1)(f) of the EIA Directive requires that the EIAR contains *"any additional information specified in Annex IV relevant to the specific characteristics of a particular project or type of project and to the environmental features likely to be affected."*

Annex IV of the EIA Directive states that the information provided in an Environmental Impact Assessment Report (EIAR) should include a *"description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects."*

This section of the EIAR contains a description of the reasonable alternatives that were studied by the developer, which are relevant to the proposed project and its specific characteristics, in terms of site location and other renewable energy technologies as well as site layout incorporating size and scale of the project, connection to the national grid and transport route options to the site. This section also outlines the design considerations in relation to the wind farm, including the associated substation, construction compound and borrow pits. It provides an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.

The consideration of alternatives is an effective means of avoiding environmental impacts. As set out in the '*Draft Guidelines on The Information to be Contained in Environmental Impact Assessment Reports' (Environmental Protection Agency, 2017),* the presentation and consideration of reasonable alternatives investigated is an important part of the overall EIA process.

Hierarchy

EIA is concerned with projects. The Environmental Protection Agency's draft guidelines (EPA, 2017) state that in some instances neither the applicant nor the competent authority can be realistically expected to examine options that have already been previously determined by a higher authority, such as a national plan or regional programme for infrastructure which are examined by means of a Strategic Environmental Assessment, the higher tier form of environmental assessment.

Non-environmental Factors

EIA is confined to the potential significant environmental effects that influence consideration of alternatives. However, other non-environmental factors may have equal or overriding importance to the developer of a project, for example project economics, land availability, engineering feasibility or planning considerations.

Site-specific Issues

The EPA guidelines state that the consideration of alternatives also needs to be set within the parameters of the availability of the land, i.e. the site may be the only suitable land available to the developer, or the need for the project to accommodate demands or opportunities that are site-specific. Such considerations should be on the basis of alternatives within a site, for example design and layout.

3.1.2 Methodology

The EU Guidance Document (EU, 2017) on the preparation of EIAR outlines the requirements of the EIA Directive and states that, in order to address the assessment of reasonable alternatives, the Developer needs to provide the following:

- A description of the reasonable alternatives studied; and
- An indication of the main reasons for selecting the chosen option taking into account the environmental effects.

There is limited European and National guidance on what constitutes a 'reasonable alternative' however the EU Guidance Document (EU, 2017) states that reasonable alternatives "*must be relevant to the proposed project and its specific characteristics, and resources should only be spent assessing these alternatives*".

The guidance also acknowledges that "*the selection of alternatives is limited in terms of feasibility. On the one hand, an alternative should not be ruled out simply because it would cause inconvenience or cost to the Developer. At the same time, if an alternative is very expensive or technically or legally difficult, it would be unreasonable to consider it to be a feasible alternative*".

The current Draft EPA Guidelines (EPA, 2017) state that "*It is generally sufficient to provide a broad description of each main alternative and the key issues associated with each, showing how environmental considerations were taken into account is deciding on the selected option. A detailed assessment (or 'mini-EIA') of each alternative is not required.*"

Consequently, taking consideration of the legislation and guidance requirements into account, this chapter addresses alternatives under the following headings:

- 'Do Nothing' Alternative;
- Alternative Locations;
- Alternative Technologies;
- Alternative Turbine Layouts and Development Design; and,
- Alternative Mitigation Measures.

Each of these is addressed in the following sections.

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

While environmental considerations have been at the core of the decision-making process for all of the project processes and infrastructure components, it should be noted that the majority of alternative options considered under the headings listed above are unlikely to have had significantly, greater environmental effects than the chosen option.

3.2 'Do-Nothing' Alternative

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

An alternative land-use option to the development of a renewable energy project at the proposed development site would be to leave the site as it is, with no changes made to existing land-use practices. Turf cutting and agriculture operations would continue at the site.

In implementing the 'Do-Nothing' alternative, however, the opportunity to capture a significant part of the country's renewable energy resource would be lost, as would the opportunity to contribute to meeting Government and EU targets for the production and consumption of electricity from renewable resources and the reduction of greenhouse gas emissions. The opportunity to generate local employment, local authority development contributions, rates and investment in the local area would also be lost. On the basis of the positive environmental effects arising from the project, when compared to the do-nothing scenario, therefore the do–nothing scenario was not the chosen option.

The existing surrounding agriculture and turf cutting operations can and will continue in conjunction with this proposed use of the site.

A comparison of the potential environmental effects of the 'Do-Nothing' Alternative when compared against the chosen option of developing a renewable energy project at this site are presented in Table 3-1 below.

Table 3.1 Comparison of environmental effects when compared against the chosen option (developing the proposed wind farm at this site)

Environmental Consideration	Do Nothing Alternative
Population & Human Health (incl. Shadow Flicker)	No increase in local employment and no long-term financial contributions towards the local community. No potential for shadow flicker to affect sensitive receptors.
Biodiversity & Ornithology	No habitat loss
Land, Soils & Geology	Neutral
Geotechnical	Neutral
Water	Neutral
Air & Climate	Will not provide the opportunity for an overall increase in air quality or reduction of greenhouse gasses. Will not assist in achieving the renewable energy targets set out in the Climate Action Plan.
Noise & Vibration	No potential for noise impacts on nearby sensitive receptors.
Landscape & Visual	No potential for landscape and visual impacts.
Cultural Heritage & Archaeology	No potential for impacts on unrecorded, subsurface archaeology.
Material Assets	Neutral

3.3 Alternative Locations

3.3.1 Strategic Site Screening

In locating and screening potential sites, EMPower carried out a desk-based geographical information system (GIS) screening exercise in 2018 throughout the Republic of Ireland. This identified all registered environmental designations, protected views, cultural and heritage sites and other areas of special sensitivity. These areas and their surrounds were not considered for future development. Other key constraints and factors in this screening process include proximity to grid infrastructure, wind speed, land ownership, tourism, distance to housing and development zoning within relative County Development Plans (CDP).

Table 3.2 2018 Feasibility Study - Key Development Constraints

Development Constraints		
• wind speed	• proximity to existing grid	• airports
• existing generation in the region	• existing electrical loads in the region	• environmental designations and sensitivities
• tourism amenity	• grid line route	• topography
• haulage route	• land use	• water bodies

EMPower carried out the screening process for the entire Republic of Ireland. For the purpose of demonstrating this process at a legible scale, the area of County Kerry is presented below as an example.

At the outset, the existing high voltage electrical grid infrastructure was identified and mapped. A 20km buffer was imposed on each high voltage substation, and the site search was focused within this buffer. The reason for this is that EMPower aims to construct wind developments without the need for external overhead electrical lines, instead installing underground cables. Connecting a project via underground cable that is greater than 20km from an existing substation can render the project uneconomical, particularly when aiming to provide the lowest cost assets in an auction market. See figure 3.1, below.

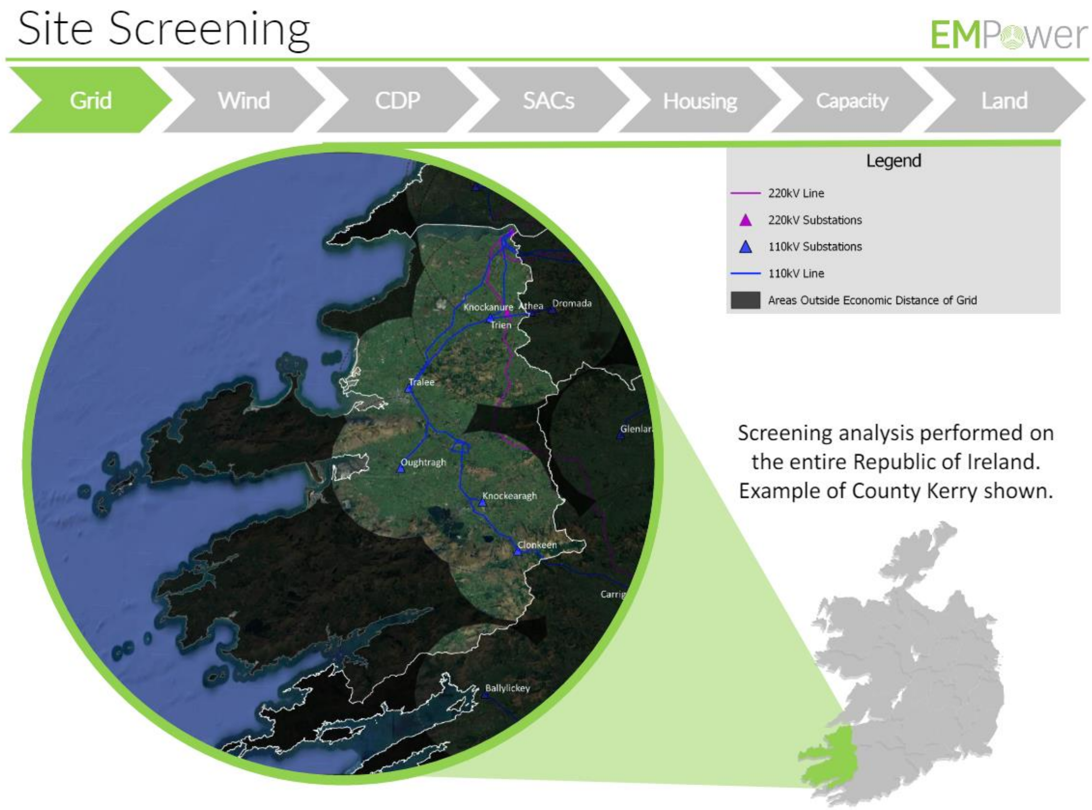


Figure 3.1 High voltage electrical grid infrastructure.

Wind speed is also mapped in order to identify the strongest resourced areas of Ireland. This is critical in order to provide the most economic source of energy for the Irish consumer. Areas of high wind speed are of course preferable, assuming that other constraints are satisfied. See figure 3.2.

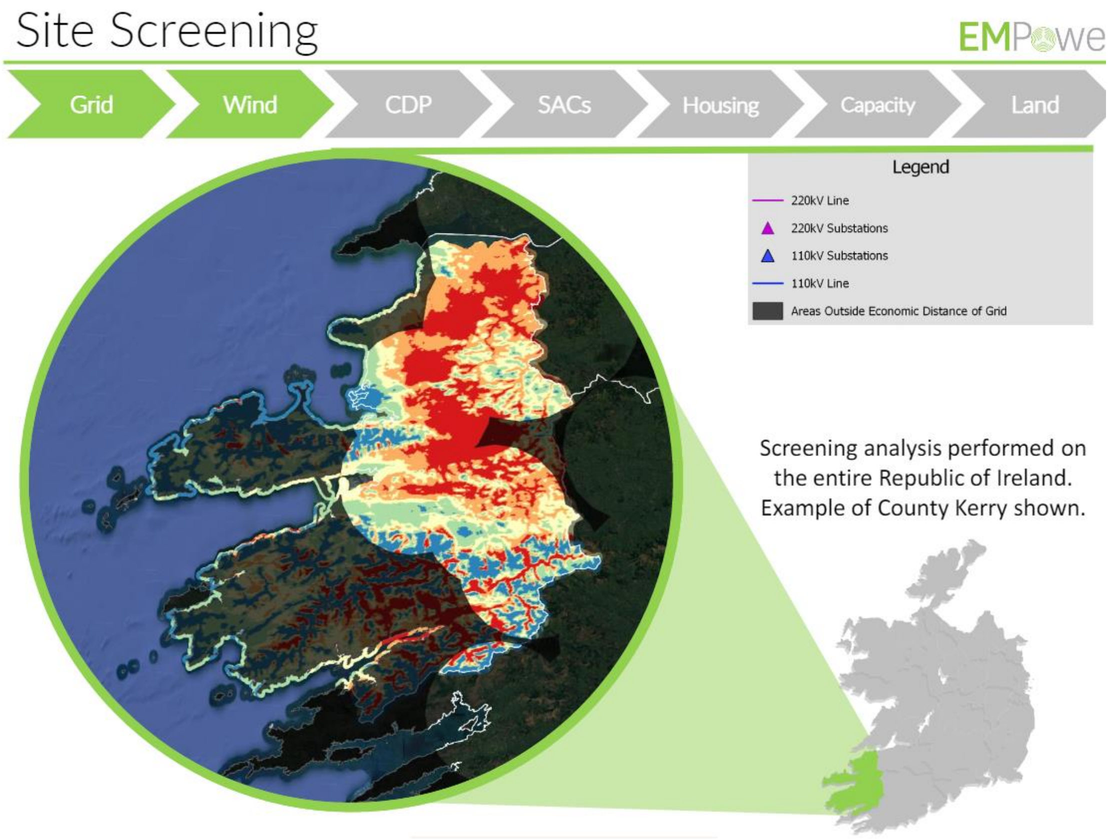


Figure 3.2 Wind Speed Map

Most County Development Plans in Ireland include some form of Wind Energy Strategy, whereby the areas within the county are identified and ranked based on their suitability for wind development. In the Kerry County Development Plan 2015-2021 (KCDP), these zones are set out as Strategic (most preferred, shown in blue in the below map), Open to Consideration (shown as orange in the below map) and Unsuitable (shown as red in the attached map). EMPower aimed to focus the site screening to areas that are deemed strategic/preferred. For County Kerry, the constraints analysis shows that there are no opportunities left to develop wind energy at an economic scale in the strategic/preferred areas of County Kerry. See Figure 3.3

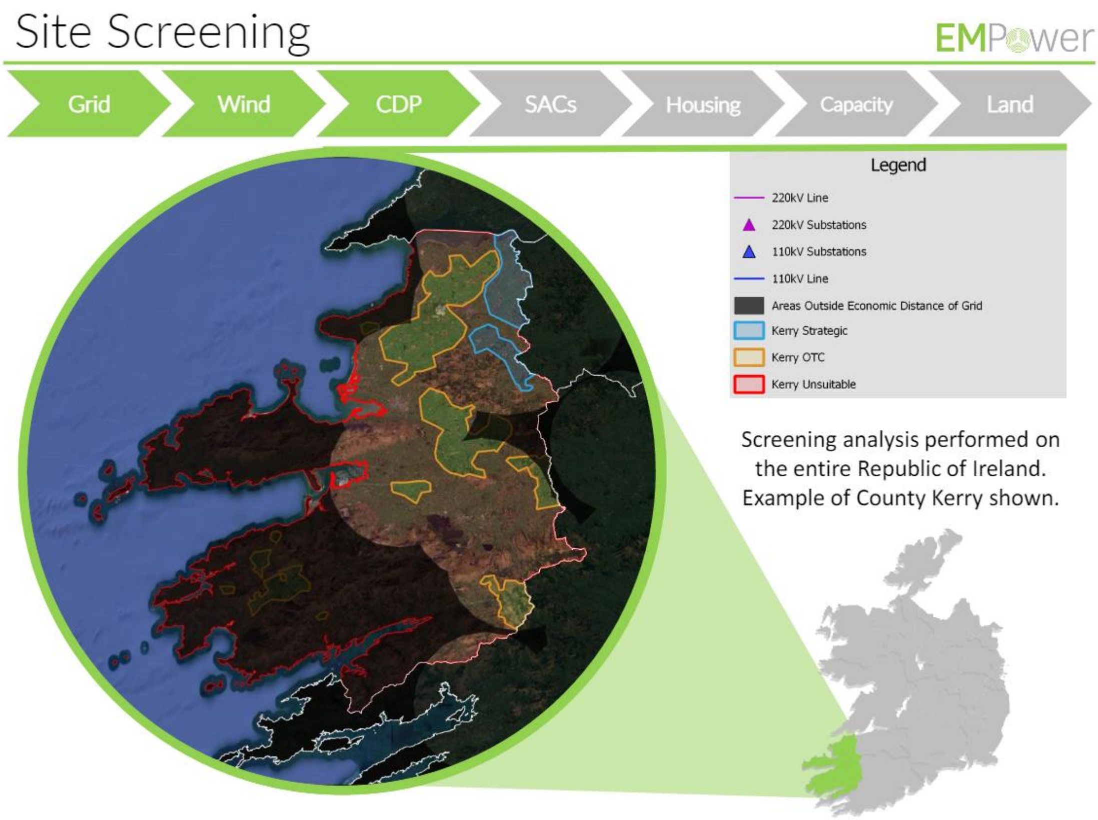


Figure 3.3 Kerry Wind Energy Strategy Areas

A crucial consideration in identifying potential site locations is environmentally protected areas. Special Protected Areas (SPA), Special Areas of Conservation (SAC), National Heritage Areas (NHA) and Proposed National Heritage Areas (PNHA), along with other environmental and cultural constraints, were identified and mapped throughout Ireland. EMPower directed its site screening outside of these protected areas. See Figure 3.4.

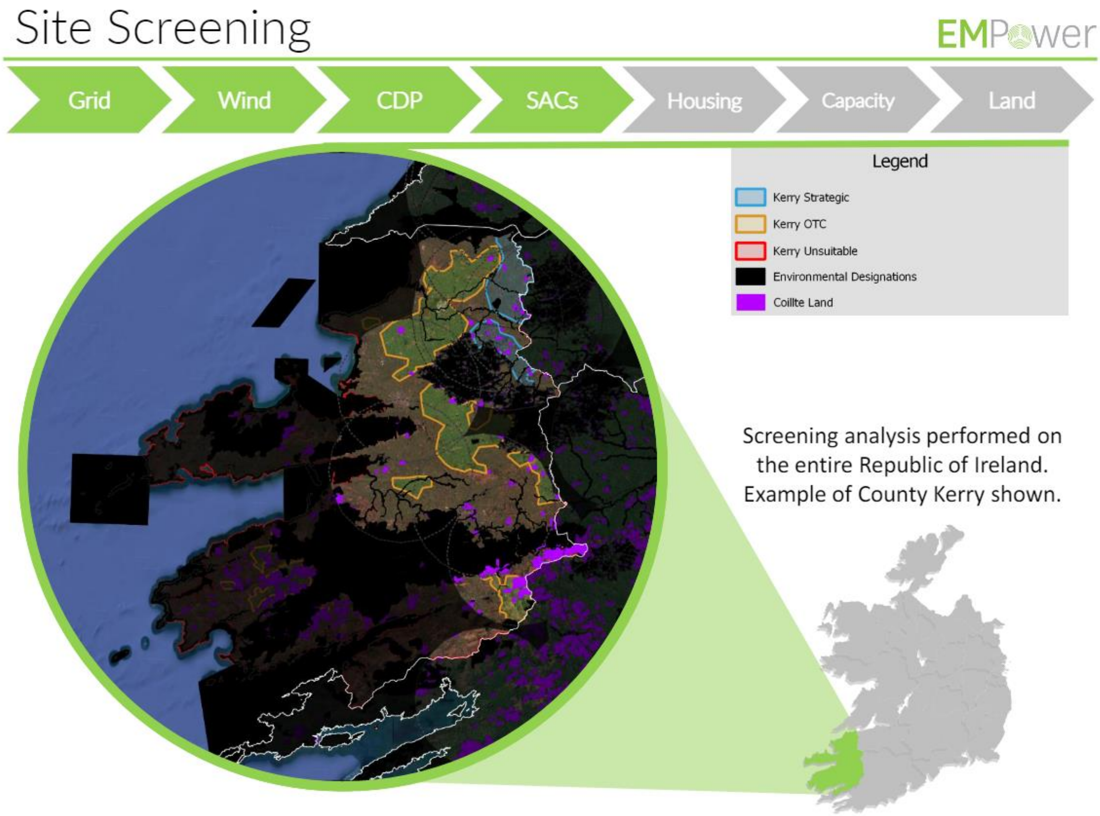


Figure 3.4 Elimination of areas with Environmental Designations

Proximity to housing proves to be a very influential constraint when identifying suitable wind development sites in Ireland. Residential and commercial building locations were attained from Eircode's database of 2.2 million address points. A buffer of 700m was applied to each building point, provisionally ensuring an adequate setback distance from each dwelling. This setback distance could later be altered based on site specific conditions, ensuring compliance with all relevant guidelines and regulations. This produced an output of multiple sites which were suitable for development according to relevant planning guidelines. See figure 3.5

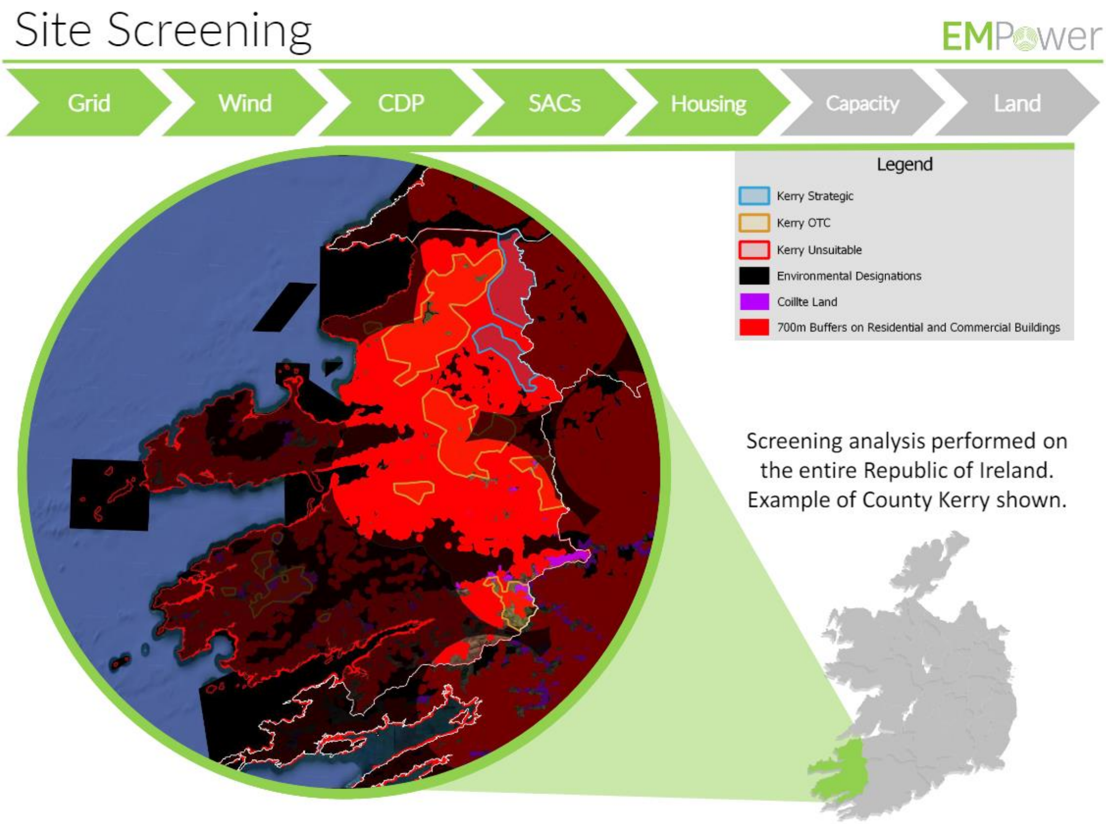


Figure 3.5 Proximity to Housing

Areas free from all identified constraints could be classed as "Buildable Areas", meaning that they would be suitable in principle for wind development according to the latest guidelines, subject to further investigation and environmental analysis. These areas are shown in green in figure 3.6.

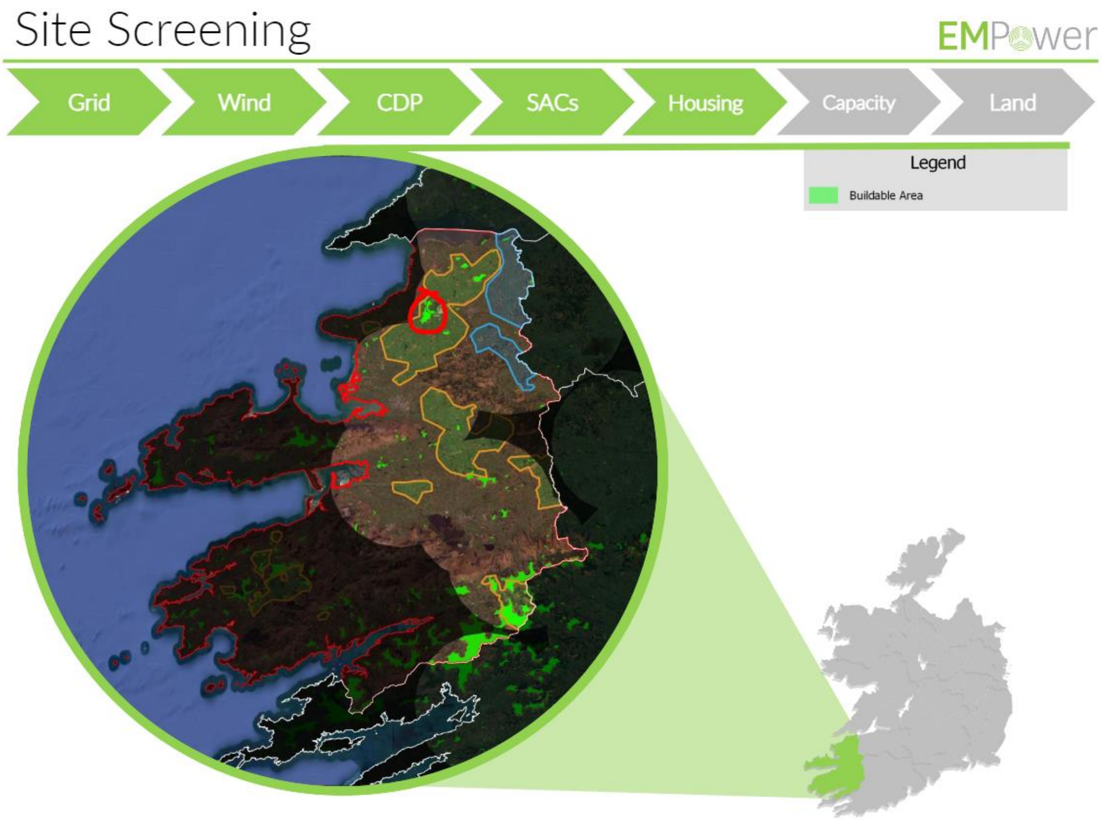


Figure 3.6 Buildable Areas

As depicted in figure 3.7, there were not sufficient “Buildable Areas” within the Strategic/Preferred zone in Kerry (KCDP 2015) after excluding all environmental designations, state lands and housing setbacks, to establish a wind farm project in-keeping with Kerry County Council and national planning guidelines. The primary issue is the housing density within these zones. Therefore, the Applicant focused primarily on areas zoned by the council as “Open to Consideration” for wind energy development.

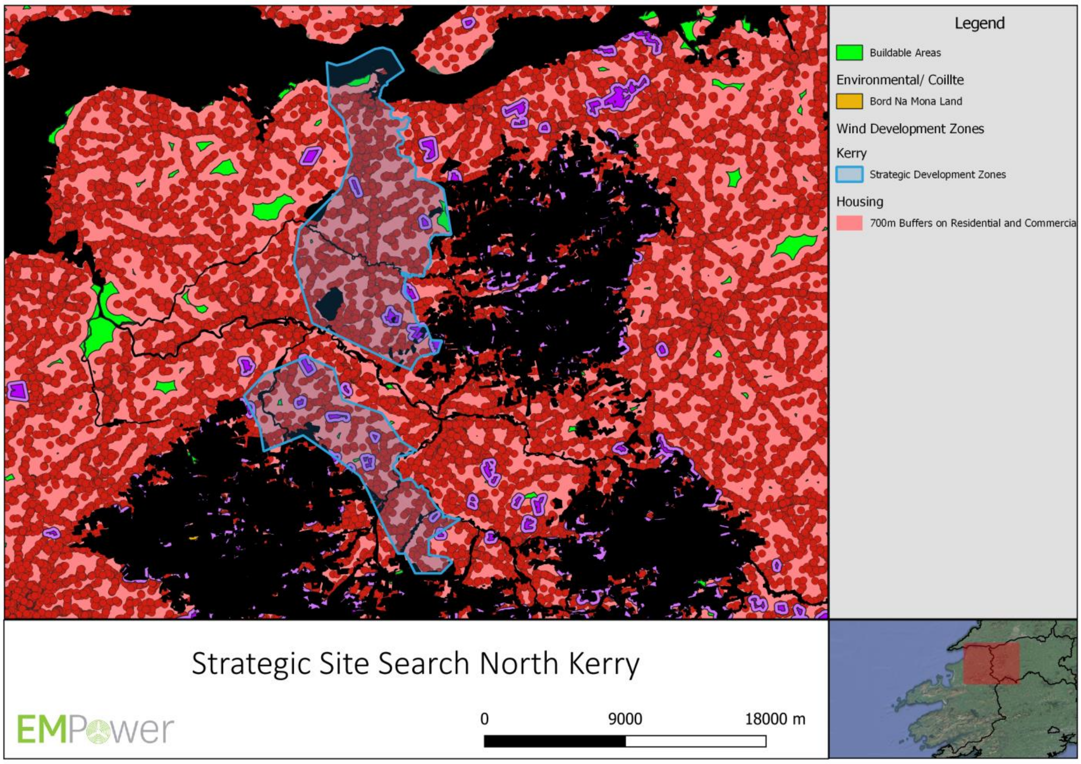


Figure 3.7 North Kerry Strategic Site Search

One such buildable area located in the Open to Consideration designation was the initial study area of the proposed Ballynagare Wind Farm, depicted in figure 3.8.

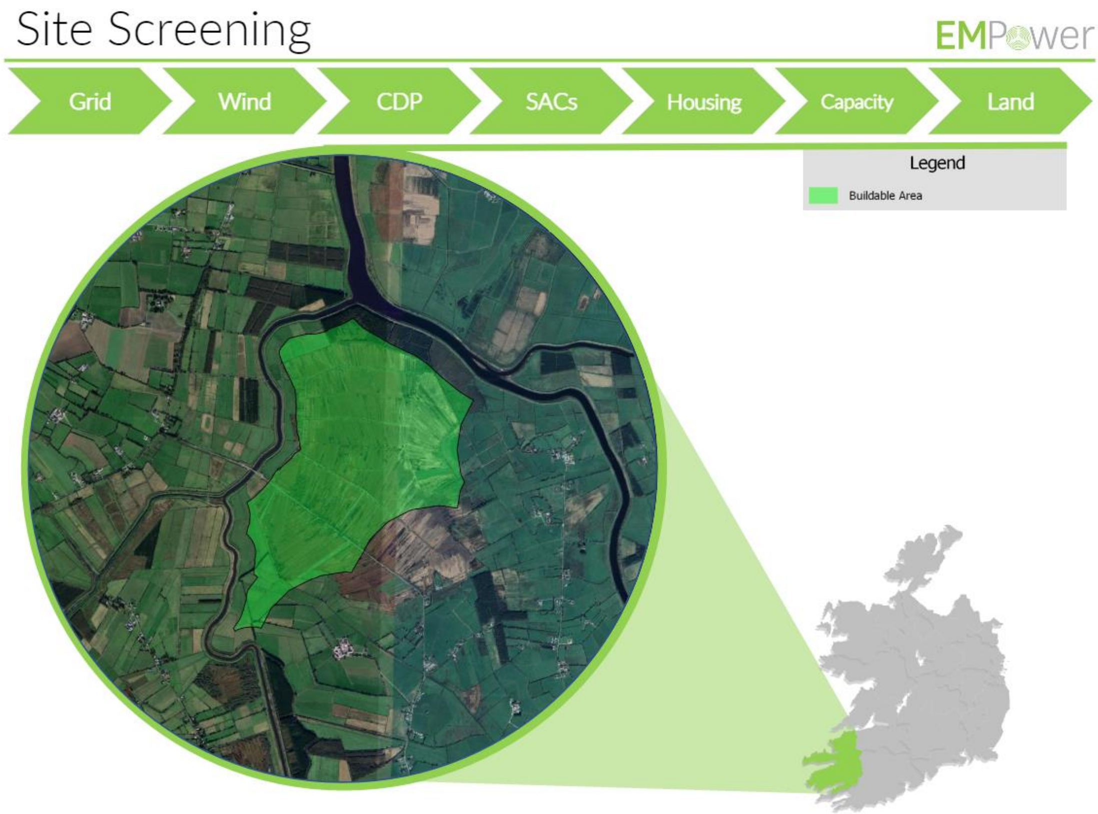


Figure 3.8 Ballynagare Initial Study Area

Based on this analysis, over 60 sites were identified throughout Ireland for further investigation. Further investigation was carried out into the environmental, grid, planning and commercial risks of numerous sites, including;

- Derrinculling, 2.5km north-east of Kilgarvan, Co. Kerry
- Ballinamoe, 3km south-west of Birr, Co.Offaly
- Clarabricken, 4km north-east of Kilkenny City
- Ballynagare, 7.5km west of Listowel, Co.Kerry

These sites are illustrated and listed in the figures below. Site visits were carried out in early 2018 to verify ground conditions, land use, transport infrastructure, potential impacts on tourism and aesthetics, as well as proximity to existing electrical substations.

After a detailed site investigation, each project was evaluated based on key characteristics, the results of which are demonstrated in the Table 3.3Table 3.3.

3.3.2 Derrincullig

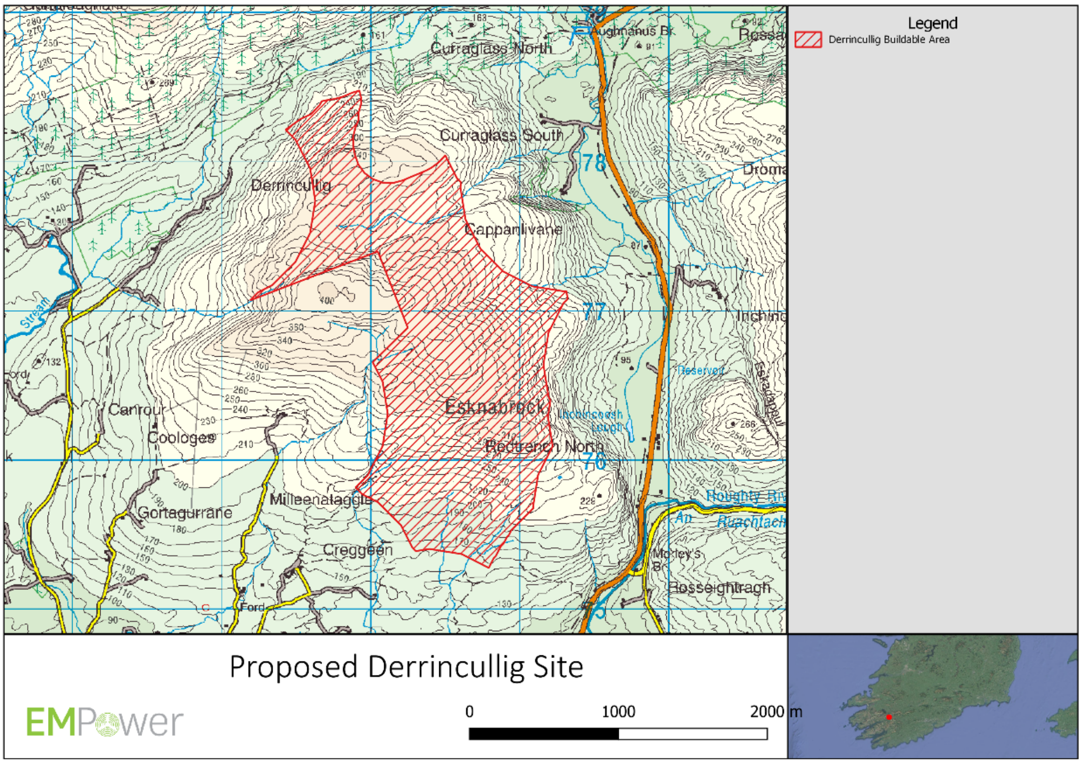


Figure 3.9 Derrincullig Site

The Derrincullig site is located within a large "Open to Consideration" area in Co. Kerry in the mountains bordering counties Kerry and Cork. This site is in the vicinity of several existing wind farms, including Coomagearlahy 1,2 and 3, Midas and Grousemount Wind Farms. There was a previous application submitted including lands within this site, which was refused by Kerry County Council and An Bord Pleanála in 2013 and 2014 respectively. Reasons cited in the refusal included the visual impact that the project would have on the landscape. Although this site is in the "Open to Consideration" zone and it may be possible to minimise the visual influence on the landscape through layout design, the Ballynagare site is deemed to be of less impact and a preferable development opportunity.

3.3.3 Ballinamoe

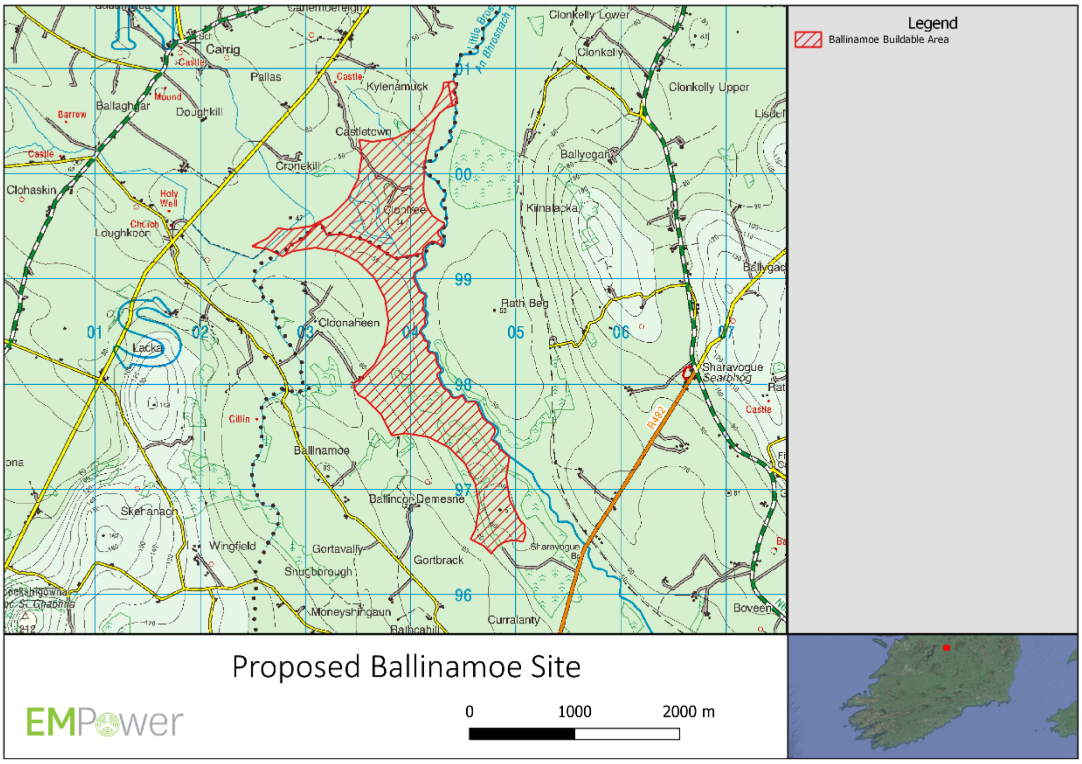


Figure 3.10 Ballinamoe Site

The Ballinamoe site is located on the border of Tipperary and Offaly, approximately 3km south-west of Birr town, Co. Offaly. The area of the site located in Offaly is within the Offaly County Development Plan's Open to Consideration area for wind energy. However, the section of the site located in Tipperary is designated as Unsuitable for wind energy, as per Tipperary's County Development Plan. Additionally, the availability of grid capacity in this area was deemed of greater risk than all other projects demonstrated in this analysis. For these reasons, the Ballynagare site is ultimately deemed to be a more acceptable planning proposal, as well as a more viable development opportunity.

3.3.4 Clarabricken

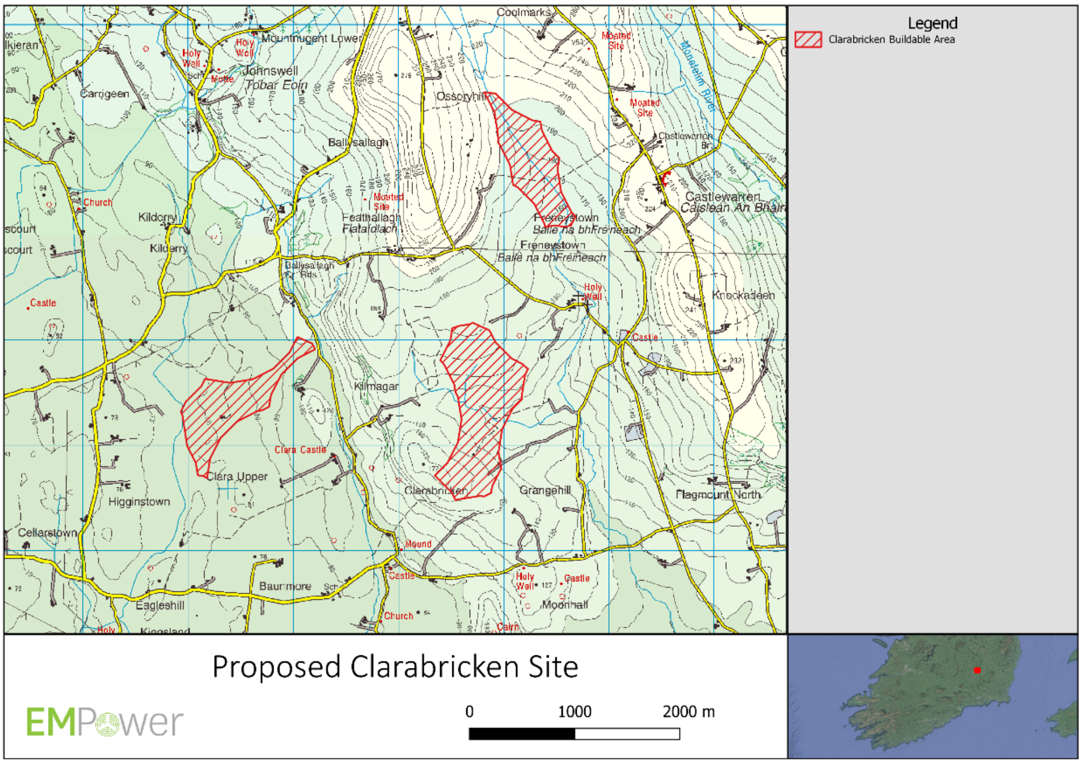


Figure 3.11 Clarabricken Site

The Clarabricken site is located approximately 4km north-east of Kilkenny City. It is located within Kilkenny County Council's "Open to Consideration" wind development zone. The site is deemed to have an adequate wind resource and is located within just 3km north of the Kilkenny 110kV substation, where available capacity is considered to exist. However, the site's buildable area does not form a contiguous block of land, instead being separated by numerous local roads and housing. This could potentially cause issues in terms of land access, as well as certain households being situated between the project's turbines resulting in a potentially greater effect on residential amenity. For this reason, as well as the project's proximity to Kilkenny City, the proposed Ballynagare Wind Farm is considered a lesser impact, technically viable alternative.

3.3.5 Ballynagare

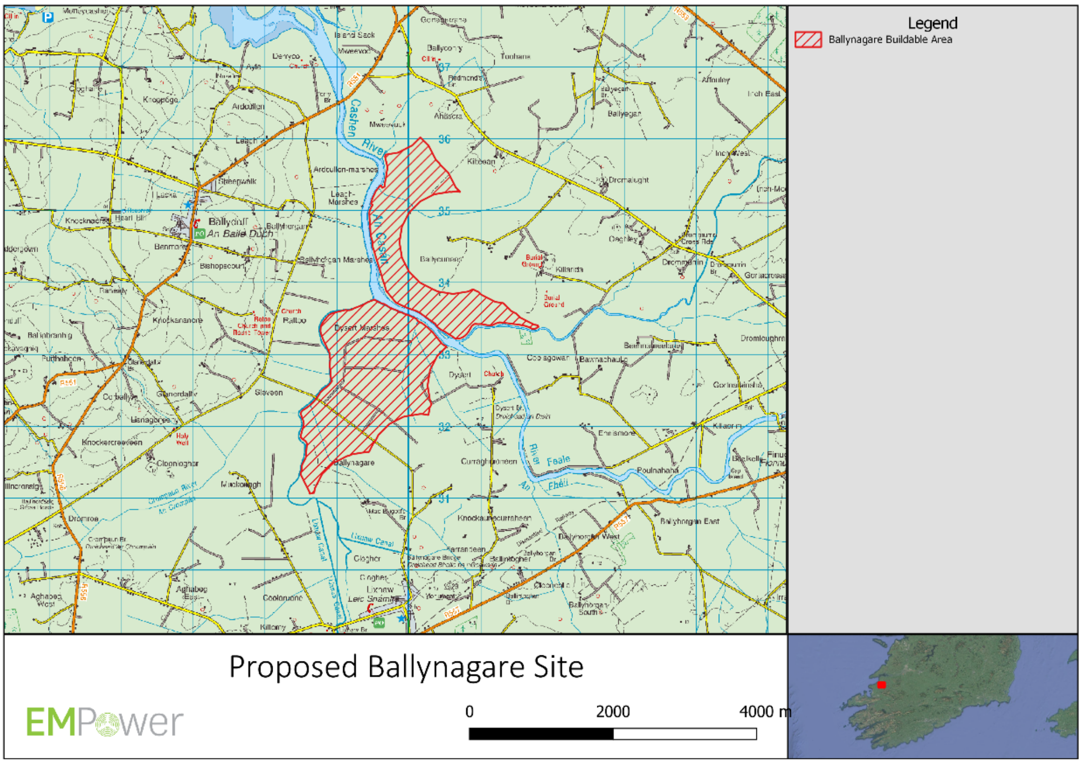


Figure 3.12 Originally Identified Ballynagare Site

The Ballynagare site is located approximately 10km west of Listowel town in North Kerry. The site is situated in a mainly flat rural landscape, with a mix of agricultural lands and areas of bog. Ballynagare's comparative advantage is demonstrated across numerous categories in Table 3.3 below. The Ballynagare site is considered to be within economic distance of existing grid infrastructure, contains an adequate wind resource to be competitive in an auction process and is capable of complying with current relevant planning and environmental guidelines. Based on the analysis completed it was deemed to impose the least impact on its receiving environmental while presenting the most viable opportunity from a technical, financial and planning perspective.

Table 3.3 EMPower - Comparative analysis of potential wind farm development sites.

	Derrinculig	**Ballinamoe**	**Clarabricken**	**Ballynagare**
County	Kerry	Offaly / Tipperary	Kilkenny	Kerry
Potential No. Turbines	10 - 13	13 - 16	9 - 12	9 - 12
Wind Dev. Zone	Open to Consideration	Open to Consideration / Unsuitable	Open to Consideration	Open to Consideration
Wind resource	Class 2	Class 2	Class 3	Class 2
Tourism	High – Situated within 2km of McGillycuddy's Reeks Mountains. Visual impact sited as reason for refusal of previous planning application on site.	Low – Not located within a high-volume tourism area.	Medium / High – Situated approximately 4km from Kilkenny City and approximately 2km from the M9 motorway.	Low – Not located within a high-volume tourism area.
Environmental Risk	Medium – Situated within 1km from McGillycuddy's Reeks SAC and 4km from Killarney National Park SPA.	Medium – Situated adjacent to Sharavogue Bog SAC, and 10km from Slieve Bloom Mountains SPA	Low – Situated 3km from River Barrow and Nore SAC.	Medium – Situated adjacent to Lower River Shannon SAC.
Grid risk	Medium – Numerous existing and under construction wind farms in the vicinity. Clonkeen substation located 7km from site.	Medium – Located 5km from Dallow 110kv Substation, thought to contain very limited capacity	Low – 3km north of Kilkenny substation where available capacity is thought to exist	Low – Tralee to Kilpadogue 110kV line runs through site, no need for underground cabling
Terrain/ land use	Mountainous, bog, agricultural	Rural general, peat harvesting, bog	Rural general, peat harvesting, bog	Rural general, bog, peat harvesting, small forestry
Housing Density	Low	Medium	Medium	Medium

The Ballynagare was examined in further detail under the following headings:

- Proximity of Existing Grid Infrastructure
- Designated Sites
- Average Wind Speeds
- Population Density

3.3.5.1 Planning Policy

The Kerry County Development Plan 2015-2021 (KCDP) is the principal policy instrument used to manage change in land use within the County. The KCDP incorporates the aims, objectives, policies and guidelines to provide for the proper planning and sustainable development of County Kerry. The (KCDP) is a spatial planning framework that gives effect to the delivery of sustainable and planned economic and social development in a manner consistent with higher level plans and strategies.

The following are key objectives provisions of the KCDP in relation to renewable energy relevant to the proposed development.

- **EP-1:**
  "Support and facilitate the sustainable provision of a reliable energy supply in the County, with emphasis on increasing energy supplies derived from renewable resources whilst seeking to protect and maintain biodiversity, archaeological and built heritage, the landscape and residential amenity."
- **EP-2**
  "Promote energy conservation through reduced consumption and incorporating renewable energy technology into building design standards."
- **EP-3:**
  "Facilitate sustainable energy infrastructure provision, so as to provide for the further physical and economic development of the County."
- **EP-7:**
  "Facilitate the sustainable development of additional electricity generation capacity throughout the region/county and to support the sustainable expansion of the network. National grid expansion is important in terms of ensuring adequacy of regional connectivity as well as facilitating the development and connectivity of sustainable renewable energy resources."

The KCDP also acknowledges that the renewable energy sector is expanding rapidly and is a growing source of employment and investment. To facilitate the sustainable growth of renewable energies Kerry County Council prepared and adopted a Renewable Energy Strategy in 2012, the KCDP states the following in relation to the Renewable Energy Strategy 2012.

> *"This strategy sets out the development criteria, development management standards and objectives for the development of renewable energy in the County and will be used in the assessment of all planning applications for such development."*

Kerry County Council adopted its current Renewable Energy Strategy (RES) as the 8th variation of the County Development Plan (2009-2015) on the 5th November, 2012. The planning authority recognises the importance of exploiting renewable energy sources in order to contribute to achieving national targets in relation to reductions in fossil fuel dependency and greenhouse gas emissions. The document recognises wind energy as the most suitable form of renewable energy to meet national targets for the consumption of electricity and continues to support the development of Wind Energy. In doing so, it identifies appropriate locations for the development of wind energy based on environmental, technical, landscape and economic considerations enabling developers to identify appropriate sites for wind energy development.

The RES's lists strategic objectives for the development of the renewable energy sector which include the following:

- **NR 7-21**
  "To maximise the development of all renewable energies at appropriate locations in a manner consistent with the proper planning and sustainable development of the county. This will include requirements and considerations in relation to: landscape; cultural heritage; Natura 2000 sites and the Habitats & Birds Directive; the objectives of the Water

Framework Directive; Flood Directive; Sustainable Forestry Management; and Best Practices in the production of energy crops"

- **NR 7-22**
  "To promote the sustainable development of renewable energy types and technologies with the capacity to store energy which can be released at times of peak demand."
- **NR 7-24**
  "To secure the maximum potential for the generation of electricity from wind energy resources that is consistent with proper planning and sustainable development of the county. This will include requirements and considerations in relation to: landscape; cultural heritage; Natura 2000 sites and the Habitats & Birds Directive; the objectives of the Water Framework Directive; Flood Directive; electricity infrastructure; settlement patterns; and wind energy potential."

When identifying key areas for wind development, a methodology of identifying environmental, landscape, technical and economic criteria were developed with a Geographical Information System (GIS). This identified four types of wind deployment zones.

- **Strategic Site Search Area** - A Strategic Area can accommodate tall turbines laid out in relatively large wind farms, within which, wind developments can benefit from economies of scale in both construction and operation. To achieve their potential these areas must be developed in a co-ordinated way. Proposals must consider the possibility of shared infrastructure and the siting of turbines in any development must consider the need to maximise the development potential of the area as a whole.
- **Open to Consideration** - Site searches within these areas will identify sites with wind energy capacity and the environmental and infrastructural capacity to support wind development. They differ from Strategic Areas in that there are fewer suitable sites. It is recommended that during the site search process, developers consult with the Planning Authority. Again the capacity of these areas has limits and the cumulative impact of wind development in these areas will be monitored
- **Areas which currently lack grid infrastructure** - These areas are within, and adjacent to the Dingle, Iveragh and Beara peninsulas. This designation will be kept under review and amended to reflect any development in grid infrastructure.
- **Unsuitable** - These areas have not been identified in the legend of the Wind Deployment Zones Map, however, these are areas that are not considered suitable for wind farm development due to their overall sensitivity, arising from landscape, ecological, recreational and/or cultural and built heritage reasons and are taken to be the areas of Kerry not identified as being in any of the previously listed areas. The HDA and SEA process has informed the identification of these areas.

Based on Map 7.6 'Renewable Energy Strategy' the proposed development site is located within an area classified as 'Open to Consideration'. There are a range of provisions within the RES that support the provision of renewable energy, including the objectives listed in Section 2.4.3.1.1 of Chapter 2 of this EIAR.

The Kerry County Development Plan fully recognises the importance of combating climate change and deriving more energy from renewable sources, it is the intention of Kerry County Council to support and facilitate the sustainable provision of a reliable energy supply in the County, with emphasis on increasing energy supplies derived from renewable resources. It is acknowledged that that the renewable energy sector is expanding rapidly and is a growing source of employment and investment. The proposed development is located within an area which under the County Development Plan is classified as 'Open to Consideration'. Furthermore, there is a range of policy in place which supports the development of renewable energy.

3.3.5.2 Existing Grid Infrastructure

The Ballynagare site is located within close proximity of 2 no. existing electricity substations and therefore a wind energy development at this location has multiple options for connection to the national electricity grid. The 110/38kV Clahane substation is located 5.1 km southwest of the candidate site boundary at its closest point. The 110/38kV Trien substation is located 12.2 km northwest of the Ballynagare site boundary.

3.3.5.3 Designated Sites

The nearest Natura 2000 site, i.e. Special Area of Conservation (SAC) or Special Protection Area (SPA), to the candidate site is the Lower River Shannon SAC, located immediately adjacent to north and west of the proposed development site.

3.3.5.4 Average Wind Speeds

The Irish Wind Atlas produced by Sustainable Energy Authority of Ireland (SEAI) shows average wind speeds for the country. With the upland nature of the landscape, the Wind Atlas shows that wind speeds on the proposed development site range from 7.0m/s to 7.2m/s at a 100m elevation. Such wind speeds indicate that this site is viable for commercial wind energy development. On-site monitoring of the wind resource, which is ongoing, will further verify that with a sufficient turbine height and blade diameter, the wind resource of the site is commercially viable.

3.3.5.5 Population Density

As described above, the Applicant sought to identify an area with a relatively low population density. Having reviewed the settlement patterns in the vicinity, the study area has emerged as suitable to accommodate the proposal. Kiltomy and Drommartin Electoral Divisions, within which all wind turbines are located for the candidate Ballynagare site, have population densities of 25.5 and 30.4 persons per square kilometre respectively. This is significantly lower than the average national population density of 69.55 persons per square kilometre.

3.3.5.6 Summary

The Ballynagare site is not situated within any environmental designations and is also located in an area with a low population density, relative to the national average, with viable annual wind speeds. This, when combined with the relatively close proximity of two existing 110/38kV substations and associated electricity transmission infrastructure, further highlights the suitability of the site as it can make further sustainable use of these established items of infrastructure.

The purpose of the site screening exercise outlined in Section 3.3.1, above, was to identify areas within the Republic of Ireland, that would be capable of accommodating a wind farm development while minimising the potential for adverse impact on the environment.

While the outcome of the site screening process has identified the site of the current proposal as a suitable location for a wind farm development of the nature proposed, it does not preclude other sites within EMPower's site screening analysis being brought forward for consideration in the future.

3.4 Alternative Turbine Numbers and Turbine Models

The proposed wind turbines will each have a potential power output of 6 megawatt (MW). It is proposed to install 7 turbines at the site which could achieve an approximate 42MW output. Such a wind farm could also be achieved on the proposed site by using smaller turbine technology (for example 4.2 MW machines). However, this would necessitate the installation of at least 10 turbines to achieve a similar output. Furthermore, the use of smaller turbines would not make efficient use of the wind resource available having regard to the nature of the site.

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

The use of alternative smaller turbines at this site would not be appropriate as they would fail to make the most efficient use of the wind resource passing over the site. Furthermore, the increased use of materials, excavation and movement of peat and increase in visual impact associated with a larger number of smaller turbines would result in a higher level of negative environmental effects than the chosen option.

It should be noted that the turbine model to be installed on the site will be the subject of a competitive tendering process. The maximum height of the turbines that will be selected for construction on the site will be between 169.5 and 170 metres when measured from ground level to blade tip. The rotor diameter will be between 149 and 150 metres. For the purposes of this EIAR a range of turbines within this size envelope has been assessed (e.g. tallest turbine within defined range has been assessed for visual impact, widest rotor diameter within the defined range has been assessed for shadow flicker etc.). The EIAR therefore provides a robust assessment of the turbines that could be considered within the overall development description.

A comparison of the potential environmental effects of the installation of a larger number of smaller wind turbines when compared against the chosen option of installing a smaller number of larger wind turbines are presented in Table 3.4 below.

Table 3.4 Comparison of environmental effects when compared against the chosen option (larger wind turbines)

Environmental Consideration	Larger number of smaller turbine models
Population & Human Health (incl. Shadow Flicker)	Greater potential for shadow flicker impacts on nearby sensitive receptors due to the increased number of turbines.
Biodiversity & Ornithology	Larger development footprint would result in greater habitat loss. Greater potential collision risk for birds due to the presence of more turbines.
Land, Soils & Geology	Larger development footprint would result in greater volumes of peat and spoil to be excavated and managed.
Geotechnical	Neutral
Water	Larger development footprint, therefore, increasing the potential for silt laden runoff to enter receiving watercourses.
Air & Climate	Increased potential for vehicle emissions and dust emissions due to an increased volume of construction material and turbine component deliveries to the site.

Noise & Vibration	Potential for increased noise impacts on nearby sensitive receptors due to reduced separation distance between residential dwellings and turbine locations.
Landscape & Visual	A larger number of turbines would have a greater landscape and visual impact.
Cultural Heritage & Archaeology	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.
Material Assets	Potential for greater traffic volumes during construction phase due to larger development footprint and requirement for more construction materials and turbine components.

3.5 Alternative Turbine Layout and Development Design

The design of the proposed development has been an informed and collaborative process from the outset, involving the designers, developers, engineers, environmental, hydrological and geotechnical, archaeological specialists and traffic consultants. The design process has also taken account of the recommendations and comments of the relevant statutory and non-statutory organisations, near neighbours / the local community and local authorities as detailed in Section 2.6 of Chapter 2.

The aim of the process being to reduce the potential for environmental effects while designing a project capable of being constructed and viable.

Throughout the preparation of the EIAR, the layout of the proposed development has been revised and refined to take account of the findings of all site investigations, baseline assessments and external feedback received which have brought the design from its first initial layout to the current proposed layout.

3.5.1 Detailed Constraints Mapping

The design and layout of the proposed wind energy development follows the recommendations and guidelines set out in the 'Wind Energy Development Guidelines' (Department of the Environment, Heritage and Local Government, 2006) and the 'Best Practice Guidelines for the Irish Wind Energy Industry' (Irish Wind Energy Association, 2008).

The 'Wind Energy Development Guidelines for Planning Authorities' (DoEHLG, 2006) are currently the subject of a targeted review. The proposed changes to the development management standards associated with onshore wind energy developments are outlined in the Draft Revised Wind Energy Development Guidelines, December 2019 (Draft WEGs 2019).

The constraints mapping process involves the placing of buffers around different types of constraints so as to identify clearly the areas within which no development works will take place if possible. The size of the buffer zone for each constraint has been assigned using guidance presented in the wind energy guidance documents listed above. The constraints maps for the site encompasses the following constraints and associated buffers:

- Residential dwellings plus a minimum 700 metre buffer (exceeding the requirement of 4 x tip height separation distance as required by the Draft WEGs 2019);
- Designated sites plus 100 metre buffer;
- Rivers and streams plus 50 metre buffer;

- Recorded Archaeological Sites and Monuments plus 50 metre buffer.
- Telecommunications buffer plus operator-specific buffer;
- Existing wind turbines plus 4 x rotor diameter buffer.

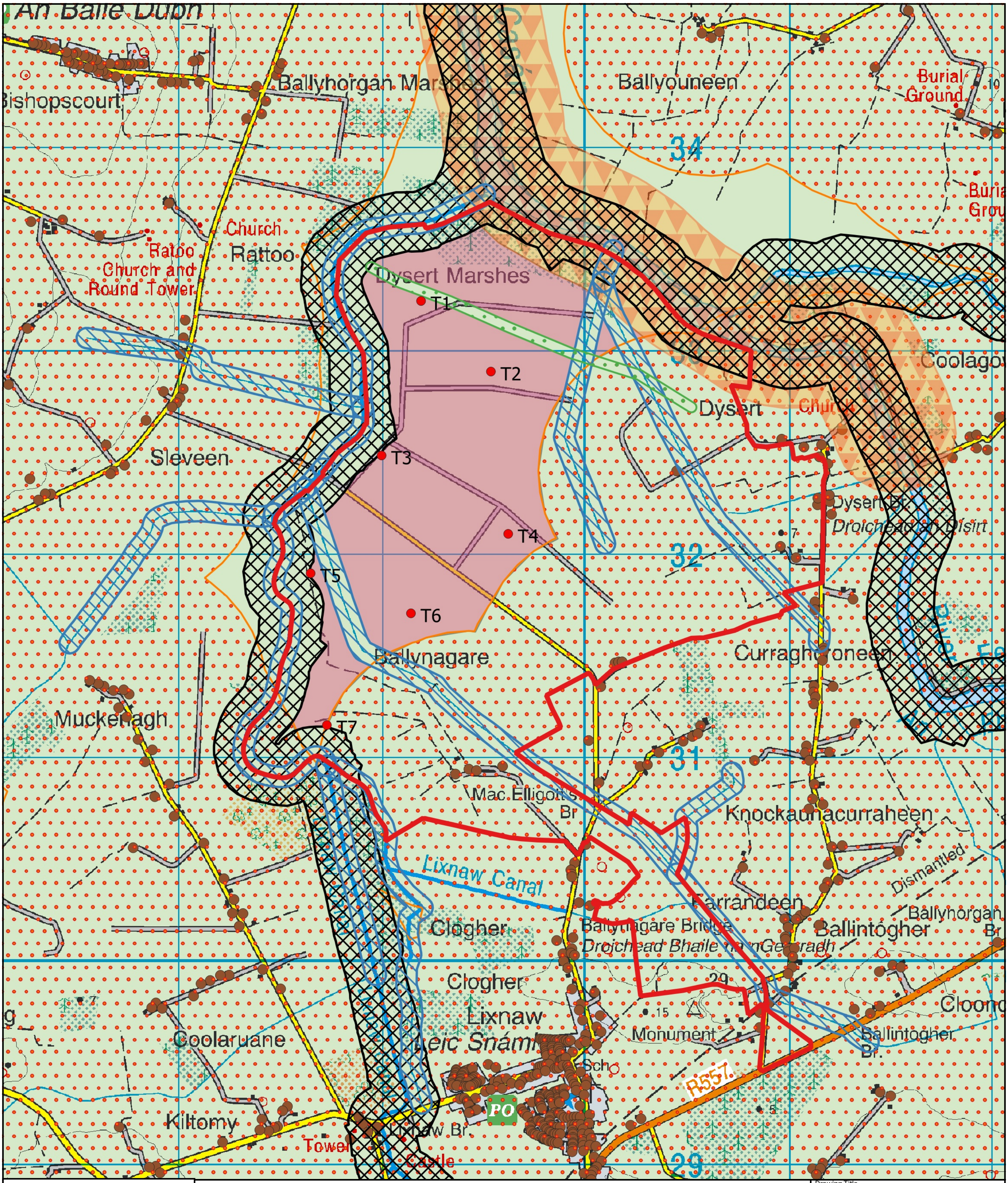
Facilitators at the site build on the existing advantages and include the following:

- Available lands for development;
- Good wind resource;
- Existing access points and general accessibility of all areas of the site due to existing road infrastructure; and
- Limited extent of constraints.

The inclusion of the detailed, combined constraints on a map of the EIAR Study Area allows for a viable area to be identified as shown in Figure 3.13.

A turbine layout was then developed to take account of all the constraints mentioned above including their associated buffer zones and the separation distance required between them.

Following the mapping of all known constraints described above, detailed site investigations were carried out by the project team. The ecological assessment of the site encompassed habitat mapping and extensive surveying of birds and other fauna. These assessments, as described in Chapters 6 and 7 of this EIAR, informed the decision on the siting of turbines and the carrying out of any development works, such as the construction of roads. The hydrological and geotechnical investigations of the site examined the proposed locations for turbines, roads and other components of the proposed development, such as the substation and the construction compound. Where specific areas were deemed as being unsuitable for the siting of turbines or roads, etc., alternative infrastructure locations within the Ballynagare site were proposed and assessed, taking into account the areas that were already ruled out of consideration. The turbine layout for the proposed wind farm was also informed by wind data and the results of noise assessments as they became available.



Map Legend

- EIAR Study Area
- 50m Stream Buffer
- 680m Buffer from Dwellings
- 125m Buffer from SAC
- Dwellings
- 300m Buffer from Whooper Swan Flocks
- 25m Buffer from Togher
- Viable Area for Turbines

N

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Drawing Title: Detailed Constraints Map	
Project Title: Ballynagare Wind Farm	
Drawn By: TB	Checked By: MW
Project No.: 200512	Drawing No.: Figure 3.13
Scale: 1:25000	Date: 13.10.2021

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3.5.2 Turbine Layout

The final proposed turbine layout takes account of all site constraints and the distances to be maintained between turbines and from houses, roads, etc. The layout is based on a combination of the results of all site investigations that have been carried out during the EIAR process, the community engagement process that began in November 2020 and the scoping with statutory and non-statutory consultees. As information regarding the available land was compiled and assessed, the proposed layout has been revised and amended to take account of the physical constraints of the site and the requirement for buffer zones and other areas in which no turbines could be located, availability of land as well as cumulative impacts.

The selection of turbine and layout has also had regard to wind-take, noise and shadow flicker impacts and the separation distance to be maintained between turbines. The EIAR and wind farm design process was an iterative process, where findings at each stage of the assessment were used to further refine the turbine layout, always with the intention of minimising the potential for environmental impacts.

There were a number of reviews of the specific locations of the various turbines during the optimisation of the site layout. The initial constraints and site screening study identified a significant buildable area to the north and east of the River Feale, primarily in the area of Ballyouneen, as well as to the south in the areas of Dysert Marshes and Ballynagare. The total buildable area was considered potentially suitable for up to 16 no. turbines (a cluster of 10 no. turbines to the south of the River Feale and a cluster of 6 turbines to the north). This buildable area is shown in Figure 3.14.

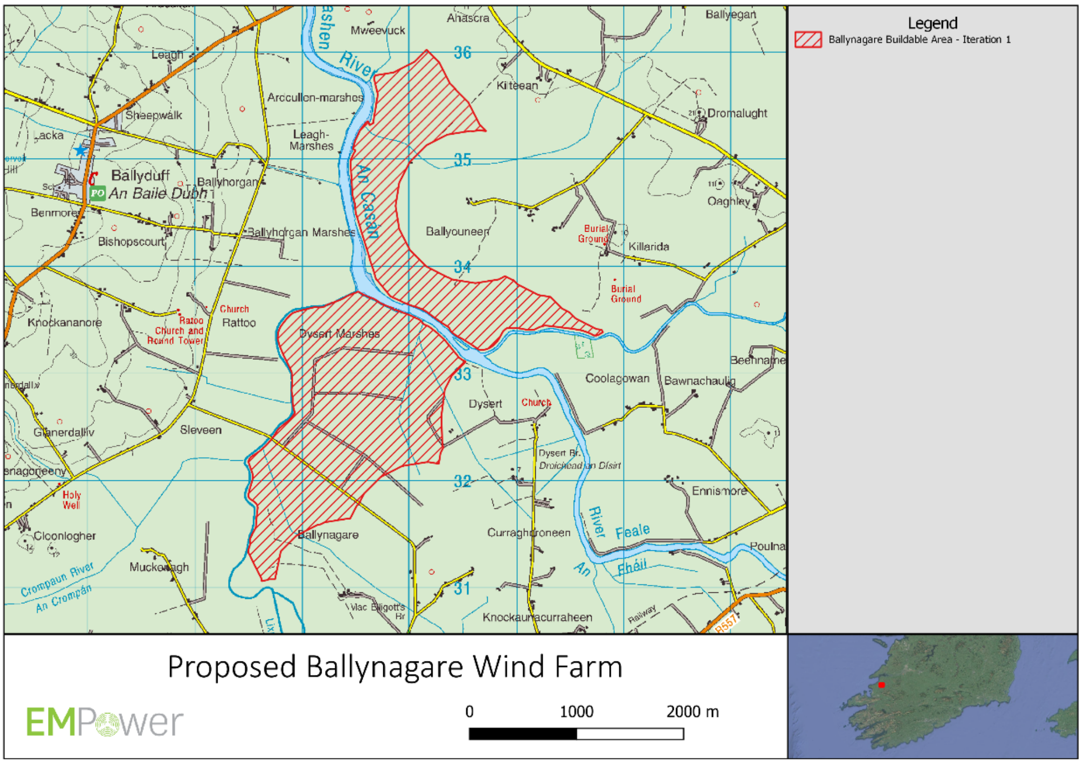


Figure 3.14 Initial Site Buildable Area

Following one year of ornithological surveys and analysis, the decision was made to exclude the northern buildable area from further development. This decision was taken proactively in the interest of mitigating impacts on the population of Whooper Swan observed to be active in this area during the winter months. This practice of mitigation through design was consistently used throughout the iterative layout development, as new information became available from environmental studies and key stakeholders.

The reduced Buildable Area of the proposed Ballynagare site is illustrated in Figure 3.15. This proposed site extents was presented to the local community at the initial Public Consultation Webinar in December 2020. Valuable feedback was received during this initial community consultation which informed the iterative layout design.

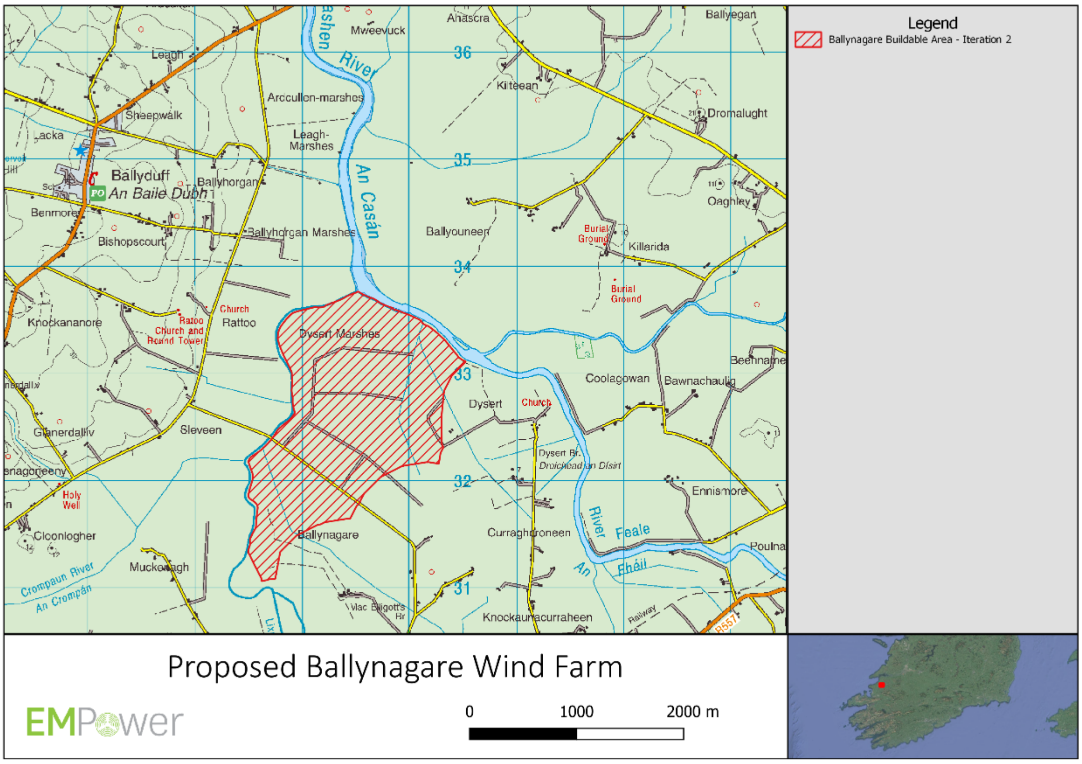


Figure 3.15 Second Iteration of the Buildable Area

The first iteration of the wind turbine layout was developed within the bounds of the reduced Buildable Area and taking account of the initial constraints analysis conducted on the proposed site. A total of ten turbines were considered constructable on the townlands of Ballynagare, Dysert, Dysert Marshes and Curraghcroneen. This design, which is illustrated in Figure 3.16, was presented to key stakeholders and the local community in March 2021.

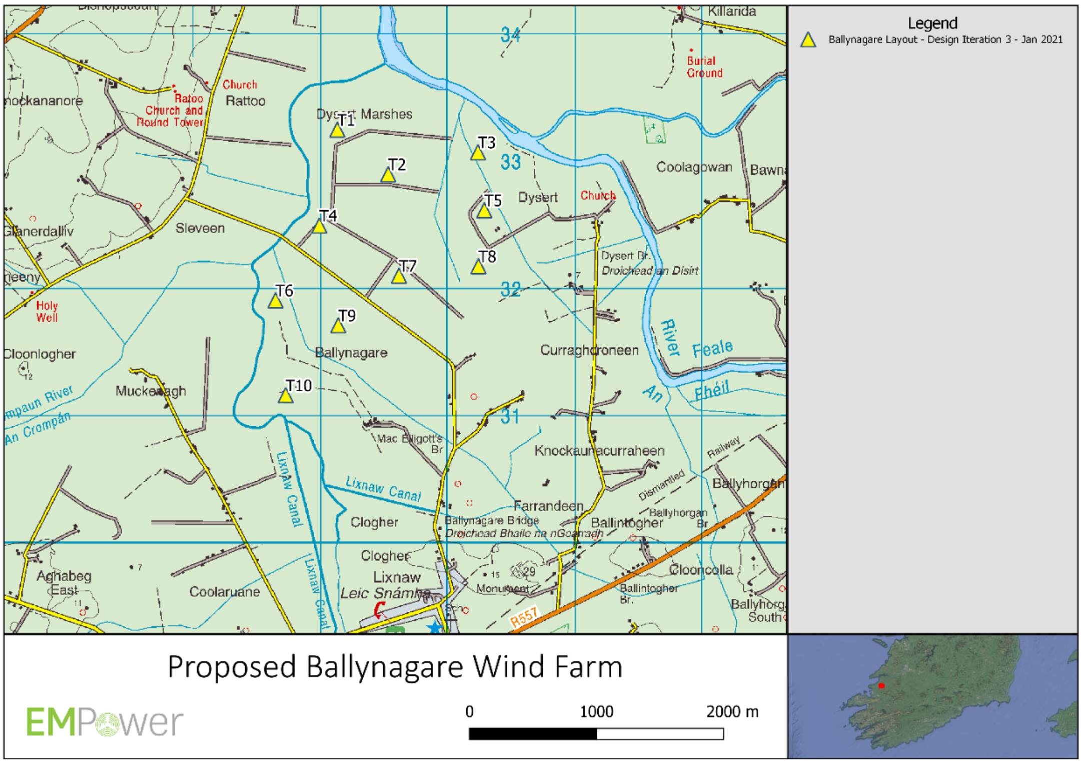


Figure 3.16 First Iteration of Wind Turbine Layout

The turbine layout was further refined and a connected road network proposed in April 2021. While solving the need to connect all project turbines with the existing local road network, the initial internal roads layout was primarily based on land availability. As a result of developing and optimising this initial road design to a constructable configuration, minor adjustments were made to turbine positions and hardstand orientations. The initial internal roads layout is demonstrated in Figure 3.17.

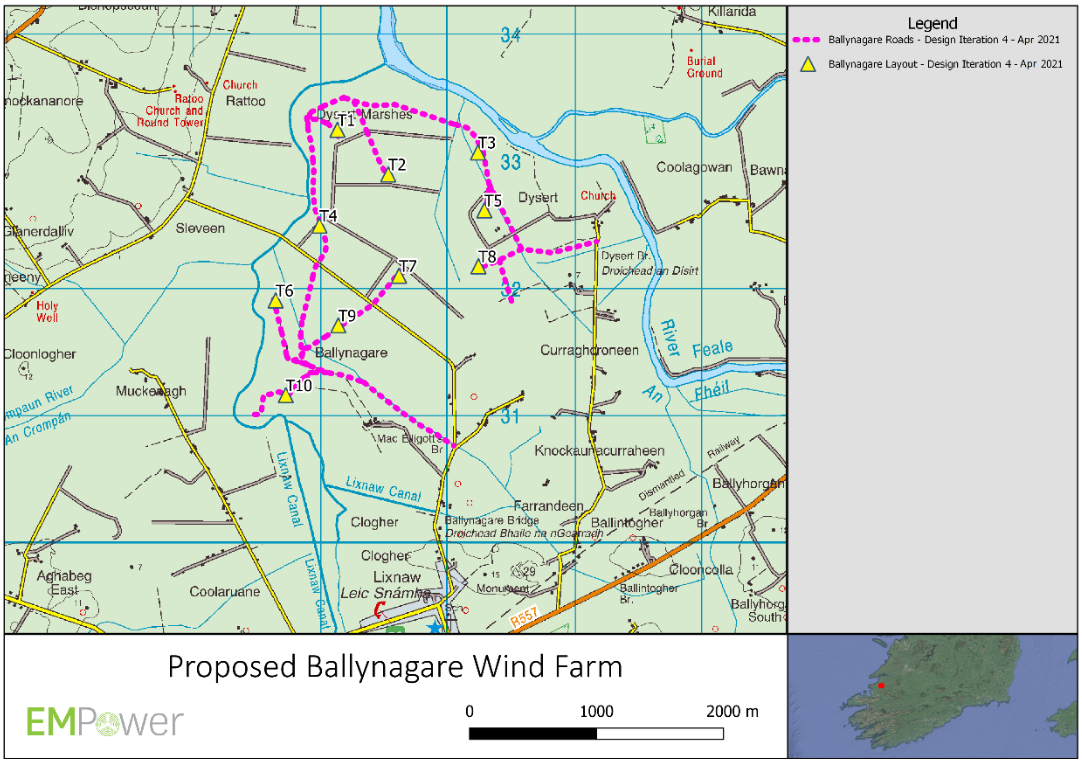


Figure 3.17 Second Iteration of Wind Turbine Layout

In May 2021, the Applicant made the decision to reduce the Proposed Ballynagare Wind Farm to 7 turbines by removing the 3 most easterly turbines from the development. This decision served to increase the distance from the nearest Ballynagare project turbine to the Whooper Swan grazing areas north of the River Feale from approximately 300m to over 600m. This adjustment also served to increase the distance of the Project's turbines from residents of Dysert and Curraghcroneen areas, and thereby further mitigating potential impacts of the proposed wind farm for these communities. Furthermore, the associated revision to the internal roads design avoids the need to use local road to Currughcroneen for component delivery or construction traffic. This updated roads layout allowed the Project Site to connect directly to the R-557.

Potential impacts on local avian species, proximity to housing and the potential impacts arising from the use of local roads were among the key concerns raised in the public consultation process. The exclusion of the three most easterly turbines helps to mitigate these potential impacts and demonstrates the value the local community's input during the project design phase.

The updated 7-turbine layout is illustrated in Figure 3.18.

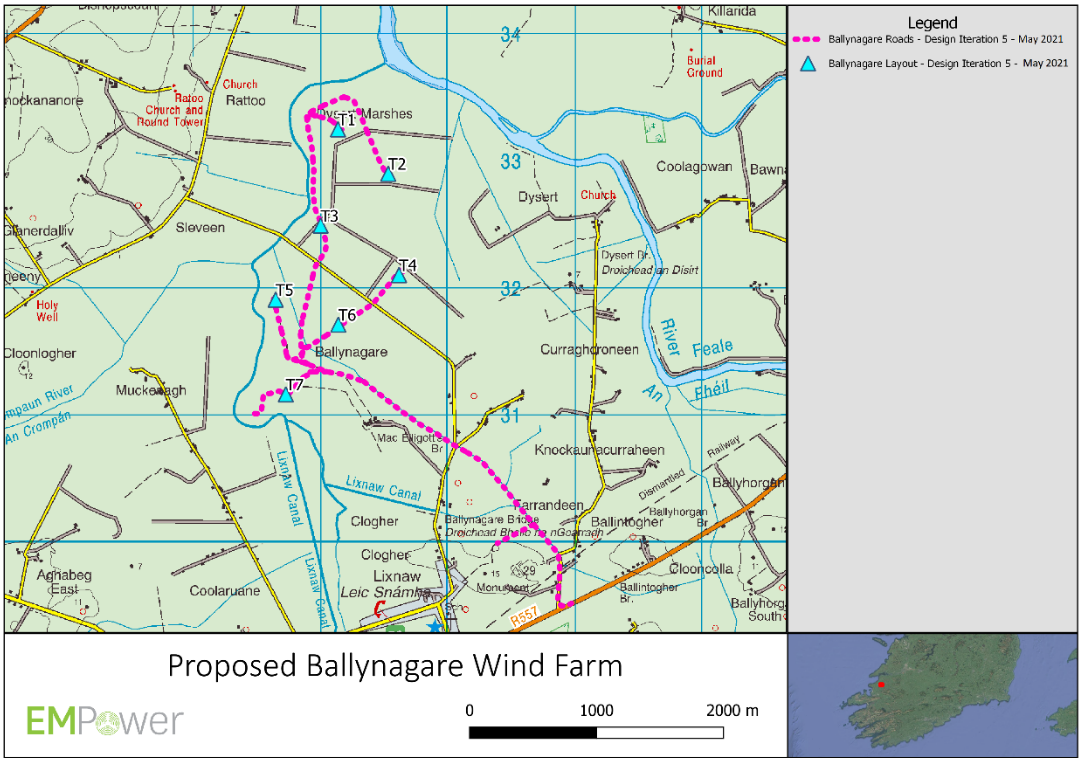


Figure 3.18 Third Iteration of Wind Turbine Layout

Further slight adjustments were made to the turbine layout, including the micro-siting of turbines and hardstands, in June 2021, following an engineering review. The final (fourth iteration) proposed layout is shown in Figure 3.19, below.

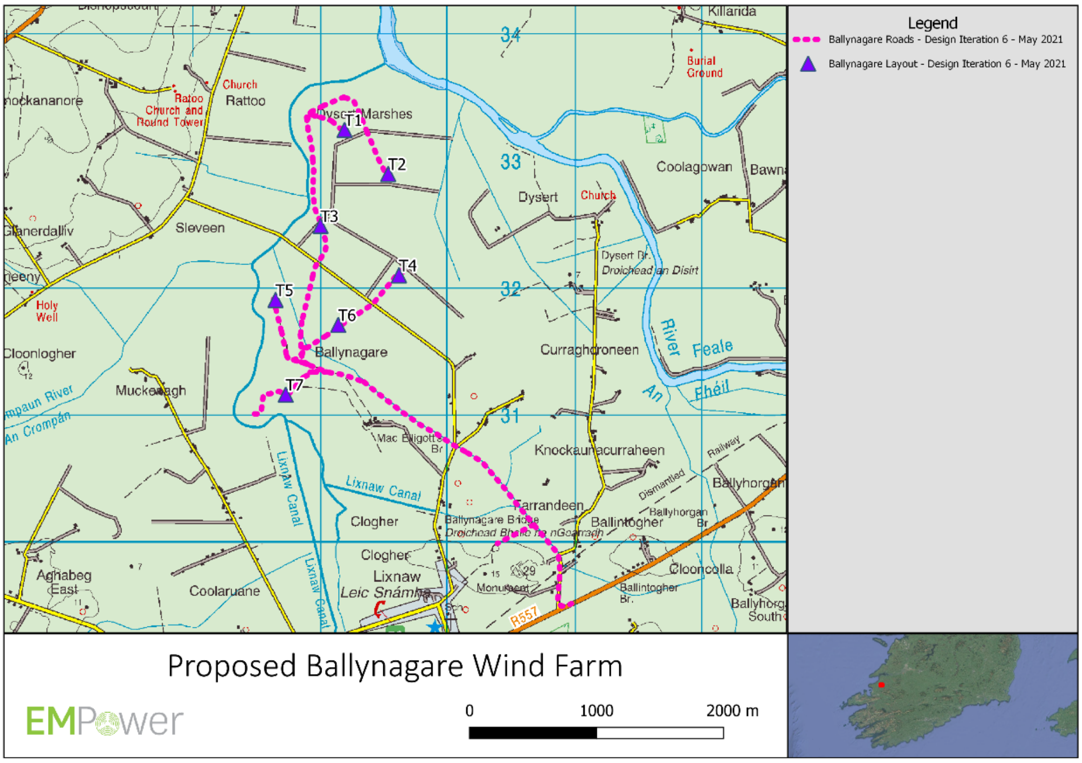


Figure 3.19 Forth Iteration of Wind Turbine Layout

A comparison of the potential environmental effects of initial site buildable area (16 turbine) and first iterations (10 turbines) of the turbine layout as compared against the final turbine layout (7 turbines) are presented in Table 3.5 below.

Table 3.5 Comparison of environmental effects when compared against the chosen option (final turbine layout)

Environmental Consideration	16-Turbine Layout	10-Turbine Layout
Population & Human Health (incl. Shadow Flicker)	No material environmental difference for population or human health. Potential for increased shadow flicker duration at nearby sensitive receptors.	No material environmental difference for population or human health. Potential for increased shadow flicker duration at nearby sensitive receptors.
Biodiversity & Ornithology	Greater risk of impacts to Whooper Swan species observed to be active in winter months in area of Ballyouneen. Larger development footprint would have resulted in reduced habitat loss within the constrained-out area i.e. viable area. Slightly increased collision risk or bird species due to greater number of turbines.	Slightly greater risk of impacts to Whooper Swan given a lesser distance to the grazing area in Ballyouneen. Larger development footprint would have resulted in reduced habitat loss within the constrained-out area i.e. viable area. Slightly increased collision risk or bird species due to greater number of turbines.
Land, Soils & Geology	Larger development footprint would lead to an increase in peat and spoil volumes to be excavated and would require more crushed stone to be extracted for construction.	Larger development footprint would lead to an increase in peat and spoil volumes to be excavated and would require more crushed stone to be extracted for construction.
Geotechnical	Overall, no significant environmental difference.	Overall, no significant environmental difference.
Water	Neutral	Neutral
Air & Climate	More turbines would have maximised the use of the latent wind resource of the site and the opportunity to further reduce the country's dependence on fossil fuels.	More turbines would have maximised the use of the latent wind resource of the site and the opportunity to further reduce the country's dependence on fossil fuels.
Noise & Vibration	Potential for greater noise impacts due to reduced separation distance between turbines and closest sensitive receptors.	Potential for greater noise impacts due to reduced separation distance between turbines and closest sensitive receptors.

Landscape & Visual	Potential for greater visual impacts due to the wider visual extent of the proposed turbines.	Potential for greater visual impacts due to the wider visual extent of the proposed turbines.
Cultural Heritage & Archaeology	No material environmental difference for cultural heritage.	No material environmental difference for cultural heritage.
Material Assets	Larger development footprint would lead to an increase in construction traffic volumes and traffic impacts across a greater extent of the public road network.	Larger development footprint would lead to an increase in construction traffic volumes and traffic impacts across a greater extent of the public road network.

3.5.3 Road Layout

Access tracks are required onsite in order to enable transport of infrastructure and construction materials within the proposed development. Such tracks must be of a gradient and width sufficient to allow safe movement of equipment and vehicles. It was decided at an early stage during the design of the proposed development that maximum use would be made of existing roadways and tracks, where available and where possible, to minimise the potential for impacts by using new roads as an alternative. Given the land ownership constraints of the site, this was not always possible.

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

An alternative option to making maximum use of the existing road network within the site would be to construct an entirely new road network, having no regard to existing roads or tracks. This approach was not favourable, as it would create the potential for additional significant environmental effects to occur in relation to land, soils and geology (increased excavation and aggregate requirements), hydrology (increased number of new watercourse crossings) and biodiversity (increased habitat loss).

A comparison of the potential environmental effects of constructing an entirely new road network when compared against maximising the use of the existing road network is presented in Table 3-6 below.

Table 3.6 Comparison of environmental effects when compared against the chosen option (maximising the use of the existing road network)

Environmental Consideration	New Road Network
Population & Human Health (incl. Shadow Flicker)	Neutral
Biodiversity & Ornithology	Larger, new development footprint would result in greater habitat loss.
Land, Soils & Geology	Larger, new development footprint would result in greater volumes of peat and spoil to be excavated and stored. Larger volume of stone required from on-site borrow pit and off-site quarries for road construction.
Geotechnical	Neutral
Water	Larger, new development footprint and increased number of new watercourse crossings, therefore, increasing the potential for silt laden runoff to enter receiving watercourses.
Air & Climate	Potential for greater dust emissions due to the requirement of an increased volume of stone from the on-site borrow pit and off-site quarries. Potential for greater vehicular emissions due to an increased volume of construction traffic.
Noise & Vibration	Potential for increased noise impacts on nearby sensitive receptors during the construction of the new roads.
Landscape & Visual	Potential for greater visual and landscape impacts due to the construction of an entirely new network of roads.
Cultural Heritage & Archaeology	Larger, new development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.
Material Assets	Potential for greater traffic volumes during construction phase due to larger, new development footprint and requirement for more construction materials.

3.5.4 Location of Ancillary Structures

The ancillary infrastructure required for the construction and operation of the proposed development include temporary construction compounds, an electricity substation and associated grid connection and borrow pit.

3.5.4.1 Construction Compounds

The two proposed construction compounds will be used for the storage of all construction materials and turbine components. The use of multiple temporary construction was deemed preferable to the alternative of a single large compound at the site for a number of reasons. Principally, it will facilitate more efficient construction practices and will result in shorter distances for traffic movements within the site during construction. As a result, vehicle emissions and the potential for dust arising will be reduced.

A comparison of the potential environmental effects of constructing a single, large construction compound when compared against constructing multiple, smaller compounds is presented in Table 3-7 below.

Table 3.7 Comparison of environmental effects when compared against the chosen option (multiple construction compounds)

Environmental Consideration	Single Large Construction Compound
Population & Human Health (incl. Shadow Flicker)	Potential for increased vehicular and dust emissions from longer distance of traffic movements within the site which could have adverse health effects.
Biodiversity & Ornithology	Neutral
Land, Soils & Geology	Neutral
Geotechnical	Neutral
Water	Neutral
Air & Climate	Potential for increased vehicular and dust emissions from longer distance of traffic movements within the site.
Noise & Vibration	Potential for increased noise impacts on nearby sensitive receptors due to longer distance of traffic movements within the site.
Landscape & Visual	Neutral
Cultural Heritage & Archaeology	Neutral
Material Assets	Less efficient construction practices due to longer movements of construction vehicles, plant and materials within the site.

3.5.4.2 Electricity Substation

The selection of the location of the on-site substation has had regard to the constraints of the site, outlined in Section 3.5.1 above. Ease of access and ensuring a suitable setback from turbine locations was also taken into consideration. It should also be noted that while the operational lifespan of the proposed turbines is expected to be 35 years, the electricity substation and associated infrastructure will become an ESB Networks asset. This will be a permanent feature of the proposal as it will continue to form part of the electrical infrastructure of the area in the event of the remainder of the site being decommissioned.

One alternative substation location was considered at a very early stage of the design of the proposed development, as shown in Figure 3-5. While this alternative location was more centrally located within the site and would have slightly decreased the length of internal cabling between the turbines and the substation, it would have led to an increase in the length of grid connection cabling to the nearest existing substations. This location also would have required cabling to be run along the local road to Curraghcroneen, which would have created traffic impacts for the local road users. In addition, this location would have required the importation of fill in order to raise the substation above the appropriate flood level as per ESB specifications.

A comparison of the potential environmental effects of the alternative location when compared against chosen location is presented in Table 3.8 below.

Table 3.8 Comparison of environmental effects when compared against the chosen option

Environmental Consideration	Alternative Substation Location
Population & Human Health (incl. Shadow Flicker)	Potential for increased vehicular and dust emissions from increased traffic movements within the site, due to the volume of rock to be fill material required, which could have adverse health effects.
Biodiversity & Ornithology	neutral
Land, Soils & Geology	Increased volume of peat and spoil to be excavated due presence of peat soils and longer cable run.
Geotechnical	Presence of peat which would need to be excavated and removed for permanent storage.
Water	Increased potential for silt laden runoff to enter watercourses due to the additional footprint required to build up the substation base to above the 1000 year flood level.
Air & Climate	Potential for increased vehicular and dust emissions from increased traffic movements within the site, due to the volume of fill material required.
Noise & Vibration	Potential for increased noise impacts during construction phase on nearby sensitive receptors due to additional earthwork requirements.
Landscape & Visual	Neutral
Cultural Heritage & Archaeology	Neutral
Material Assets	Potential for greater traffic volumes during construction phase due to larger development footprint and requirement for more construction materials.

3.5.4.3 Grid Connection

A key consideration in determining the grid connection method for a proposed wind energy development is whether the cabling is undergrounded or run as an overhead line. While overhead lines are less expensive and allow for easier repairs when required, underground lines will have no visual impact. For this reason, it was considered that underground lines would be a preferable alternative to overhead lines. The draft Wind Energy Guidelines 2019 also indicate that underground cables are the preferred option for connection of a wind energy development to the national grid. Objective EP-8 of the KCDP states that it is an objective of the Council to:

- **EP-8**
  "Ensure that the siting of electricity power lines is managed in terms of the physical and visual impact of these lines on both the natural and built environment, the conservation value of Natura 2000 sites and especially in sensitive landscape areas. When considering the siting of powerlines in these areas the main technical alternatives considered should be set out, with particular emphasis on the undergrounding of lines, and the identification of alternative routes at appropriate locations. It should be demonstrated that the development will not have significant, permanent, adverse effects on the environment including sensitive landscape areas and the ecological integrity of Natura 2000 sites."

The output of the windfarm is such that it will be capable of connecting to a 38kV substation. There are 2 no. existing 38kV electricity substations located within 15km of the proposed development site, namely:

- Clahane 110 / 38kV Electricity Substation
- Triene 110 / 38kV Electricity Substation

Therefore, underground grid connection cabling routes to each of these existing substations were identified and brought forward for further analysis

The two routes considered are shown in Figure 3.20 and are detailed below.

Option A is an underground cabling route connecting the proposed onsite substation to the existing Clahane substation. This grid connection cabling route runs approximately 400m along the proposed wind farm access roads and approximately 9.4km along public roads. In total, the cabling route measures approximately 9.8km in length.

Option B is an underground cabling route connecting the proposed onsite substation to the existing Triene substation which is located approximately 12.2km northeast of the proposed onsite substation. This cabling route runs approximately 400m along the proposed wind farm access roads and 15.75km along public roads. In total, the cabling route measures approximately 16.15km in length.

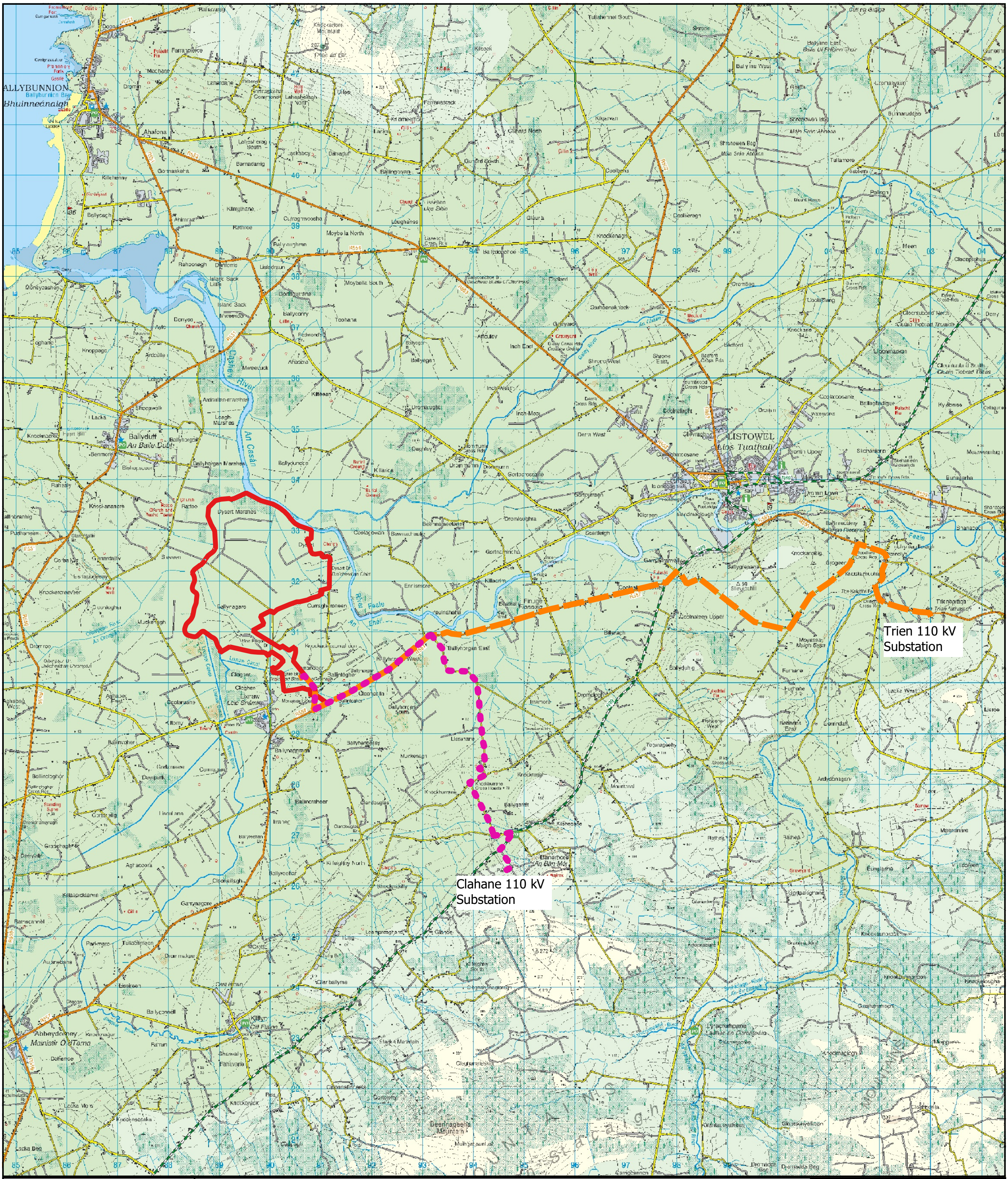
Once it leaves the wind farm site Grid Connection Options A runs along existing roads and/or tracks for its entire lengths and therefore has low levels of habitat loss. Grid Connection Option B runs predominantly along existing roads but would leave the road curtilage for short sections to facilitate some water course crossings. All culvert and water course crossings for both options will be accomplished without in-stream works. The proposed crossing methods are discussed in detail in Chapter 4 of this EIAR.

By virtue of its longer route, Option B passes by more residential dwellings than Option A and therefore has the potential to cause greater, short-term nuisance to local residents in terms of access, traffic volumes, noise and dust emissions during the construction phase.

Based on the environmental considerations outlined above, Grid Connection Option A has slightly lower potential for environmental impacts and has therefore been brought forward to be assessed as part of the overall Ballynagare Wind Farm project within the EIAR. A comparison of the potential environmental effects of the alternative grid connection cabling routes is presented in Table 3-9 below.

Table 3.9 Comparison of environmental effects of grid route Option A and Option B

Environmental Consideration	Option A	Option B
Population & Human Health (incl. Shadow Flicker)	The route passes fewer residential dwellings and therefore has the lower potential for nuisances for local residents to occur in relation to dust emissions from vehicle movements and excavations which could have adverse health effects.	This route passes more residential dwellings and therefore, has slightly higher potential for nuisances for local residents to occur in relation to dust emissions from vehicle movements and excavations which could have adverse health effects.
Biodiversity & Ornithology	Neutral	Neutral
Land, Soils & Geology	Lower volume of peat, spoil and tar to be excavated due to shorter route.	Increased volume of peat, spoil and tar to be excavated due to longer route. Difference is not considered significant.
Geotechnical	Neutral	Neutral
Water	Neutral	Neutral
Air & Climate	Neutral	Neutral
Noise & Vibration	Neutral	Neutral
Landscape & Visual	Neutral	Neutral
Cultural Heritage & Archaeology	Grid route is located within public road and therefore has low potential for impacts on unrecorded, subsurface archaeology.	Grid route is located predominantly within public road and therefore has low potential for impacts on unrecorded, subsurface archaeology. However, there is potential for small areas where the route may need to leave the road curtilage. This combined with the larger development footprint would slightly increase the potential for impacts on unrecorded, subsurface archaeology vs Option A.
Material Assets	Shortest route and shortest length on public roads and therefore has the least potential for impacts on existing services.	Potential for slightly greater traffic volumes during construction phase due to larger development footprint and requirement for more construction materials. Route follows regional route for longer than Option A.



Map Legend

- Proposed Wind Farm Site
- Grid Route Option A (Clahane)
- Grid Route Option B (Trien)

N

Drawing Title	
Grid Connection Route Options	
Project Title	
Ballynagare Wind Farm	
Drawn By: TB	Checked By: MW
Project No.: 200512	Drawing No.: Figure 3.20
Scale: 1:100000	Date: 13.10.2021

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3.5.4.4 Borrow Pit

The use of an onsite borrow pit represents an efficient use of existing onsite resources and eliminates the need to transport large volumes of construction materials along the local public road network to the site. A search for a suitable on-site borrow pit location was undertaken taking into account the site characteristics, including geology, topography, ground conditions, habitat type and surface water features. A suitable borrow pit location was identified on the project site to source the material required for the construction of access roads and turbine bases. The proposed borrow pit location was the only suitable location identified within the development site.

3.6 Turbine Delivery

Wind turbine components (blades, nacelles and towers) are not manufactured in Ireland and therefore must be imported from overseas and transported overland to the site of a proposed development. With regard to the selection of a transport route to the proposed development site, alternatives were considered in relation to turbine components, general construction-related traffic, and site access locations.

3.6.1 Port of Entry

The alternatives considered for the port of entry of wind turbines into Ireland for the proposed development include Shannon-Foynes Port, County Limerick and the Port of Galway. Shannon Foynes Port is the principal deepwater facility on the Shannon Estuary and caters for dry bulk, break bulk, liquid and project cargoes. The Port of Galway also offers a roll-on roll-off procedure to facilitate import of wind turbines. Both ports and indeed others in the state (including Cork and Dublin), offer potential for the importing of turbine components. Shannon Foynes Port is significantly closer to the proposed site and was therefore selected as port of entry for the project.

3.6.2 Turbine Delivery Route

The assessment of the most suitable delivery routes was conducted in parallel with the assessment of potential site entrances as outlined above. For turbine components and other abnormal load transport, cognisance was taken of the haul routes used for other wind farm developments in the local area in addition to the general preference to minimise the requirement for significant accommodation or widening works along the public road network and associated environmental effects. Two potential transport routes were identified for turbine delivery to the site as follows:

- Option A. From the Port of Foynes turbines would be transported along the N69, south on the N21 National Secondary Road towards Newcastle West bypassing Castleisland and passing Abbeyfeale towards Tralee before turning north east on the N69 and then left at Mountcoal cross. The route then continues north towards the proposed development site.
- Option B. From the Port of Foynes turbines would be transported west along the N69 turning left at Tarbert and heading south through Listowel after which a local road would carry the turbines to the proposed development site.

As assessment of both options was carried out taking account of criteria such as junction accommodation works, road upgrade requirements and associated environmental effects. On further investigation, local road geometry rendered Option 2 impractical. Therefore, Option A emerged as the preferred option given the limited road upgrade work required. The turbine delivery route options are shown on Figure 3-13.

Further, the transport analysis (as presented in Chapter 14 of this EIAR), shows that only localised accommodation works will be required to accommodate delivery of the proposed Ballynagare Wind

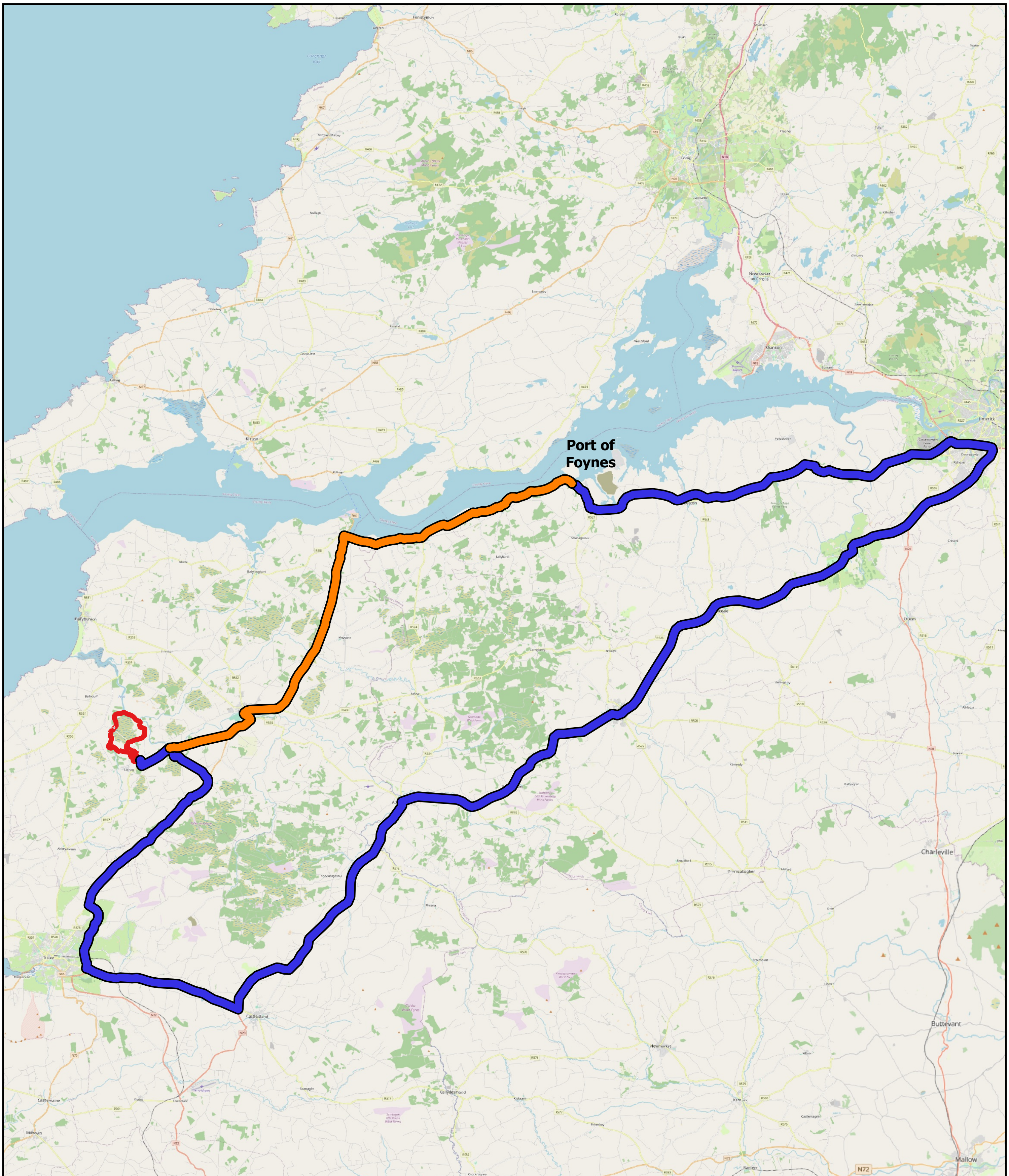
Farm turbines and these works are assessed in the EIAR. The turbine transport route will utilise the national and primary roads available to ensure the road network holds the capacity to manage large loads.

Table 3.10 Comparison of environmental effects when compared against the chosen option (chosen turbine delivery route)

Environmental Consideration	Option B
Population & Human Health (incl. Shadow Flicker)	Decreased vehicular emissions due to increased distance of travel could result in less impact to human health. Increased disruption to residences and businesses due to more extensive accommodation works required.
Biodiversity & Ornithology	Neutral
Land, Soils & Geology	Neutral
Geotechnical	Neutral
Water	Neutral
Air & Climate	Decreased vehicular emissions due to increased distance of travel.
Noise & Vibration	Neutral
Landscape & Visual	Neutral
Cultural Heritage & Archaeology	Neutral
Material Assets	Increased potential for adverse traffic impacts on more local road users due to accommodation works required.

It should be note that while large turbine components and other abnormal loads deliveries will be via the Option A delivery route exclusively, other general construction material deliveries may be delivered via other major routes in the wider area The assessment of traffic volumes associated with the construction and operation of the proposed development is included in Chapter 14: Material Assets, Section 14.1 of this EIAR.

The geometric assessment of large turbine components and other abnormal load deliveries during the construction of the proposed wind energy development is based on the use of extended articulated trucks which is the standard and most common delivery vehicle technology for turbine blades. This assessment is included in Section 14.1 of this EIAR. However, alternative delivery vehicle technologies such as blade adapters or lifters may be considered, should they be deemed economically viable and readily available at the time of construction of the wind farm and to fall within all assessment envelopes identified in this EIAR.



Map Legend

- Proposed Wind Farm Site
- Haul Route Option A (Preferred)
- Haul Route Option B

N

Microsoft product screen shots reprinted with permission from Microsoft Corporation

Drawing Title	
Haul Route Options	
Project Title	
Ballynagare Wind Farm	
Drawn By: TB	Checked By: MW
Project No.: 200512	Drawing No.: Figure 3.21
Scale: 1:400000	Date: 13.10.2021

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3.7 Alternative Mitigation Measures

Mitigation by avoidance has been a key aspect of the proposed project's evolution through the selection and design process. Avoidance of the most ecologically sensitive areas of the site limits the potential for environmental effects. As noted above, the site layout aims to avoid environmentally sensitive areas. Where loss of habitat occurs within the site, this has been mitigated by proposing enhancement lands as described in Chapter 6 of this EIAR.

The alternative to this approach is to further encroach on the environmentally sensitive areas of the site and accept the potential adverse environmental effects associated with this. Mitigation measures could be put in place to compensate for the loss of environmentally sensitive areas, however such an approach would not represent base practice.

The best practice design and mitigation measures set out in this EIAR will contribute to reducing any risks and have been designed to break the pathway between the site and any identified environmental receptors. The alternative is to either not propose these measures or propose measures which are not best practice and /or effective and neither of these options is acceptable or sustainable.

4. DESCRIPTION OF THE PROPOSED DEVELOPMENT

4.1 Introduction

This section of the Environmental Impact Assessment Report (EIAR) describes the development and its component parts which is the subject of a proposed application for planning permission to Kerry County Council, ('the proposed development'). This section of the EIAR also describes all those components for which planning permission is not being sought, such as the proposed whooper swan habitat enhancement area. The overall project as described in Chapter 4 has been assessed in the EIAR.

Ballynagare Wind Farm Limited (the Applicant) is seeking planning permission to construct a wind energy development on land at Ballynagare, approximately 9km west of Listowel and approximately 2km north of Lixnaw County Kerry. The development is located in the townlands of Ballynagare, Dysert Marshes, Farrandeen, Monument, Knockaunacurraheen, Ballintogher, Ballnageragh, Clooncolla, Ballyhorgan West, Ballyhorgan East, Lissahane, Knockburrane, Ballygarret, Banemore, and Pallas.

The development comprises:

- Construction of 7 no. wind turbines with the following maximum and minimum parameters:
    - Overall ground to blade tip height in the range of 170m maximum to 169.5m minimum
    - Hub height of 95m
    - Rotor diameter in the range of 150m maximum to 149m minimum
- Turbine hardstand areas;
- Provision of 1 no. permanent meteorological mast with a height of 110 metres.
- Upgrade of existing roads and access junctions
- Provision of new site entrances, roads and hardstand areas
- 2 no. peat storage areas
- 2 no. construction compounds
- 1 no. borrow pit
- All site drainage works
- 1 no. onsite 38kV substation, control building and plant, associated security fencing and wastewater holding tank
- All associated underground electrical and communication cabling connecting the turbines to the proposed on-site substation
- Connection of the proposed 38kV on-site substation via underground cable in the public road to the entrance of the existing Clahane 110kV substation in the townland of Pallas
- All ancillary site and ground works, apparatus and signage

The application is seeking a ten-year planning permission and 35 year operational life from the date of commissioning of the wind farm. Current and future wind turbine generator technology will ensure that the wind turbine model, chosen for the proposed development, will have an operational lifespan greater than the 35 year operational life that is being sought as part of this application.

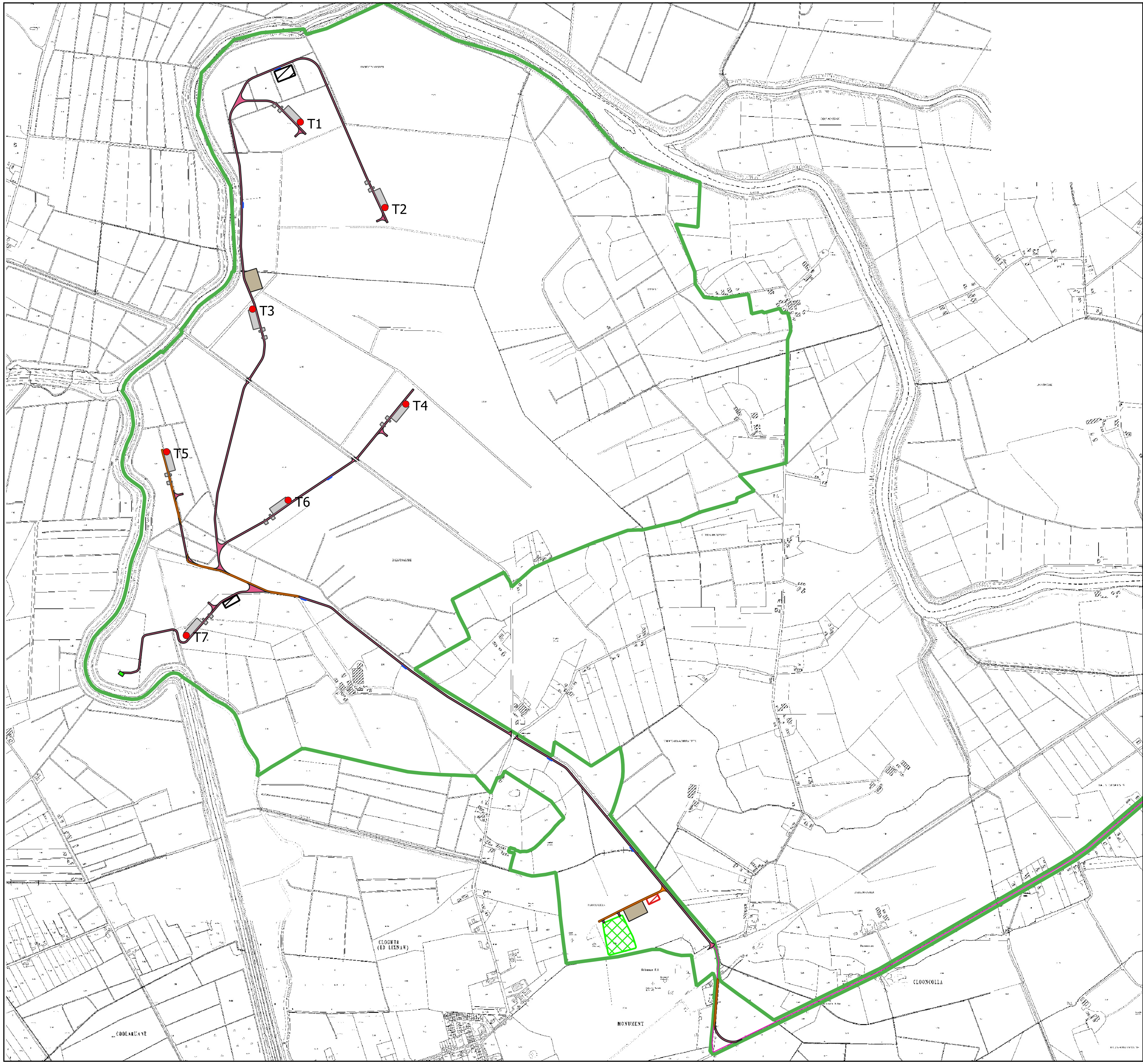
It is proposed to construct a 38 kV substation as part proposed development, and to connect to the National Grid via an underground cable connection running from the proposed on-site substation to the existing Clahane Substation, located approximately 7 kilometres to the southeast, in the townland of Pallas. The underground cabling will follow the route of existing public roadways.

All elements of the proposed development described in the list above together with the Turbine Delivery Route and the whooper swan enhancement lands have been assessed in this EIAR and are described in detail in this chapter.

4.2 Development Layout

The layout of the proposed development has been designed to minimise the potential environmental effects of the proposed development, while at the same time maximising the energy yield of the wind resource passing over the site. A constraints study, as described in Section 3.5.1 of this EIAR, has been carried out to ensure that turbines and ancillary infrastructure are located in the most appropriate areas of the site. Where possible, the proposed development layout makes use of the existing access roads and tracks within the site.

The overall layout of the proposed development is shown on Figure 4-1. This drawing shows the proposed locations of the wind turbines, electricity substation, grid connection route, borrow pit, peat and spoil repository, construction compounds, internal roads layout, the construction access road and the main site entrance. Detailed site layout drawings of the proposed development are included in Appendix 4-1 to this EIAR.



Map Legend

- EIAR Study Area Boundary
- Proposed Turbine Locations
- Proposed Borrow Pit
- Proposed Hardstanding
- Proposed Turbine Foundation
- Proposed Substation
- Proposed Temporary Construction Compound
- Proposed New Roads
- Existing Roads for Upgrade
- Proposed Passing Bay
- Proposed Met Mast Location
- Proposed Temporary Peat Storage Areas
- Proposed 38kV Grid Connection

N

Drawing Title: Proposed Site Layout	
Project Title: Ballynagare Wind Farm	
Drawn By: TB	Checked By: MW
Project No.: 200512	Drawing No.: Figure 4.1
Scale: 1:15000	Date: 2021.10.13

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4.3 Development Components

4.3.1 Wind Turbines

4.3.1.1 Turbine Locations

The proposed wind turbine layout has been optimised using industry standard wind farm design software to maximise the energy yield from the site, while maintaining sufficient distances between the proposed turbines to ensure turbulence and wake effects do not compromise turbine performance. The Grid Reference coordinates of the proposed turbine locations are listed in Table 4 1 below.

The final ground level of the turbine foundations will be determined by the actual ground conditions at each proposed turbine location and may differ slightly from those levels listed in Table 4.1. Also, in accordance with the Wind Energy Development Guidelines for Planning Authorities' (Department of the Environment, Heritage and Local Government (DOEHLG), 2006) micro-siting of the turbine positions may be required within the criteria set out in the guidelines. All sensitive electrical equipment within the proposed turbines will be raised to a level above the theoretical 1,000 year flood elevation.

Table 4.1 Proposed turbine locations

Turbine Number	Easting	Northing	Ground Level Elevation (m OD)
1	489168.9075	633294.2662	0.78
2	489512.6774	632946.997	0.73
3	488974.8514	632534.2959	0.91
4	489597.5548	632148.4197	0.70
5	488625.6129	631954.4156	0.41
6	489119.2683	631757.5398	0.67
7	488705.6813	631207.8471	0.88

4.3.1.2 Turbine Type

Wind turbines use the energy from the wind to generate electricity. A wind turbine, as shown in Plate 4.1 below, consists of four main components:

- Foundation unit
- Tower
- Nacelle (turbine housing)
- Rotor

Plate 4.1 Wind turbine components

The proposed wind turbines will have a maximum ground to blade tip height of between 169.5 and 170 metres with a rotor diameter of between 149 and 150 metres.

The exact make and model of the turbine will be dictated by a competitive tender process, but it will not exceed the maximum size envelope set out above. Modern wind turbines from the main turbine manufacturers have evolved to share a common appearance and other major characteristics with only minor cosmetic differences differentiating one from another. The wind turbines that will be installed on the site will be conventional three-blade turbines, that will be geared to ensure the rotors of all turbines rotate in the same direction at all times. The turbines will be light grey matt colour.

Turbine design parameters have a bearing on the assessment of shadow flicker, noise, visual impact, traffic and transport and ecology (specifically birds), as addressed elsewhere in this EIAR. In each EIAR section that requires the consideration of turbine parameters as part of the impact assessment, the turbine design parameters that have been used in the impact assessment are specified. At the turbine selection stage of the project, pre-construction, new turbines models or variants may be available that were not on the market at the pre-planning and EIAR preparation stage, which would better suit the site and fit within the proposed size envelope. Should this circumstance arise, the specific parameters of the new turbines will be assessed for their compliance with the criteria set out and considered in this EIAR, the relevant guidance in place at the time and any conditions that may be attached to any grant of planning permission that might issue.

A drawing of the proposed wind turbine is shown in Figure 4.2. The individual components of a typical geared wind turbine nacelle and hub are shown in Figure 4.3 below.

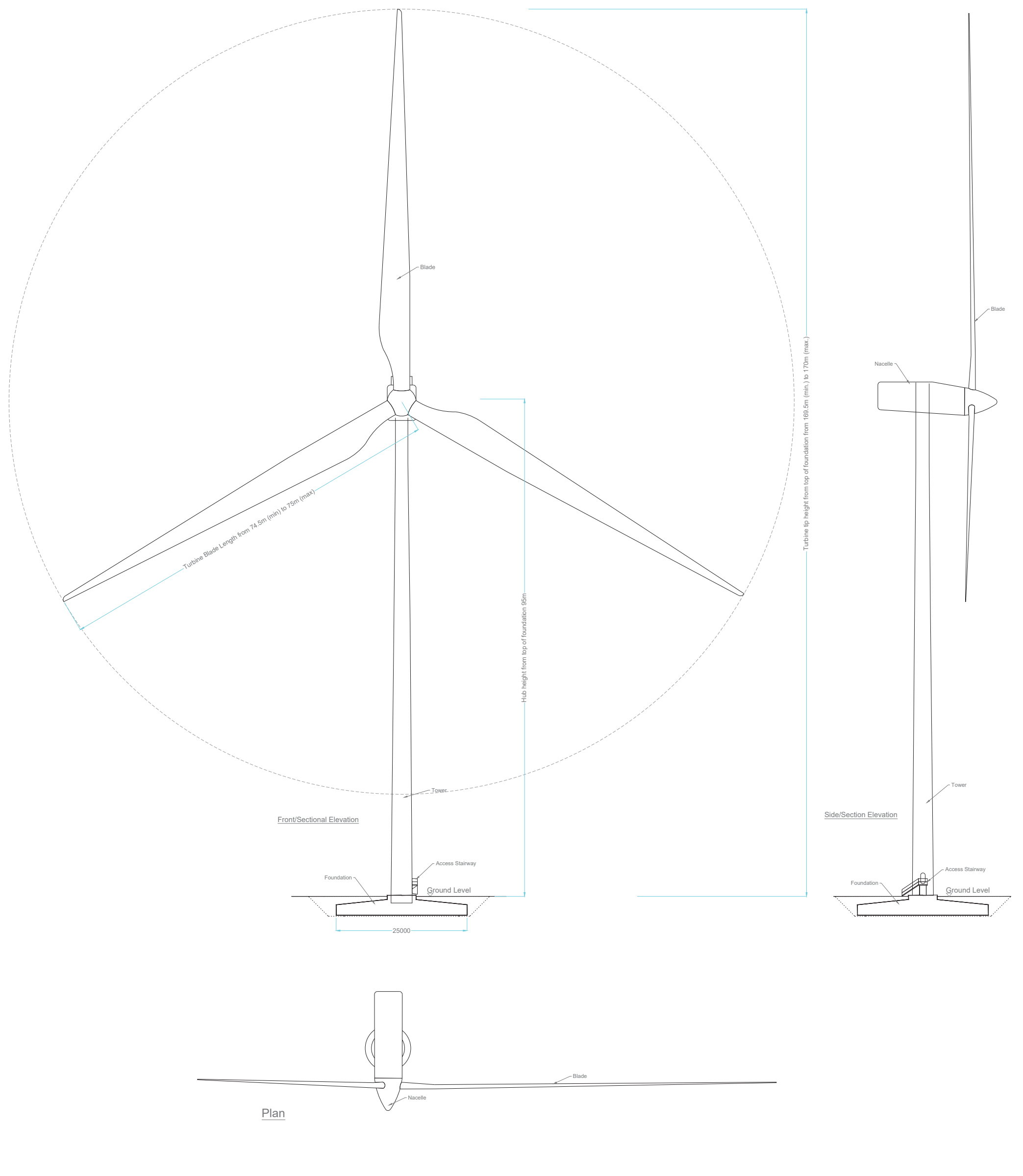

Figure 4-2

DRAWING TITLE:

Wind Turbine Hardstanding & Elevations

PROJECT TITLE:

Ballynagare Wind Farm, Co. Kerry

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Thomas Blackwell**
PROJECT No.: **200512**	DRAWING No.: **200512 - 36**
SCALE: **1:500 @A1**	DATE: **22.11.2021**

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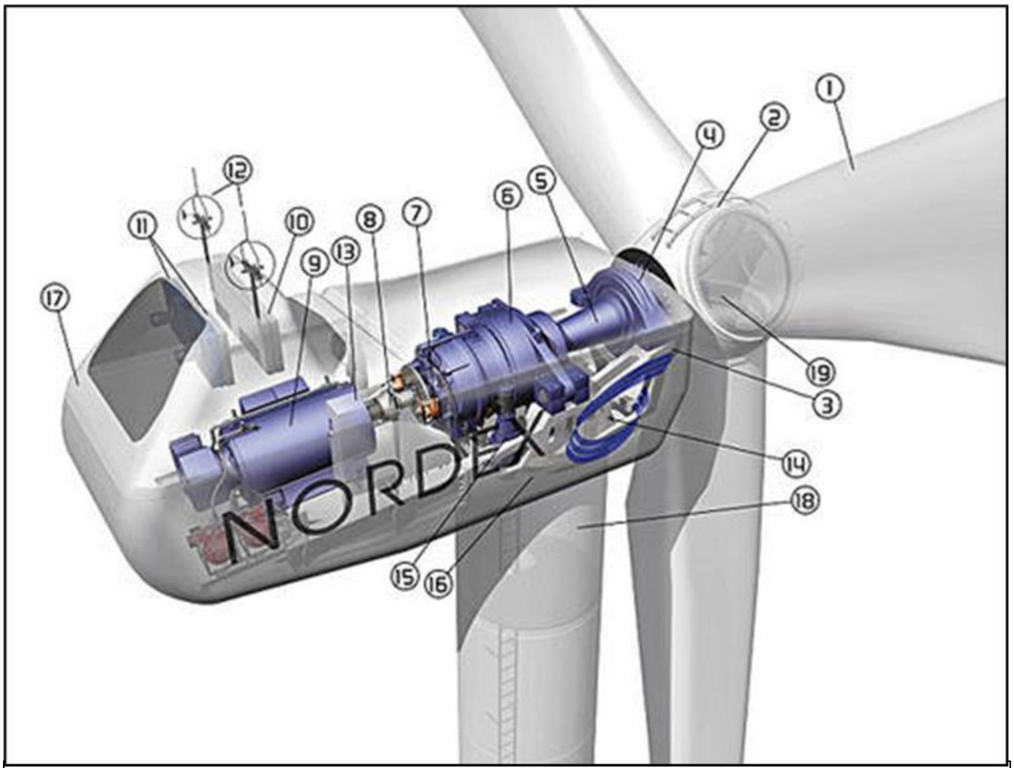
Drawing Notes

1. Drawing illustrates turbines with the maximum blade tip height of 170m.
2. Exact make and model of the turbine to be dictated by a competitive tender process.
3. Installed wind turbine not to exceed maximum size envelope set out above in any blade length and hub-height configuration.
4. Turbine Foundation to Manufacturers specifications
5. Ground level represents the top of turbine foundation.



1.Rotor Blades	2.The Hub	3.The Turbine Frame
4.The Rotor Bearing	5.The Rotor Shaft	6.The Gearbox
7.The Disk Brake	8.The Generator Coupling	9.The Generator
10.The Cooling Radiator	11.The Fan Coolers	12.The Wind Measuring System
13.The Control System	14.The Hydraulic System	15.The Yaw Drive
16.The Yaw Bearing	17.The Nacelle Cover	18.The Tower
19.The Pitch system		

Figure 4.3 Turbine nacelle and hub components

Figure 4.4 shows the turbine base layout, including turbine foundation, hard standing areas, assembly area, access road and surrounding works area.

4.3.1.3 Turbine Foundation

Each wind turbine is secured to a reinforced concrete foundation that is installed below the finished ground surface. The size of the foundation will be dictated by the turbine manufacturer, and the final turbine selection will be the subject of a competitive tender process. Different turbine manufacturers use different shaped turbines foundations, ranging from circular to hexagonal and square. Those shown on drawings included in this EIAR are circular, but the final foundation could also be square or hexagonal depending on the requirements of the final turbine supplier. The turbine foundation transmits any load on the wind turbine into the ground. The maximum horizontal and vertical extent of the turbine foundation will be 25m (minimum of 19m) and 6m (minimum of 2.7m) respectively, which has been assessed in the EIAR and shown in Figure 4.2.

After the foundation level of each turbine has been formed using piling methods or on competent strata, the bottom section of the turbine tower “Anchor Cage” is levelled and reinforcing steel is then built up around and through the anchor cage (Plate 4.2 below). The outside of the foundation is shuttered with demountable formwork to allow the pouring of concrete and is backfilled accordingly with appropriate granular fill to finished surface level (Plate 4.3 below).


Plate 4.2 Levelled turbine tower 'can'


Plate 4.3 Steel reinforcement being added

4.3.1.4 Hard Standing Areas

Hard standing areas consisting of levelled and compacted hardcore are required around each turbine base to facilitate access, turbine assembly and turbine erection. The hard-standing areas are used to accommodate cranes used in the assembly and erection of the turbine, offloading and storage of turbine components, and provide a safe, level working area around each turbine position. The hard-standing areas are extended to cover the turbine foundations once the turbine foundation is in place. The sizes, arrangement and positioning of hard standing areas are dictated by turbine suppliers. The proposed hard standing areas are illustrated on Figure 4-4 and on the detailed drawings included in Appendix 4-1 to this report. The extent of the required areas at each turbine location may be optimised on-site within the parameters set out and assessed in this EIAR depending on topography, position of the site access road, the proposed turbine position and the turbine supplier's exact requirements. Where a smaller sized hard standing area is used the environmental impacts would not be more than the proposed hardstand.

4.3.1.5 Assembly Area

Levelled assembly areas, in a roughly rectangular arrangement, will be located to one side of each hard standing area. These assembly areas are required for offloading turbine blades and tower sections from trucks until such time as they are ready to be lifted into position by cranes. The extent of the area required for the assembly areas is shown on Figure 4-4 and the detailed drawing in Appendix 4-1which has been assessed in the EIAR. There are no permanent works associated with the assembly areas.

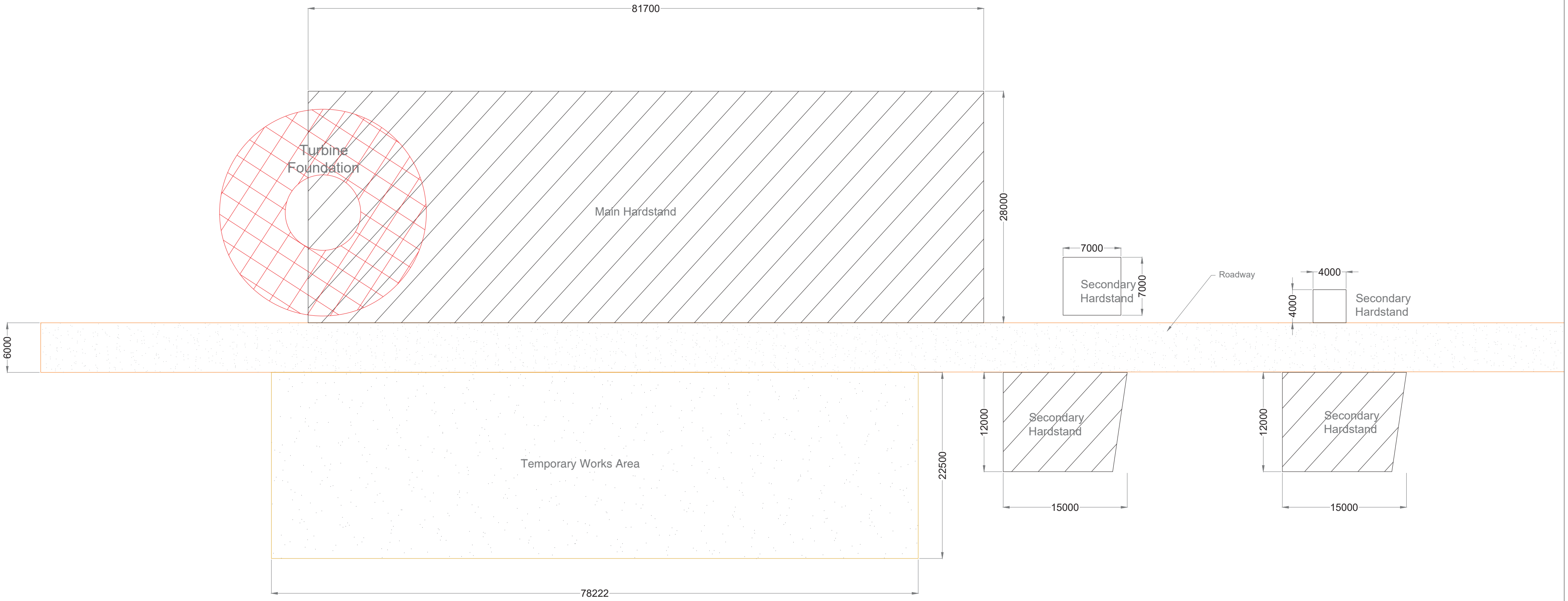


Figure 4-4

DRAWING TITLE:
Turbine Hardstand Layout Standard Detail

PROJECT TITLE:
Ballynagare Wind Farm, Co. Kerry

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Thomas Blackwell**
PROJECT No.: **200512**	DRAWING No.: **Fig 4-4**
SCALE: **1:500 @A3**	DATE: **22.11.2021**

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4.3.1.6 Power Output

It is anticipated the proposed wind turbines will have a rated electrical power output in the 5-6 megawatt (MW) range depending on further wind data analysis and power output modelling. Turbines of the exact same make, model and dimensions can also have different power outputs depending on the capacity of the electrical generator installed in the turbine nacelle. For the purposes of this EIAR, a rated output of 6.0 MW has been chosen to calculate the power output of the proposed 7-turbine wind farm, which would result in an estimated installed capacity of 42MW

The proposed wind farm has the potential to produce up to 128,772 MWh (megawatt hours) of electricity per year, based on the following calculation:

A x B x C = Megawatt Hours of electricity produced per year

- where: A = The number of hours in a year: 8,760 hours
- B = The capacity factor, which takes into account the intermittent nature of the wind, the availability of wind turbines and array losses etc: 35%
- C = Rated output of the wind farm: 42MW

The capacity factor of a wind farm takes into account the intermittency of the wind and is based on average wind speeds. A load factor of 35% is used here, based on the average figure for Ireland, as referenced by the Irish Wind Energy Association.

The 128,772 MWh of electricity produced by the proposed wind farm would be sufficient to supply 27,824 Irish households with electricity per year, based on the average Irish household using 4,628 kWh of electricity in 2016 (SEAI, 2018).

The 2016 Census of Ireland recorded 54,288 private households in County Kerry. Per annum, based on a load factor of 35%, the proposed wind farm would therefore produce sufficient electricity for approximately 51% of private households in County Kerry.

4.3.2 Site Roads

Maximum use has been made of the local road network and existing on-site roads in accessing the proposed turbine locations so as to minimise the requirement for new roadways within the site.

Straight sections of existing and new proposed roadways will require a running width of six metres to accommodate the transportation of large turbine components. Corners and junctions will have to be wider than six metres to allow the trucks to manoeuvre around bends. All site access roads that are proposed to be use as part of the proposed development, both existing and proposed, will comply with the turbine supplier's requirements. the material required for upgrade and construction of roads within the site will be obtained from the onsite borrow pit, as detailed in Section 4.3.3 below.

4.3.2.1 Existing Roads for Use or Upgrade

The existing roadways and tracks through the site will be upgraded and widened where appropriate for accessing the proposed turbine locations. It is proposed to use 1.11 kilometres of existing on-site roadways as part of the proposed development. All of these 1.11 kilometres will require upgrading. The required upgrade will entail widening of the roadway to a total running width of approximately six metres, with wider sections at corners and on the approaches to turbine locations, and the laying of a new surface dressing on the existing section of roadway where necessary.

Figure 4.5 shows section drawings for road widening within the site, including the location of cable trenches and drainage features relative to the roadway. Widening will be carried out on one side of the road only, on the side that has been identified as being the least sensitive ecologically.

4.3.2.2 New Roads

New roadways will be required for access to turbine locations in areas where existing roads are not already present.

It is proposed to construct 8.21 kilometres of new roadway as part of the proposed development. The routes of the proposed new roads are shown in Figure 4.1.

4.3.2.3 Watercourse Crossings

Across the site there will be twenty water-crossings constructed, three of which will be extensions of existing crossings of man-made drains and the remaining 17 being new crossings. Two of the new water-crossings will cross natural watercourses and 15 of the new water-crossings will cross man-made drains.

Full details of the proposed crossing methods for each watercourse crossing, along with a map of their locations are provided in Appendix 4-3 of this EIAR. Any new culverts of existing watercourses will be the subject of consent applications to the Office of Public Works under Section 50 of the Arterial Drainage Act, 1945. Cable crossings for the proposed grid connection portion of the project are discussed in Section 4.3.8, below.

4.3.2.4 Road Construction

Where relatively shallow depths of overburden are found within the site of the proposed development, it is proposed to construct new or improve existing roads directly on a solid formation. Over much of the site, this solid formation will be bedrock, which is found at shallow depths in the area.

Figure 4.5 shows section drawings for road construction and road widening where the roads are to be constructed or widened on solid formation within the site, including the location of cable trenches and drainage features relative to the roadway.

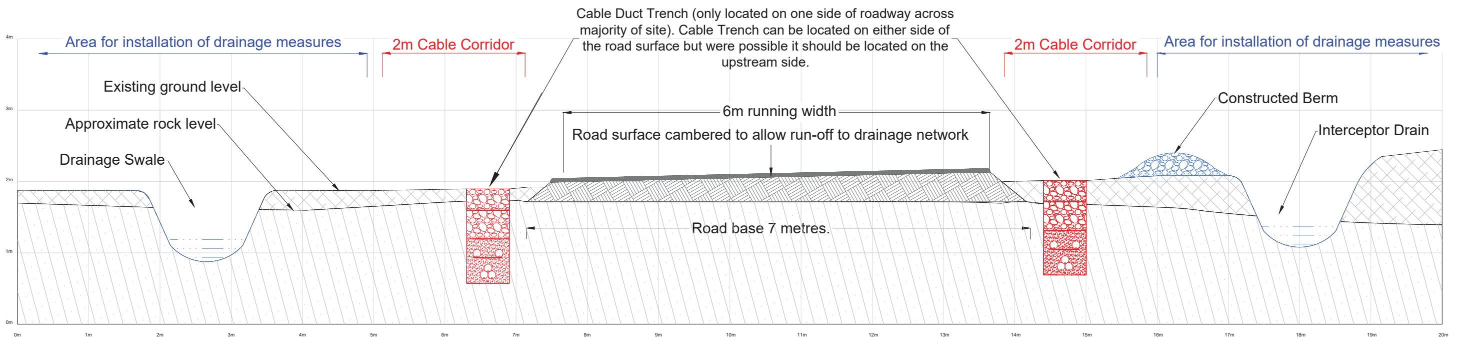
In localised areas across the site, it may be necessary to construct some floating roads over peat. The floating road design will be used typically in areas with two metres of peat depth or greater. The most suitable type of road construction will be selected at the detailed design stage based on shear strength, slope, peat depth and factor of safety of the peat over which the road must traverse.

Floating roads, a typical section of which is shown in Figure 4.6, minimise impact on the peat, particularly peat hydrology, and significantly reduce the volumes of peat requiring management as there is no excavation required and no peat arisings are generated.

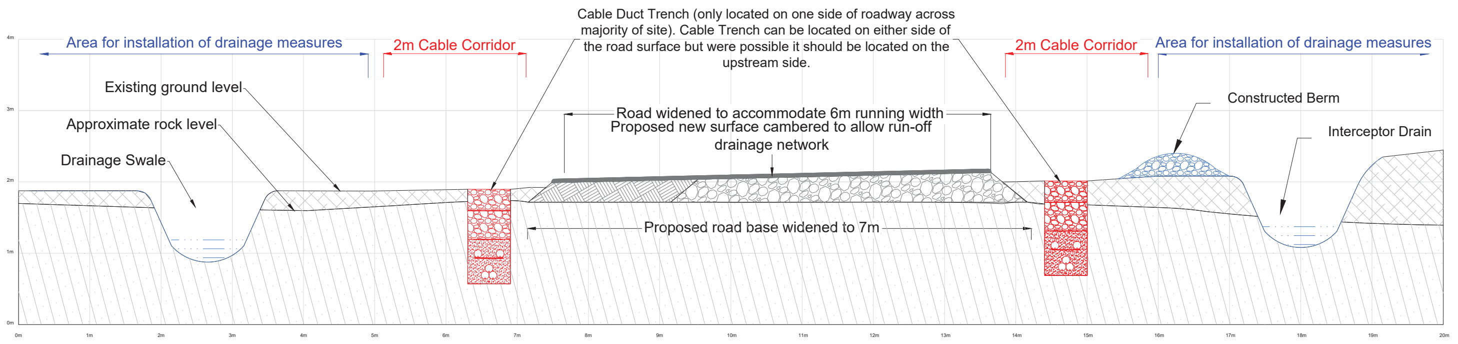
All new roadways will be constructed with a camber to aid drainage and surface water runoff. The gradient and slope of the camber will depend on the site characteristics where the road is actually being constructed.

Drawing Notes

1. Widening can occur to either side of existing roads dependent on site conditions.
2. Depths of road fill to vary dependent on site conditions.



Excavated road section.



Existing excavated road widening section.

Figure 4-5

DRAWING TITLE:
Excavated Road Sections

PROJECT TITLE:
Ballynagare Wind Farm, Co. Kerry

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Thomas Blackwell**
PROJECT No.: **200512**	DRAWING No.: **200512 - 43**
SCALE: **1:75@A3**	DATE: **22.11.2021**

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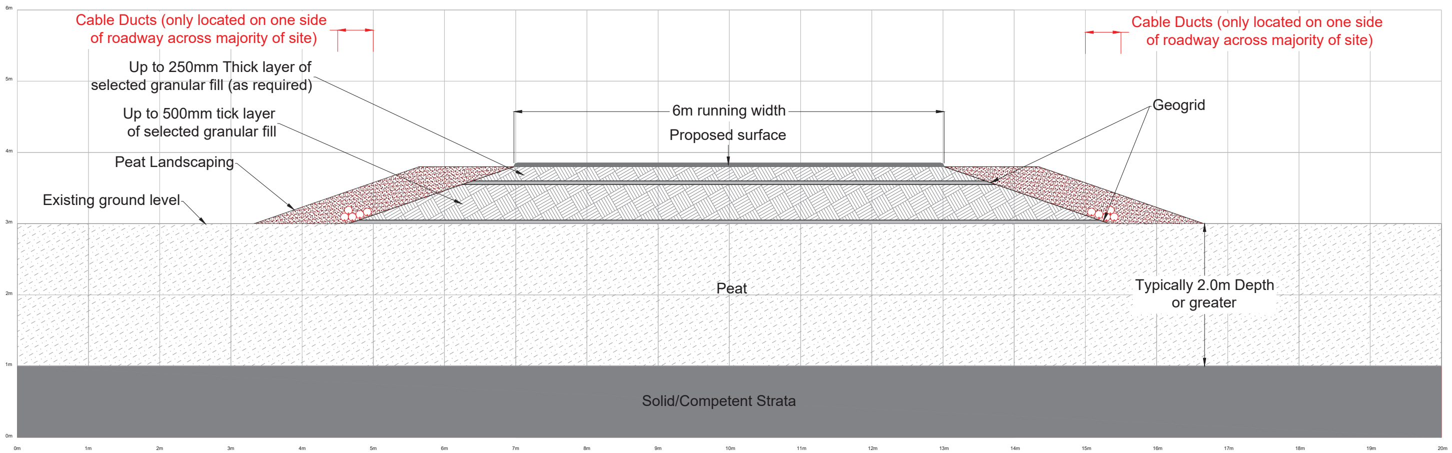
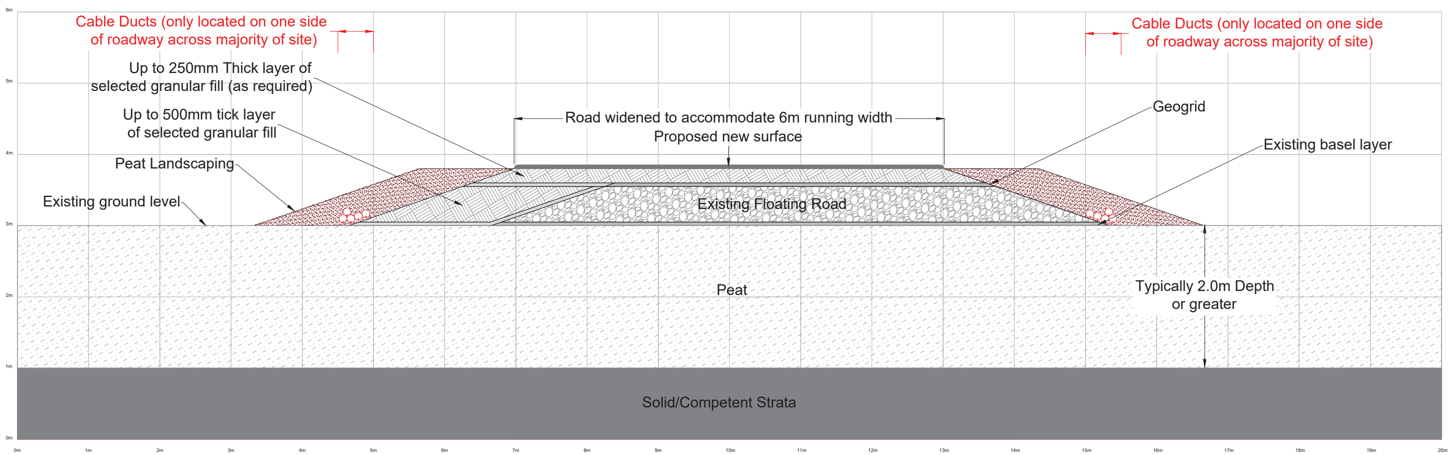
Drawing Notes

1. Widening can occur to either side of existing roads dependent on site conditions.
2. Depths of road fill to vary dependent on site conditions.



Floating road section.



Floating road widening section.

Figure 4-6

DRAWING TITLE:
Floating Road Sections

PROJECT TITLE:
Ballynagare Wind Farm, Co. Kerry

DRAWING BY: Joseph O Brien	CHECKED BY: Thomas Blackwell
PROJECT No.: 200512	DRAWING No.: 200512 - 44
SCALE: 1:75 @A3	DATE: 22.11.2021

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4.3.3 Borrow Pit

4.3.3.1 Borrow Pit Location

It is proposed to develop an on-site borrow pit as part of the proposed wind farm development. It is proposed to obtain the majority of all rock and hardcore material that will be required during the construction of the proposed development from the on-site borrow pit. A limited quantity of hardcore and other aggregate materials may have to be imported as it may not be possible to source from the on-site borrow pit, such as bedding sand for duct laying, and hardcore for initial site enabling works required before the borrow pit can be accessed and developed.

Rock is available close to and at the ground surface in an area in the southeast of the site. The proposed borrow pit will be developed at this location in an area measuring approximately 24,000m2 where rock will be extracted for use throughout the site. An area of approximately 2,267m2 will be dedicated to processing and stockpiling of crushed stone which will be used initially until such a time as there is sufficient working space within the extraction area to process and store these materials. It is intended to extract approximately 144,000 m^3 of hardcore materials from the borrow pit for the construction of all turbine foundations, hardstands and access roads thereto.

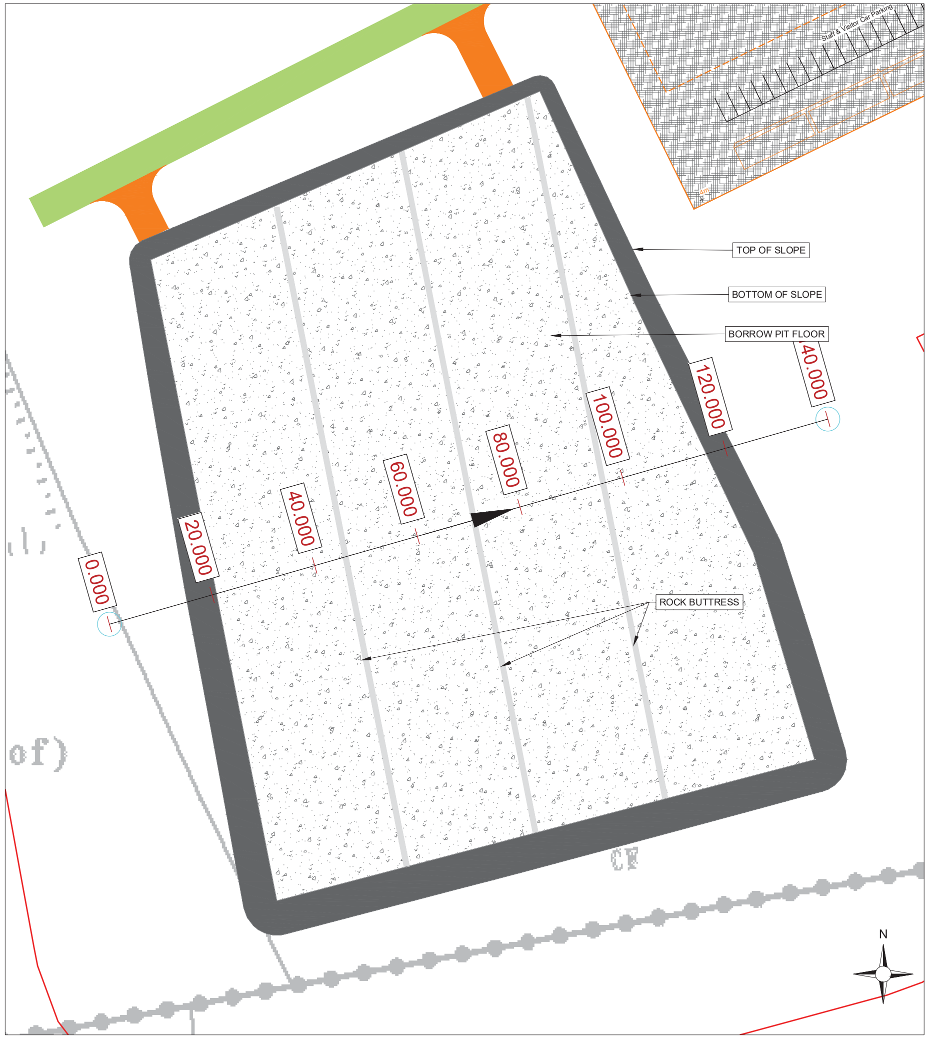
The borrow pit location is shown on Figure 4.1 and on the detailed site layout drawings included as Appendix 4-1 to this EIAR. Figure 4.7 below shows detailed sections through the proposed borrow pit. Prior to the extraction of any rock, it is proposed that overburden will be stripped from the surface of the borrow pit area by mechanical excavator. This overburden material will be stockpiled locally and will form a berm around the perimeter of the borrow pit which will partially screen the borrow pit from view. When the processing and stockpiling of crushed stone is moved to a location within the excavation area, the berm will be completed across the original processing and stockpiling area. The berm will then be seeded with agricultural grass seed mixture to assist in establishing vegetation in this area.

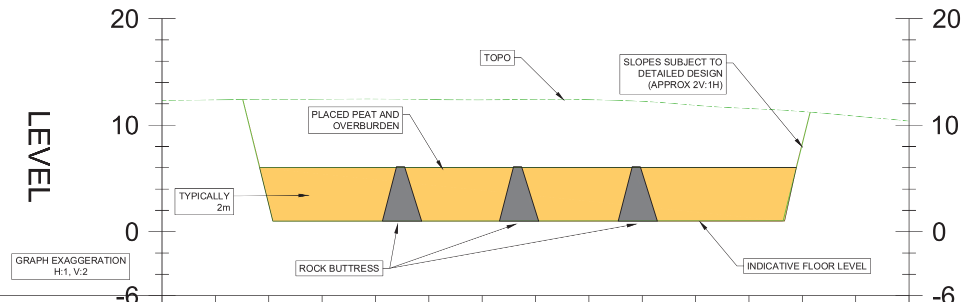
During and post-construction, the extraction area of the borrow pit will have to be permanently secured and a stock-proof fence will be erected around the borrow pit to prevent access to these areas. Appropriate health and safety signage will also be erected on this fencing and at locations around the fenced area.

The rock within the proposed borrow pit footprint will be removed by either breaking or blasting depending on its excavatability, which will be determined from a ground investigation carried out at the proposed borrow pit. Blasting will only be carried out after an appropriate method of notifying local residents has been submitted to and agreed with the Planning Authority. To generate the necessary volume of hardcore materials, the borrow pit would be excavated to an average approximate depth of up to 10 metres over the full area of the borrow pit.

Figure 4.7 shows a typical excavation profile for the borrow pit. Slopes within the excavated rock formed around the perimeter of the borrow pit will be formed at stable inclinations to suit local in-situ rock conditions. An interceptor drain will also be installed upslope of the borrow pit, where necessary. This drain will divert any surface water away from the borrow pit and hence, prevent water from ponding and lodging on the re-instated borrow pit area.

Upon removal of the rock from the borrow pit, it is proposed to reinstate the borrow pit using surplus excavated peat and spoil. The contractor excavating the rock will be required to develop the borrow pit in a way which will allow the excavated peat and spoil to be placed safely. It is proposed to place peat to approximately 5m deep across the base of the borrow pit. It may be necessary to construct cells/rock buttresses or leave upstands of intact bedrock within the borrow pit to help contain the reinstated peat and overburden. This will allow for the safe placement and grading of the materials using dumper trucks and excavators. The typical layouts of the borrow pit is presented in Appendix 4.1.





CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000
EXISTING LEVELS	12.317	12.372	12.421	12.430	12.451	12.407	12.372	12.417	12.392	12.230	11.859	11.561	11.274	10.840	10.381

Figure 4-7

DRAWING TITLE:
Borrow Pit Layout & Sections

PROJECT TITLE:
Ballynagare Wind Farm, Co. Kerry

DRAWING BY: Joseph O Brien	CHECKED BY: Thomas Blackwell
PROJECT No.: 200512	DRAWING No.: 200512 - 31
SCALE: 1:500 @ A1	DATE: 22.11.2021

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4.3.4 Peat and Spoil Management Plan

4.3.4.1 Quantities

The quantity of peat and other subsoils, requiring management on the site has been calculated, as presented in Table 4.2 below.

Table 4.2 Peat and overburden volumes requiring management/storage

Infrastructure Item	Excavated volume (m³)		
	Peat *	Non-peat *	
		Overburden **	Rock **
Floated access roads	0	-	-
Founded access roads	11,059	-	-
Turbine foundations	7,576	6,013†	-
Crane hardstands	50,523	-	-
Compound North hardstand	0	-	-
Compound South hardstand	0	-	-
Substation hardstand	0	-	-
Met mast hardstand	1,968	-	-
Borrow Pit	0	0	144,000
Total Volume for Proposed Development	**71,127**	**6,013**	**144,000**

** The volume of peat versus non-peat material excavated has been estimated using the average peat depth calculated across the site to define the basal surface of the peat.*

*** The breakdown of the constituents of the non-peat materials excavated (i.e. the ratio of overburden to rock) is based on observations of rock and overburden exposures made during the site reconnaissance and desk study.*

† Assuming overburden thickness of 3m.

4.3.4.2 Temporary Peat Repositories

Selected areas, within the site of the proposed development, have been chosen as temporary peat repository areas. These areas have been chosen based on their generally level topography and their ground conditions. The earthen overburden material will be excavated and used to create individual cells that will be formed of containing mounds, a maximum of 1.5m in height. If there is no suitable earthen overburden present within the chosen area then an imported granular fill material will be used to construct the containing mounds.

A temporary ramped incline will be constructed at one point around the perimeter of each cell, where trucks will reverse up to tip the excavated peat into the cell. Surrounding each repository area will be temporary accommodation tracks from which a long-reach excavator will spread the excess peat evenly within the cell. Each peat repository cell will be developed and filled on a once-off basis in a matter of days, and therefore, the long-reach excavator will only be working around the perimeter of each cell for a very limited period. Where necessary, to avoid heavy disturbance of the areas around each cell while the excavator is spreading material within the cell, bog mats will be used to line the accommodation track.

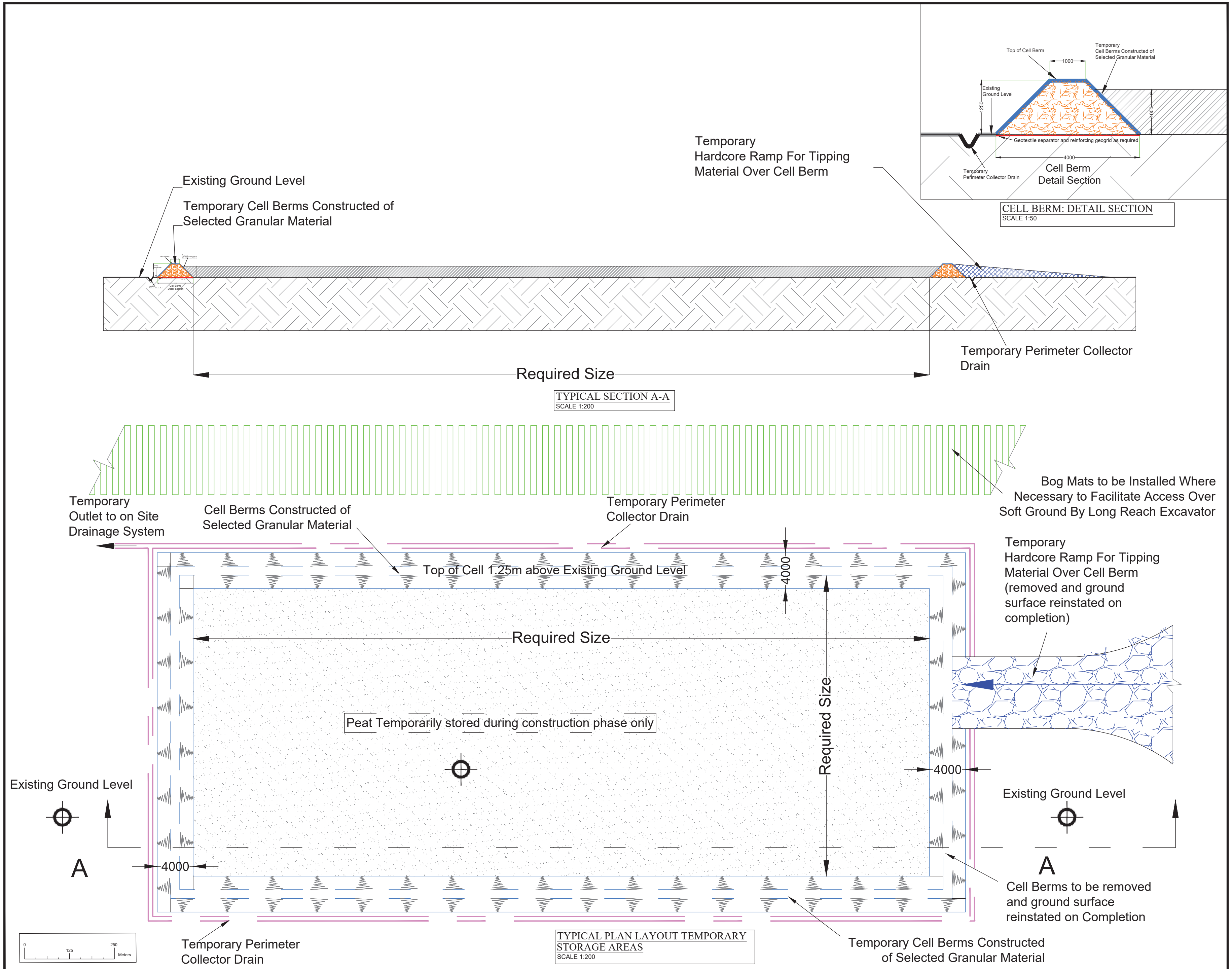
Plate 4.4 Bog mat being laid in position by excavator

Plate 4.5 Bog mat protecting ground by excavator.

The locations of proposed peat repositories are shown on Figure 4.1 and a generic layout and section drawing of the peat repository area design is illustrated on Figure 4.8. Minor adjustments to the locations of the proposed peat repository areas may occur as the construction of the site develops. These adjustments would be at the discretion of the site engineer.

Peat and other overburden excavated from the footprint of the proposed development during the course of the construction phase will be transported to the peat repository areas for temporary storage until such time as sufficient storage capacity has been generated in the proposed on-site borrow pit. Excavators will load the peat and overburden directly into dump trucks, which will be used to transport the material to the repository areas.

The material will be backfilled into the area within the peat storage cells, and the use of a long-reach excavator will ensure it is spread evenly over all areas, up to a maximum depth of 1.3 metres. The peat repository areas were chosen as the repository sites for surplus peat because of their flat topography and low ecological value. The habitats in this area are not designated for protection.



CELL BERM: DETAIL SECTION
SCALE 1:50

TYPICAL SECTION A-A
SCALE 1:200

TYPICAL PLAN LAYOUT TEMPORARY STORAGE AREAS
SCALE 1:200

NOTES:

1. THIS DRAWING IS FOR PLANNING AND ENVIRONMENTAL IMPACT ASSESSMENT PURPOSES AND SHOULD NOT BE USED AS DETAILED DESIGN OR FOR CONSTRUCTION DRAWINGS.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.

Figure 4.8

REV: FI -00	DATE: 06/10/21	DRAWN BY: CJM	CHECKED BY: LB
DESCRIPTION:	ISSUED FOR INFORMATION		

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ISSUED AS: FOR INFORMATION

CLIENT: MKO

PROJECT TITLE: BALLYNAGARE WIND FARM

DRAWING No: 20260-GDG-ZZ-XX-SK-C-0251

Revision: -FI -00

DRAWING TITLE: TEMPORARY PEAT STORAGE AREAS -TYPICAL DETAILS

SCALE: 1:200	SHEET SIZE: A1	DATE: 6/10/21
DRAWN BY: CJM	CHECKED BY: L.B	APPROVED BY: L.B.

4.3.4.3 Placement of Peat in Borrow Pit

The following particular recommendations/best practice guidelines for the placement of peat & spoil in the borrow pit should be considered and taken into account during construction.

- Peat shall be separated and stored by type, namely the acrotelmic and catotelmic layers.
    - Acrotelm (top about 0.3 to 0.4m of peat) is generally required for landscaping and shall be stripped and temporarily stockpiled for re-use as required. Acrotelm stripping shall be undertaken before the main excavations.
    - Where possible, the acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage the growth of plants and vegetation.
    - All catotelm peat (peat below about 0.3 to 0.4m depth) shall be transported immediately on excavation to the designated areas.
- Where possible, the surface of the placed peat & spoil should be shaped to allow efficient run-off of surface water from borrow pit areas.
- Silting ponds may be required at the lower side/outfall location of the borrow pit.
- A layer of geogrid to strengthen the surface of the placed peat & spoil within the borrow pit may be required.
- Infilling of the peat & spoil should commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress. The contractor excavating the rock will be required to develop the borrow pit in a way which will allow the excavated peat & spoil to be placed safely.
- The height of the rock buttresses constructed should be greater than the height of the placed peat & spoil to prevent any surface peat & spoil run-off. Buttresses up to 5m in height are likely to be required.

4.3.4.4 Placement of Peat & Spoil alongside Access Roads

In some areas of the proposed development site it is possible and environmentally sustainable to place excavated materials close to the excavation areas, in particular roads and around turbine areas. The following recommendations/best practice guidelines for the placement of peat and spoil alongside the access roads will be taken into account during the construction of the proposed development:

The following particular recommendations/best practice guidelines for the placement of peat & spoil alongside the founded roads should be considered and taken into account during construction.

- Peat and spoil shall be side-cast along founded roads only where it can be placed in a stable formation i.e. where the topography and ground conditions allow.
- Peat and spoil shall only be cast to safe heights and slope angles, considering the topography and the ground conditions. This height shall generally be up to 1m, and the slopes shall be not greater than 1 (v): 2 or 3 (h) unless a site-specific assessment during detailed design indicates a greater height and angle is safe.
- The placement of excavated peat & spoil is to be avoided without first establishing the adequacy of the ground to support the load. The placement of peat & spoil within such areas will likely require the use of long reach excavators, low ground pressure machinery and possibly bog mats in particular for drainage works.
- Where there is any doubt as to the stability of the ground then no material shall be placed on to the surface.
- Where practical, it should be ensured that the surface of the placed peat & spoil is shaped to allow efficient run-off of surface water. Where possible, shaping of the surface of the placed peat and spoil should be carried out as placement of peat &

spoil progresses. This will reduce the likelihood of debris run-off and ensure stability of the placed peat & spoil.

- Finished/shaped side slopes in the placed peat & spoil shall be not greater than 1 (v): 2 or 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat & spoil are encountered then slacker slopes will be required.
- Where possible, the acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the placed peat & spoil within these placement areas.
- Movement monitoring instrumentation may be required adjacent to the access road where peat has been placed. The locations where monitoring is required will be identified prior to construction works commencing on site.
- Supervision by a geotechnical engineer or appropriately competent person is recommended for the works.
- An interceptor drain should be installed upslope of the designated peat placement areas to divert any surface water away from these areas. This will help ensure stability of the placed peat and reduce the likelihood of debris run-off.
- All the above mentioned general guidelines and requirements should be confirmed by the designer prior to construction.

4.3.4.5 Peat Management

The volume of the borrow pit will be sufficient to accommodate all overburden and subsoil material generated during the course of the construction phase, as indicated in Table 4.2.

Water within the peat repository area will be filtered through the granular fill material that makes up the containment cells, and collected in collector drains surrounding the peat repository cells, as described in further detail below in Section 4.6.

Some overburden and peat will be stored temporarily adjacent to proposed works areas for reinstatement works after the main construction activities have been completed. For example, the working area required around each turbine foundation will have to be backfilled on completion of the turbine foundation. Similarly, the proposed roadways will have to be graded back to the level of the adjacent ground. In both these and other cases, the necessary volumes of overburden will be stored adjacent to the works areas, for reuse in reinstatement. All temporary storage areas will be assessed by an ecologist, geotechnical engineer and hydrologist prior to being used to temporarily store overburden destined for future reuse. This proposed use of temporary storage areas is considered more sustainable than hauling the material to the nearest borrow pit and transporting it back from there again to where it is needed for the reinstatement works. The stored material will be surrounded by silt fences to ensure sediment-laden run-off does not occur. Any excess mounded peat in temporary storage for long periods will be digger-bucket sealed and covered with polyethylene sheets or reseeded at the earliest opportunity.

4.3.5 Electricity Substation

It is proposed to construct an electricity substation within the site, adjacent to a proposed access road, as shown in Figure 4.1. The layout and elevations of the proposed substation are shown on Figure 4.9. The construction and electrical components of the electricity substation will be to ESB specifications. Further details regarding the connection between the proposed site substation and the national electricity grid are provided in Section 4.3.8 of this EIAR chapter. The proposed electricity substation compound measures approximately 50 metres in length by 25 metres in width and will include one wind farm control buildings and the electrical substation components necessary to consolidate the electrical energy generated by each wind turbine, and export that electricity from the wind farm site.

4.3.6 Wind Farm Control Building

A wind farm control building will be located within the substation compound. The control building will measure 21.5metres by 7.3 metres and 6 metres in height, will be located in the western half of the substation compound. Layout and elevation drawings of the control building are included in Figure 4.10.

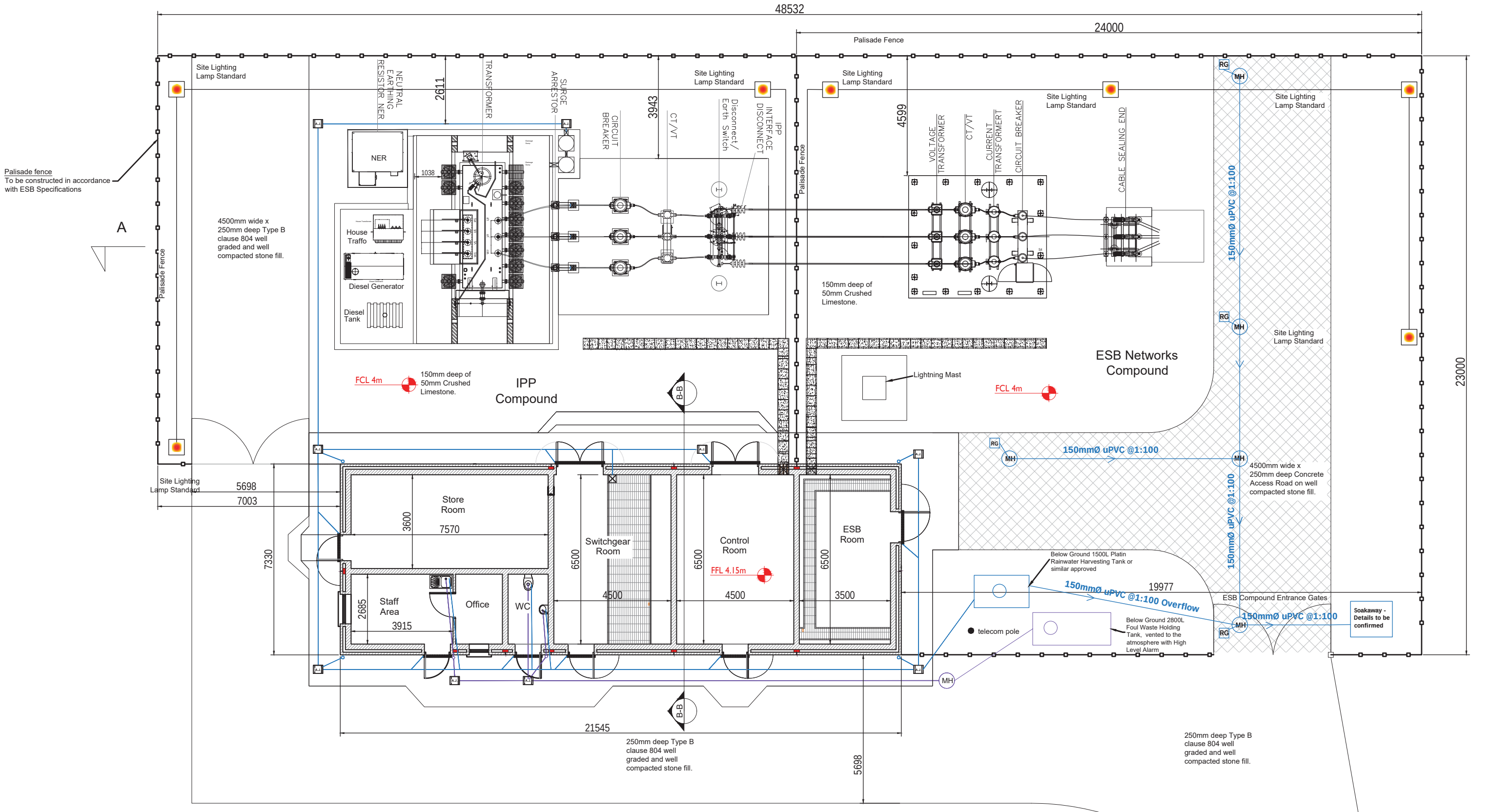
The wind farm control building will include staff welfare facilities for the staff that will work on the proposed development during the operational phase of the project. Toilet facilities will be installed with a low-flush cistern and low-flow wash basin. Due to the specific nature of the proposed development there will be a very small water requirement for occasional toilet flushing and hand washing and therefore the water requirement of the proposed development does not necessitate a potable source. It is proposed to harvest rainwater from the roofs of the buildings, and if necessary, bottled water will be supplied for drinking.

It is proposed to manage wastewater from the staff welfare facilities in the control buildings by means of a sealed storage tank, with all wastewater being tankered off site by permitted waste collector to wastewater treatment plants. It is not proposed to treat wastewater on-site, and therefore the EPA's 2009 'Code of Practice: Wastewater Treatment and Disposal Systems Serving Single Houses (p.e. 10)' does not apply. Similarly, the EPA's 1999 manual on 'Treatment Systems for Small Communities, Business, Leisure Centres and Hotels' also does not apply, as it too deals with scenarios where it is proposed to treat wastewater on-site.

Such a proposal for managing the wastewater arising on site has become almost standard practice on wind farm sites, which are often proposed in areas where finding the necessary percolation requirements for on-site treatment would be challenging, and has been accepted by numerous Planning Authorities and An Bord Pleanála as an acceptable proposal.

The proposed wastewater storage tank will be fitted with an automated alarm system that will provide sufficient notice that the tank requires emptying. The wastewater storage tank alarm will be part of a continuous stream of data from the sites turbines, wind measurement devices and electricity substation that will be monitored remotely 24 hours a day, 7 days per week. Only waste collectors holding valid waste collection permits under the Waste Management (Collection Permit) Regulations, 2007 (as amended), will be employed to transport wastewater away from the site to a licensed facility.

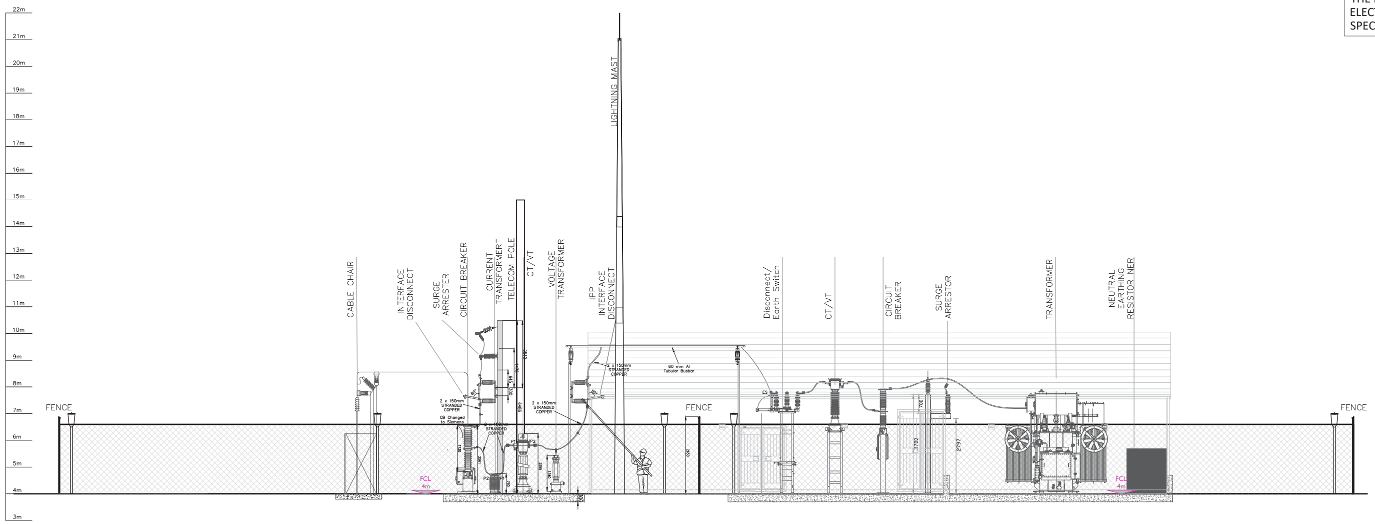
ISO A1 594mm x 841mm



Substation Compound Layout

SCALE 1:100

PLEASE NOTE THAT THE SUBSTATION LAYOUT AND SUBSTATION COMPONENTS ILLUSTRATED ON THIS DRAWING ARE INDICATIVE ONLY. THE FULL SPECIFICATION AND DETAIL WILL BE DETERMINED FROM THE ELECTRICAL EQUIPMENT SUPPLIER AND ESB FUNCTIONAL SPECIFICATION.



Section A-A Through Substation Compound

SCALE 1:100

Project Management Initials: Designer: JC Checked: SK Approved: RG

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PROJECT

Ballynagare Wind Farm

38kV Substation

CLIENT

EMPower

CONSULTANTS

NOTES: -

- Configuration of substation equipment and infrastructure is subject to detailed design and ESB design approval.
- The proposed substation layout should be used for planning purposes only.
- This drawing is to be read in conjunction with relevant drawings, specifications and reports.
- Dimensions are in millimeters, unless noted otherwise.
- Drawings are not to be scaled use figured dimensions only.

LEGEND: -

Surface water drainage shown thus

Foul drainage shown thus

Lamp Standard shown thus

Proposed Levels Shown thus (Planning)

Proposed Levels Shown thus (Elevation and Sections)

Concrete Access Road shown thus

Figure 4.9

ISSUE/REVISION

I/R	DATE	DESCRIPTION
P00	27.08.21	Issued for Planning

PROJECT NUMBER

05-801

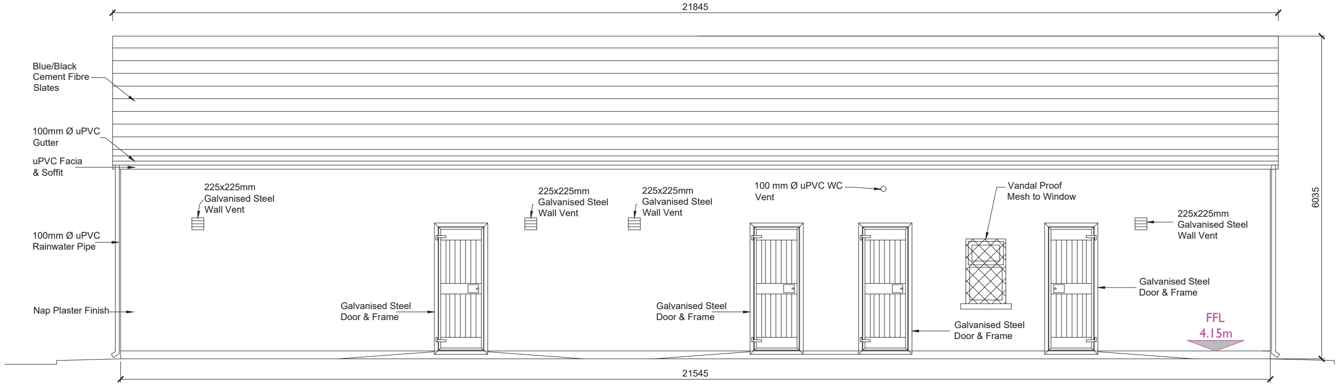
SHEET TITLE

38kV Substation Compound Layout & Section

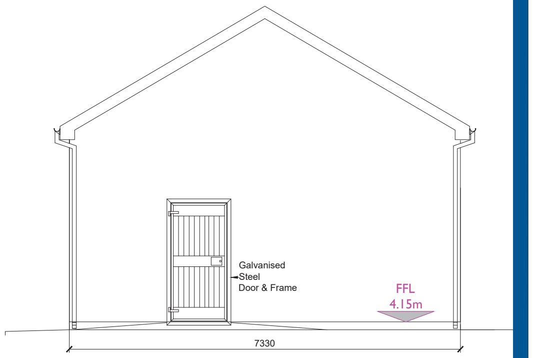
SHEET NUMBER

05801-DR-103

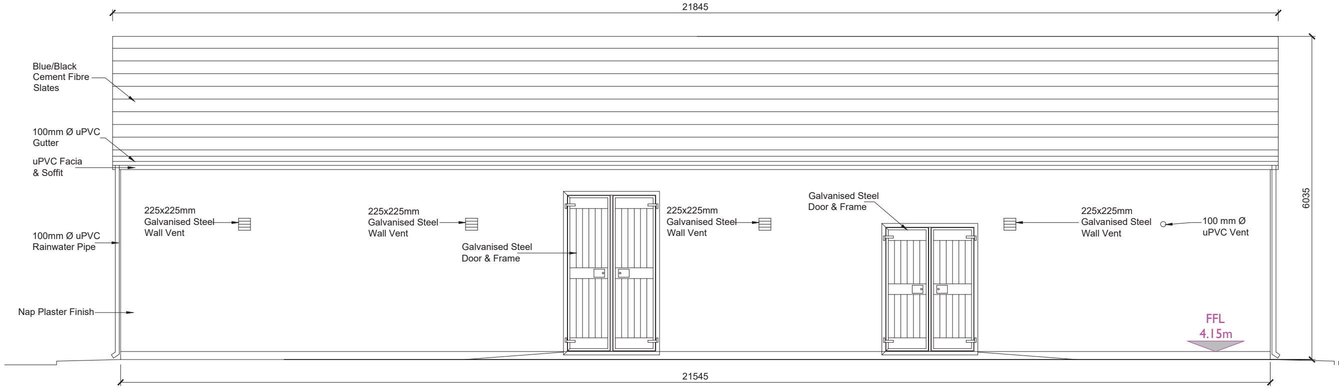
ISO A1 594mm x 841mm



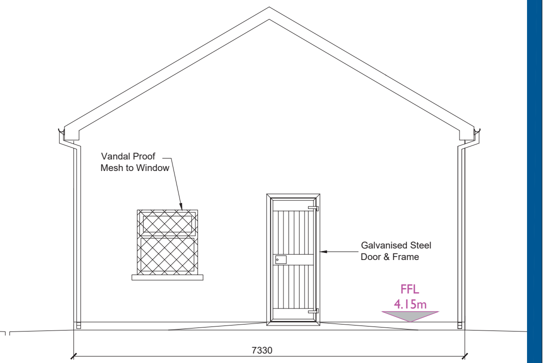
Front Elevation-East
SCALE 1:50



Side Elevation-North
SCALE 1:50



Rear Elevation-West
SCALE 1:50



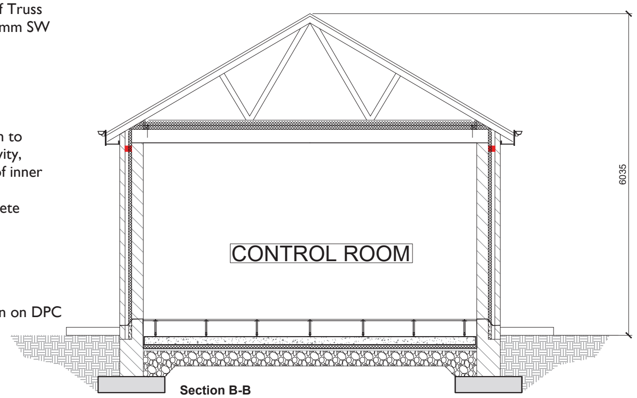
Side Elevation-South
SCALE 1:50

Roof Construction:
Roof on,
treated SW Roof Battens on,
selected Breather Membrane on
selected SW Prefabricated Roof Truss system fixed to treated 100x75mm SW Wallplate.
Plasterboard internal ceiling.

Cavity Wall:
Flat Sand / Cement Plaster finish to 100mm Outer Leaf, 100mm Cavity, 215mm Inner Leaf. Inside face of inner leaf to remain fair-faced.
Cavity wall supported on concrete strip foundation.

Floor:
Raised Access Floor on
150mm Reinforced Concrete Floor Slab on Selected Insulation on DPC on Sand Blinding all supported off Well Compacted Hardcore.

NOTE : Control Building surfaces need to be non - combustible



Section B-B
SCALE 1:50

Project Management Initials: Designer: JC Checked: SK Approved: RG

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PROJECT
Ballynagare Wind Farm
38kV Substation

CLIENT
EMPower

CONSULTANTS

NOTES: -
- Substation building is subject to detailed design and ESB design approval and should be used for planning purposes only.
- The proposed substation layout should be used for planning purposes only.
- This drawing is to be read in conjunction with relevant drawings, specifications and reports.
- Dimensions are in millimeters, unless noted otherwise.
- Drawings are not to be scaled use figured dimensions only.

LEGEND: -
Proposed Levels Shown thus (Elevation and Sections) FCL 54.60m

Figure 4.10

ISSUE/REVISION

I/R	DATE	DESCRIPTION
P00	27.08.21	Issued for Planning

PROJECT NUMBER
05-801

SHEET TITLE
38kV Substation Building Elevations

SHEET NUMBER
05801-DR-104

4.3.7 Site Cabling

Each turbine will be connected to the on-site electricity substation via an underground 38kV (kilovolt) electricity cable. Fibre-optic cables will also connect each wind turbine to the wind farm control building at the onsite substation compound. The electricity and fibre-optic cables running from the turbines to the onsite substation compound will be run in trenches that will be approximately 1.3 metres in depth and 0.6 metres in width, along the sides of roadways. The route of the cable ducts will generally follow the access track to each turbine location and are visible on the site layout drawings included as Appendix 4-1 to this report. The position of the internal site cable trench relative to the roadways is shown in section in Figure 4-5 and Figure 4-6 above. Figure 4-11 below shows two variations of a typical cable trench, one for off-road trenches (to be installed on areas of soft ground that will not be trafficked) and one for on-road trenches (to be used where trenches run along or under a roadway).

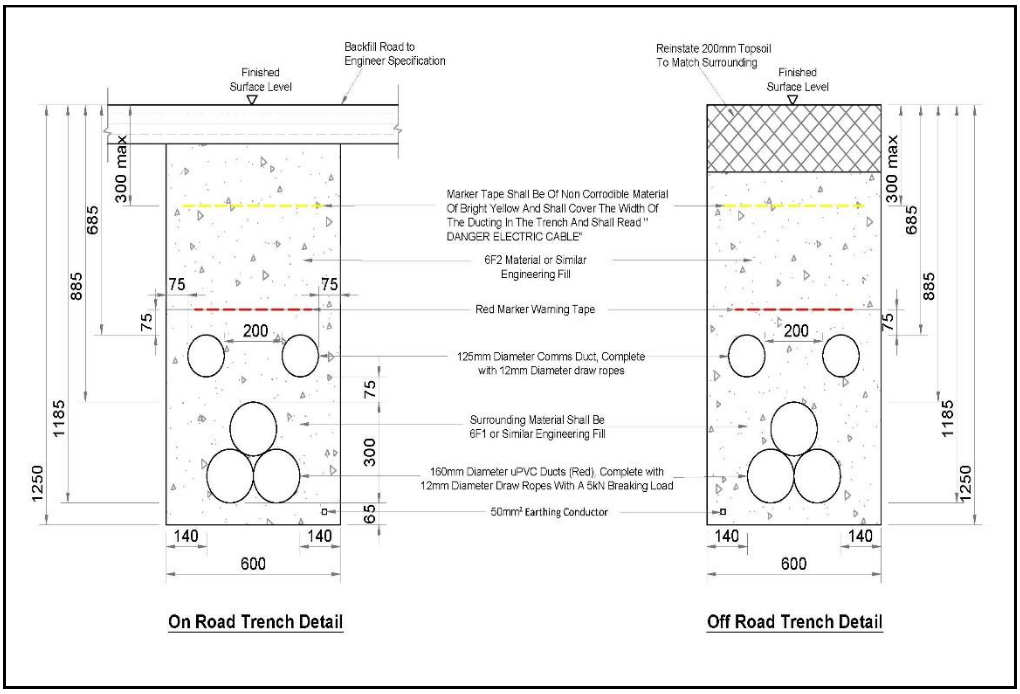


Figure 4.11 Typical Onsite Cable trench cross-section detail

Clay plugs will be installed at regular intervals of not greater than 50 metres along the length of the trenches to prevent the trenches becoming conduits for runoff water. While the majority of the cable trenches will be backfilled with native material, clay subsoils of low permeability will be used to prevent conduit flow in the backfilled trenches. This material will be imported onto the site should sufficient volumes not be encountered during the excavation phase of roadway and turbine foundation construction.

4.3.8 Grid Connection Cabling

A 38kV connection between the proposed development and the national electricity grid will be necessary to export electricity from the proposed development. The proposed underground cable connection will originate at the proposed onsite substation and connect to the existing 110kV Clahane switching station. The route will follow the proposed site roads to the proposed site entrance and turn south along a local road to the R557. The grid connection route will then turn east onto the R557 in the townland of Monument. The grid connection route follows the public road network southeast to the Clahane 110kV substation. The connection route is illustrated in Figure 4-12.

For the purposes of the grid connection design for this planning application, it is assumed that the potential maximum export capacity of the proposed wind farm will be 42MW.

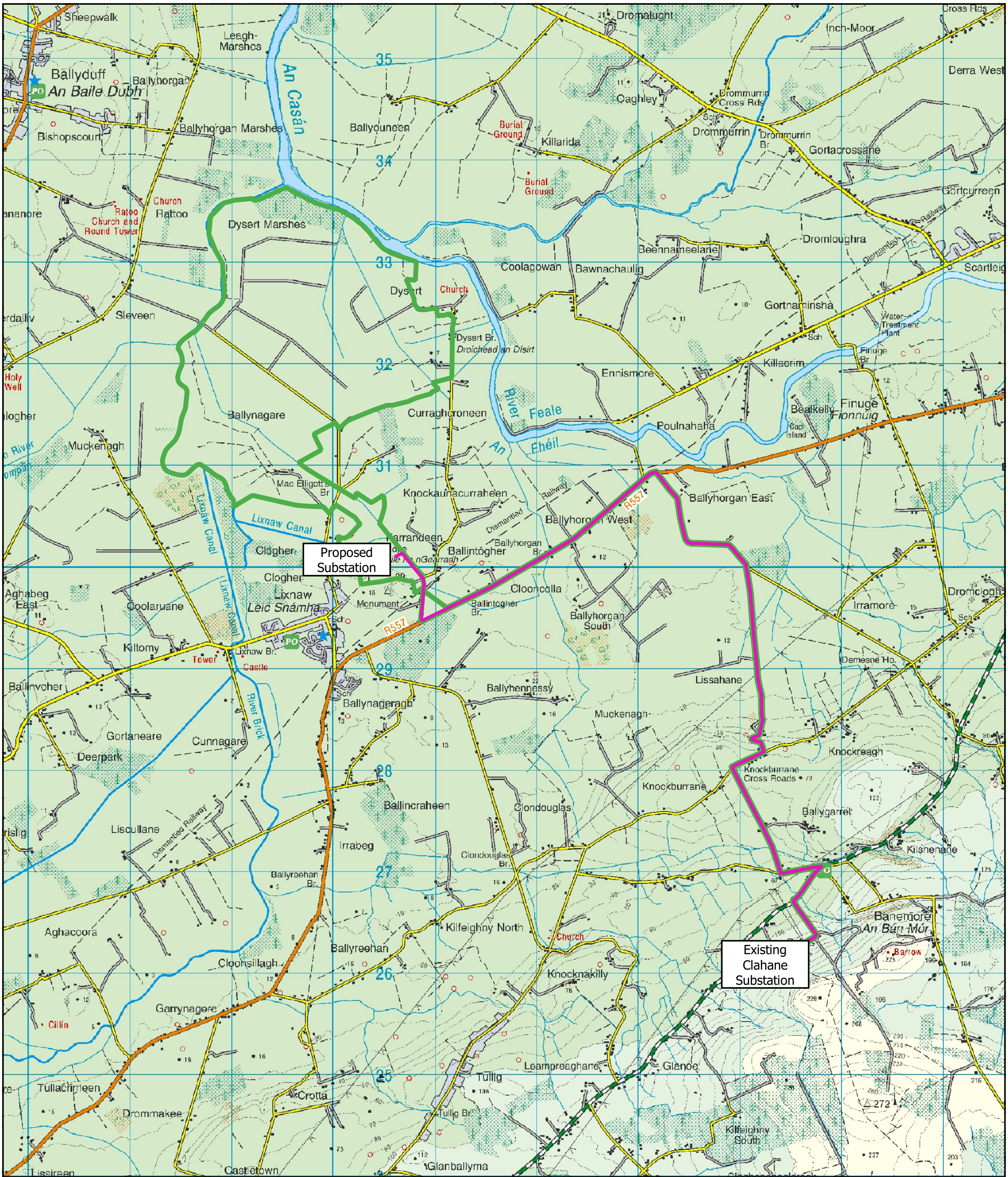
The proposed 38kV grid connection cable trench cross sections is shown in Figures 4-13. Further details in relation to the grid connection for the proposed development is outlined in Section 4.8.9 below.

4.3.8.1 Grid Connection Cable Route

The proposed grid connection cable route will commence from the proposed Ballynagare substation and connect to the existing 110kV Clahane switching station. The route will follow the proposed site roads to the proposed site entrance and turn south along a local road to the R557. The grid route travels east along the R557 for 2.7km where it heads south east along the tertiary road for 1.5km. It then travels south for 2km crossing under the Tralee-Tarbert 1 110kV and Tralee-Tarbert 2 110kV lines. It then turns west along the L1027 road for 0.35km where it then continues south for 1.1km. It then joins the L6074 road for 0.4km to Banemore Cross where it joins the N69. It then travels 0.45km south west along the N69 to the entrance of the existing Clahane 110kV substation which is approx. 550m from the N69 road. All works and construction machinery will operate within the curtilage of the public road. The total length of the proposed underground grid connection route is approximately 13.8 kilometres. The proposed grid connection cable will pass through 11 townlands, all of which are listed in Table 4.3 below. A map of the proposed grid connection cable route is shown in Figure 4.12.

Table 4.3 Townlands through which the cable route traverses

Townland Name
Knockaunacurraheen
Ballintogher,
Ballynageragh
Clooncolla
Ballyhorgan West
Ballyhorgan East
Lissahane
Knockburrane
Ballygarret
Banemore
Pallas



Map Legend

EIAR Study Area

Proposed 38kV Grid Connection

N

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Drawing Title	
Grid Connection Route	
Project Title	
Ballynagare Wind Farm	
Drawn By: TB	Checked By: LW
Project No.: 200512	Drawing No.: Figure 4.12
Scale: 1:50000	Date: 30.09.21

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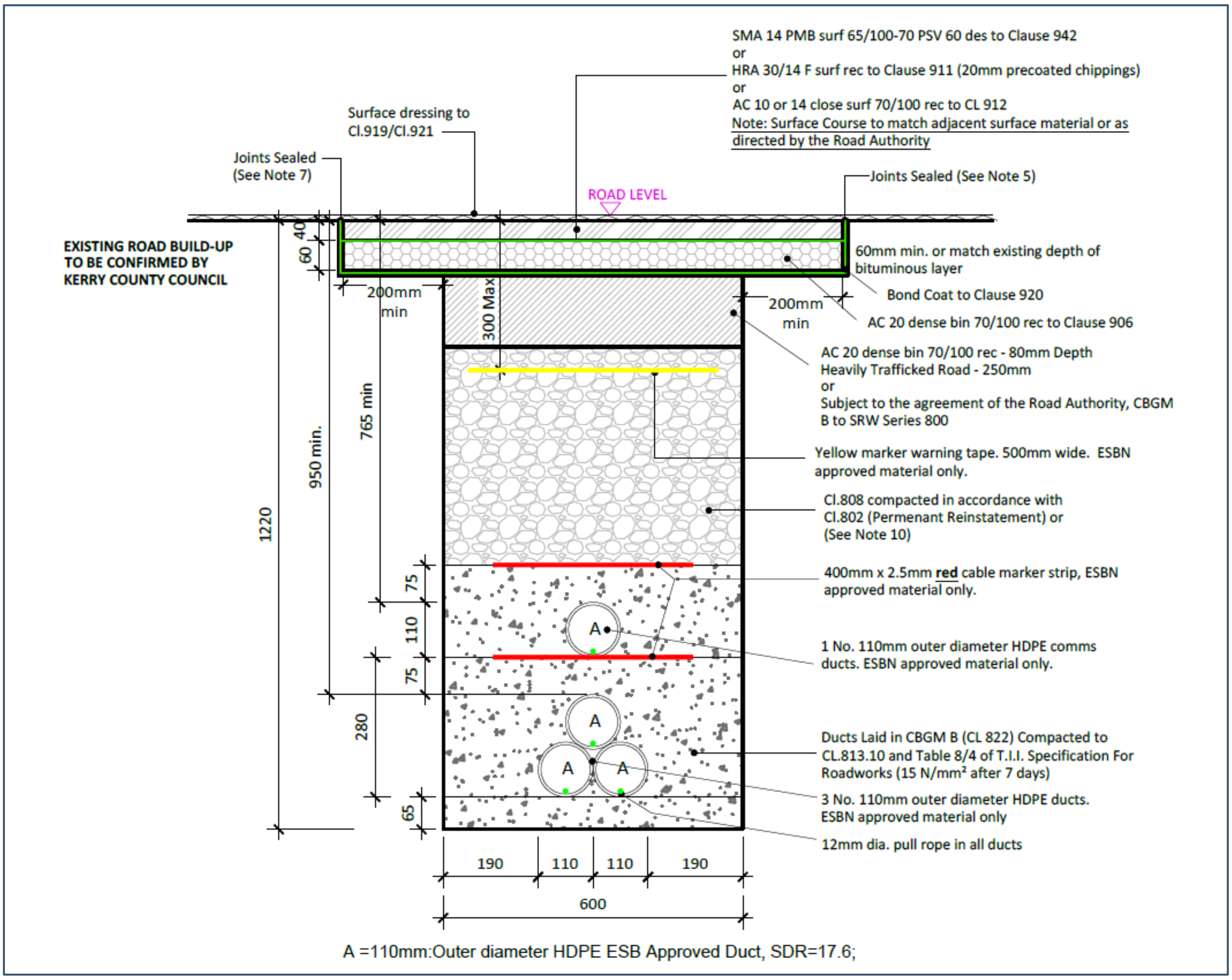


Figure 4.13 Proposed Grid Connection Cable Trench

4.3.9 Meteorological Mast

One permanent meteorological (met) mast is proposed as part of the proposed development. The met mast will be equipped with wind monitoring equipment at various heights. The mast will be located E88469 N131002 as shown on the site layout drawing in Figure 4-1. The mast will be a slender structure, 110 metres in height. The mast will either be a free-standing structure or could be supported by guyed wires radiating out 51 metres in three directions from the tower. The mast will be constructed on a hard standing area sufficiently large to accommodate the crane that will be used to erect the mast, adjacent to an existing track. The two variations of proposed met mast are shown in Figures 4.14 and 4.15. Electrical equipment at the base of the proposed met mast will be raised to an elevation of 3.75m OD to ensure that they are above the theoretical 1,000 year flood level.

4.3.10 Temporary Construction Compounds

A temporary construction compound measuring approximately 50 metres by 85 metres and 4,250m^2 in area is proposed for the southern section of the site, adjacent to the proposed access road. The location of the proposed construction compound is shown on the site layout drawing in Figure 4-1.

The construction compound will consist of temporary site offices, staff facilities and car-parking areas for staff and visitors. The layout of this construction compound is shown on Figure 4-16. Construction materials and turbine components will be brought directly to the proposed turbine locations following their delivery to the site.

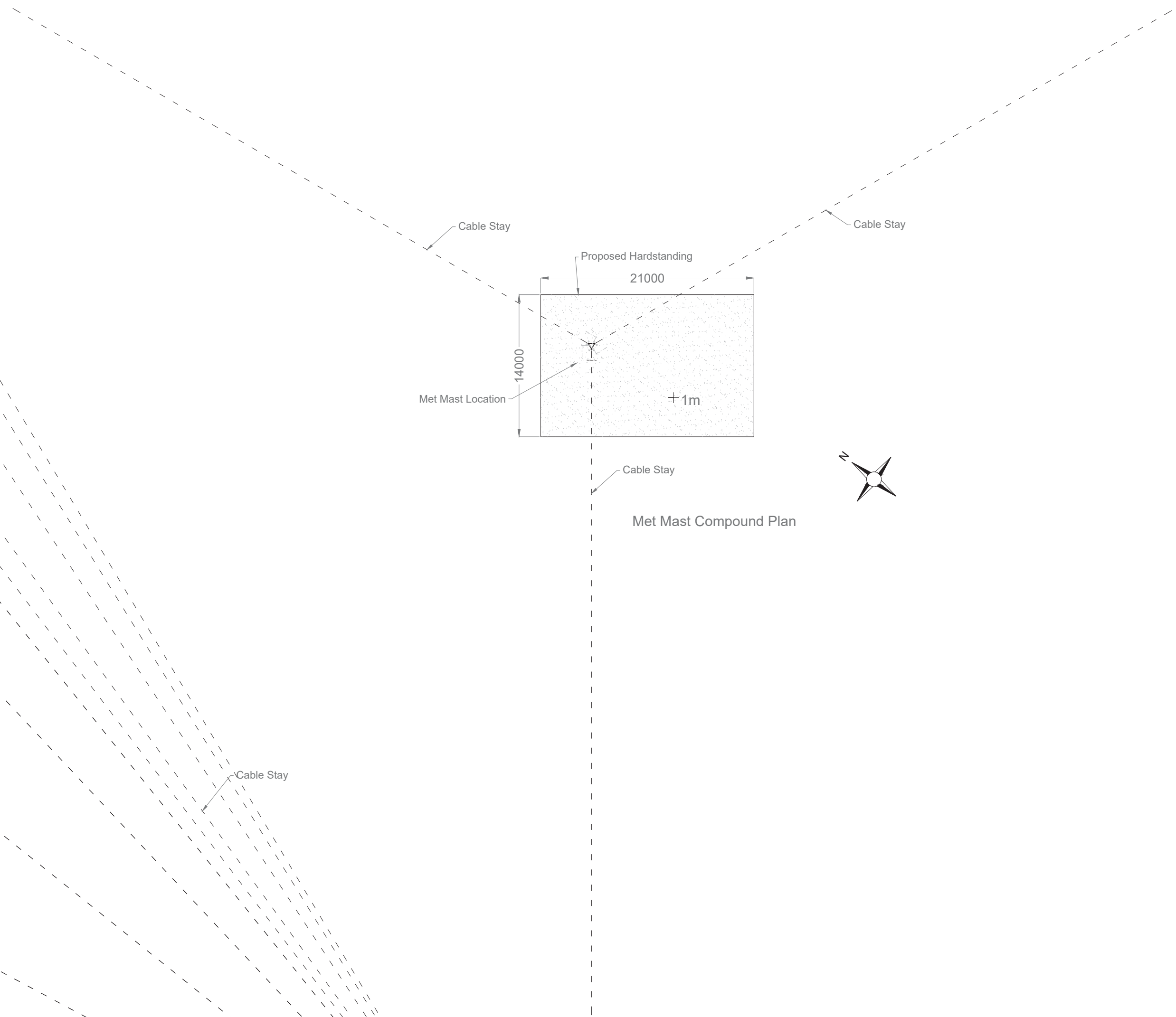
Temporary port-a-loo toilets located within a staff portacabin will be used during the construction phase. Wastewater from staff toilets will be directed to a sealed storage tank, with all wastewater being tankered off site by a permitted waste collector to wastewater treatment plants.

Once the proposed wind farm has been commissioned, this construction compound will be removed. The area will be reinstated with previously excavated spoil and will either be reseeded or left to revegetate naturally.

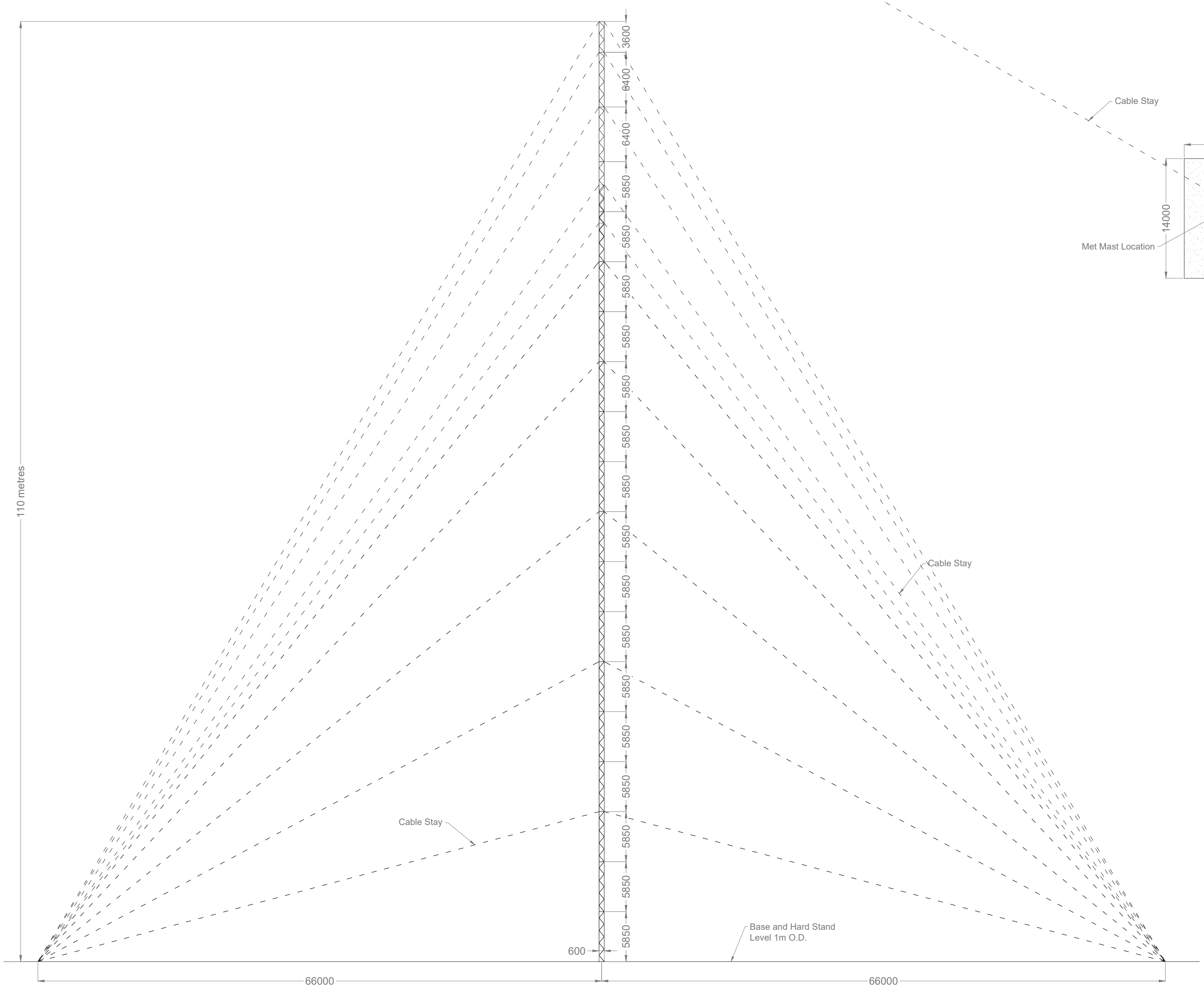
There will be a second temporary construction compound located adjacent to a proposed access road approximately 75m north of Turbine No. 3 in the west of the site. This temporary compound will measure approximately 4,250m^2 in area. This temporary construction compound will include staff facilities and a temporary port-a-loo and is also shown in Figure 4.1. The layout of this construction compound is shown in Figure 4-17. Once the proposed wind farm has been commissioned, this construction compound will be removed. The area will be reinstated with previously excavated peat and spoil and either be reseeded or left to revegetate naturally.

Drawing Notes

1. Met mast on site will either be guyed met mast or free standing met mast depending on site conditions. Both options shown only one will be used.



Met Mast Compound Plan



Met Mast Elevation

Figure 4-14

DRAWING TITLE: **Met Mast - Option 1 - Guyed Mast**	
PROJECT TITLE: **Ballynagare Wind Farm, Co. Kerry**	
DRAWING BY: **Joseph O Brien**	CHECKED BY: **Thomas Blackwell**
PROJECT No: **200512**	DRAWING No: **200512 - 34**
SCALE: **1:500 @ A3**	DATE: **22.11.2021**

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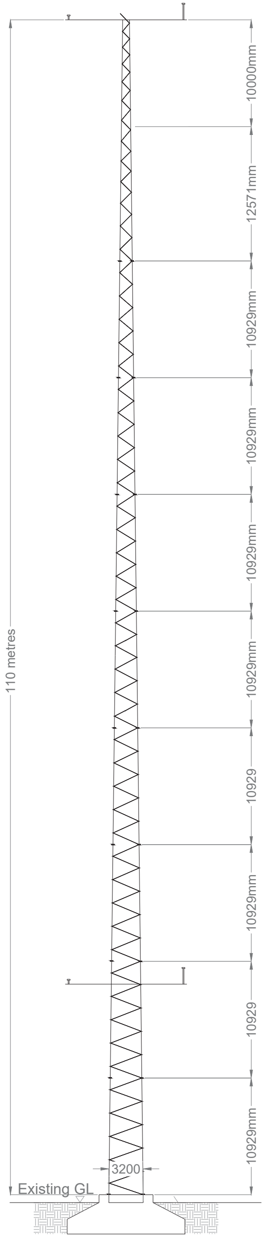
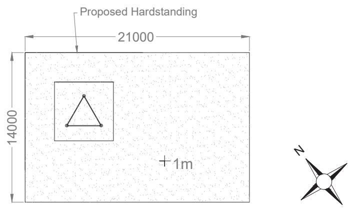
Website: www.mkoireland.ie

Drawing Notes

1. Met mast on site will either be guyed met mast or free standing met mast depending on site conditions.
   Both options shown only one will be used.





Met Mast Compound Plan

Figure 4-15

DRAWING TITLE: **Met Mast - Option 2 - Free Standing Mast**	
PROJECT TITLE: **Ballynagare Wind Farm, Co. Kerry**	
DRAWING BY: **Joseph O Brien**	CHECKED BY: **Thomas Blackwell**
PROJECT No.: **200512**	DRAWING No.: **200512 - 35**
SCALE: **1:500 @ A3**	DATE: **22.11.2021**

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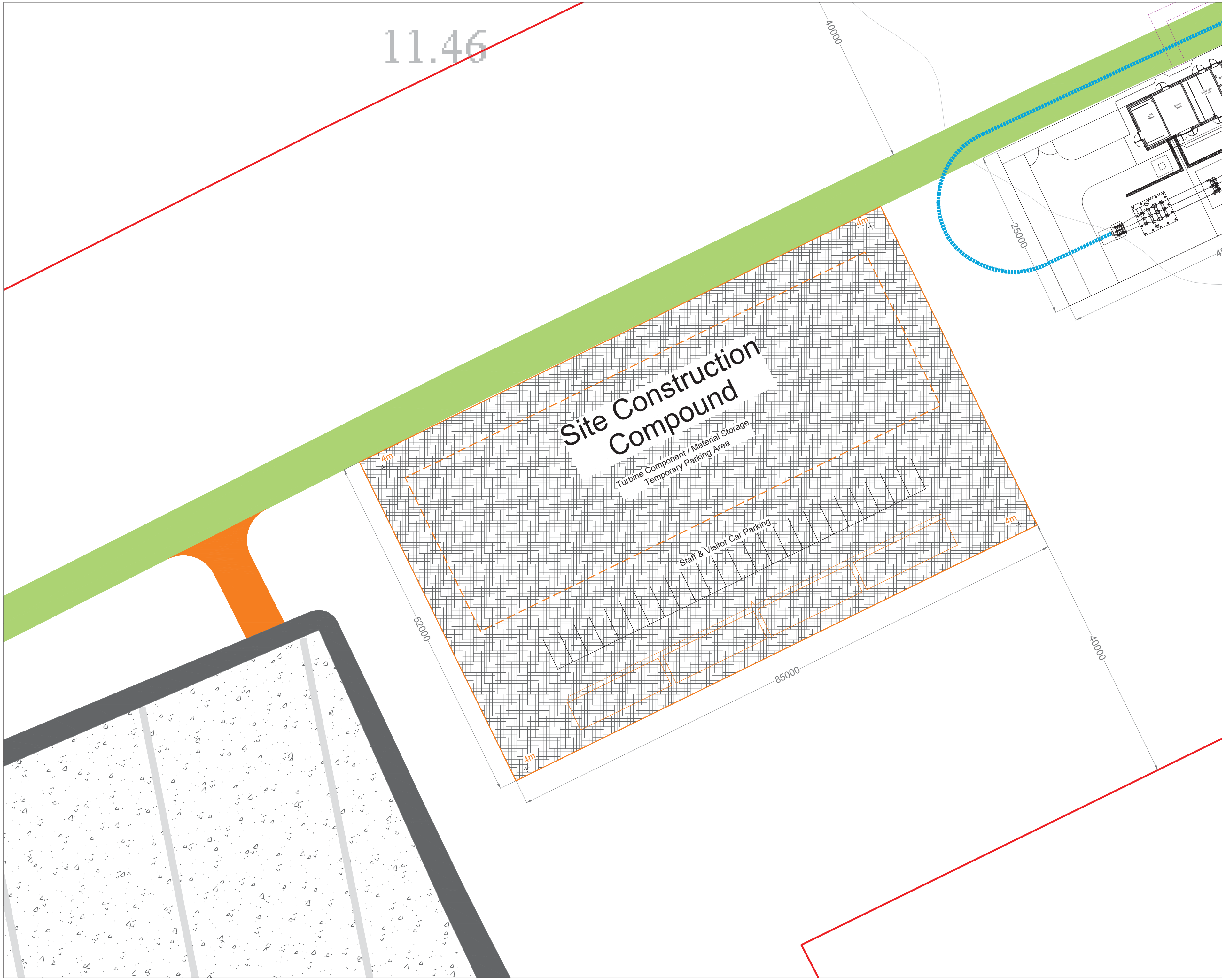

Project Design Drawing Notes

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6. The use of or reliance upon this drawing shall be deemed to be acceptance of these conditions of use unless otherwise agreed in writing, such written agreement to be sought from and issued by the copyright holder to the use or reliance upon this drawing.
7. Layout plans show 170m Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

Drawing Legend

- Planning Application Boundary
- Existing Road to be Upgraded
- Proposed Road
- Electrical Cable Trench
- Grid Connection Route
- Borrow Pit

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N

Figure 4-16

DRAWING TITLE:
Temporary Construction Compound 1

PROJECT TITLE:
Ballynagare Wind Farm, Co. Kerry

DRAWING BY: Joseph O Brien	CHECKED BY: Thomas Blackwell
PROJECT No.: 200512	DRAWING No.: 200512 - 28
SCALE: 1:500 @ A3	DATE: 22.11.2021

OS SHEET No.:
5151, 5152, 5153, 5213, 5214, 5215, 5275, 5276, 5277, 5335, 5336, 5337

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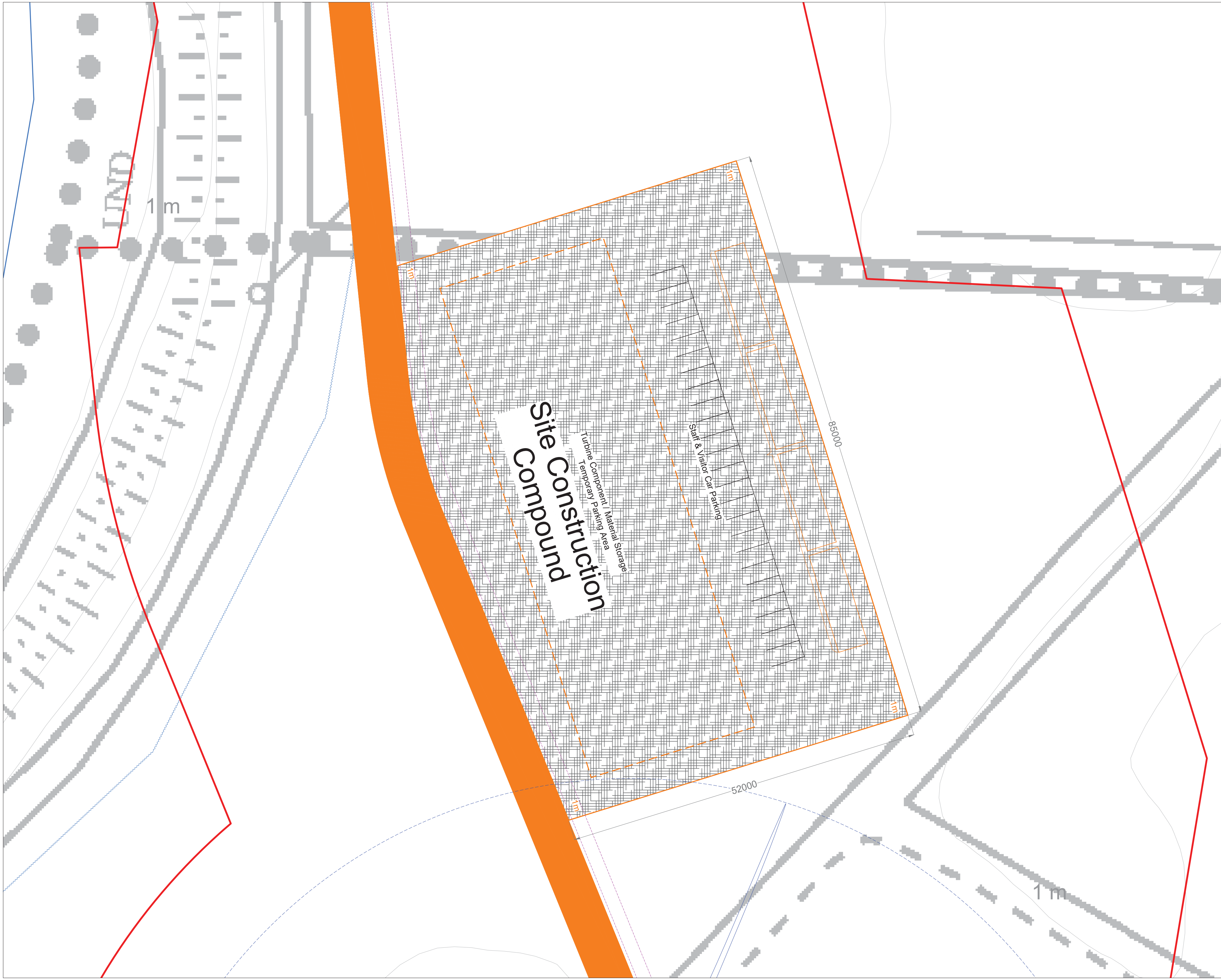

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7. Layout plans show 170m Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

Drawing Legend

- Planning Application Boundary
- Proposed Road
- Electrical Cable Trench
- River/Stream
- River/Stream 50m Buffer
- Turbine Sweep Area

N

Figure 4-17

DRAWING TITLE:
Temporary Construction Compound 2

PROJECT TITLE:
Ballynagare Wind Farm, Co. Kerry

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Thomas Blackwell**
PROJECT No.: **200512**	DRAWING No.: **200512 - 29**
SCALE: **1:500 @ A3**	DATE: **22.11.2021**

OS SHEET No.: 5151, 5152, 5153, 5213, 5214, 5215, 5275, 5276, 5277, 5335, 5336, 5337

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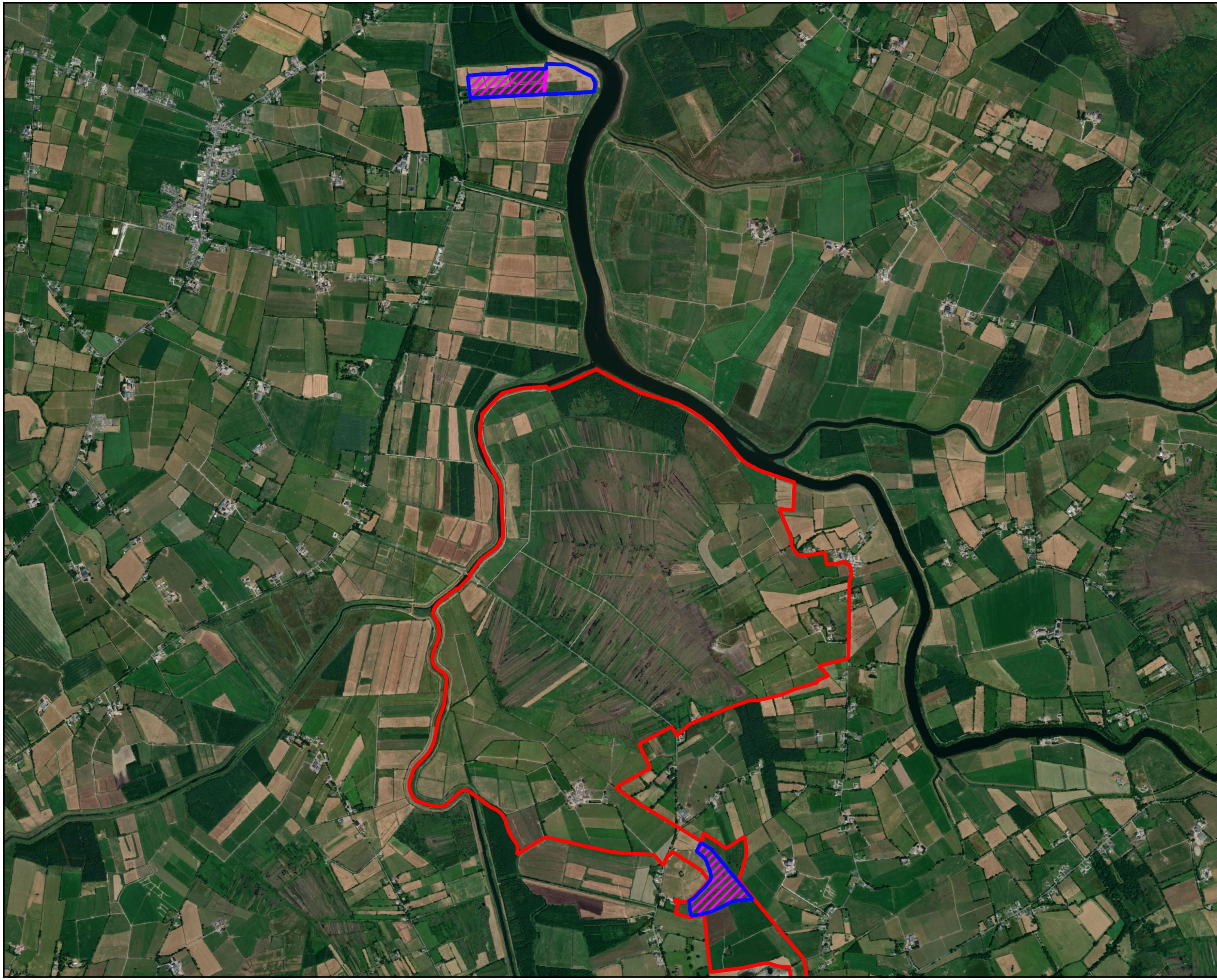
4.3.11 Associated Works

4.3.11.1 Whooper Swan Enhancement Lands

The proposed development is located adjacent to a non-designated but nationally important area for whooper swan in Ballyouneen, Co. Kerry. Nationally important numbers of whooper swan were observed roosting and foraging on improved agricultural farmland in Ballyouneen during two winter seasons of bird survey in October 2019-March 2020 and October 2020-March 2021. In addition, flocks of up to 57 whooper swan (regionally important) considered to be associated with the nationally important population at Ballyouneen were observed foraging in the south-west area of the proposed development.

The potential for effects on whooper swan at the wind farm site is assessed in full in Chapter 7 of this EIAR. The proposed development is not expected to impact the foraging and roosting grounds at Ballyouneen. However, due to the presence of smaller foraging flocks in the south-west of the wind farm site, it is proposed to identify and manage 15.76ha of currently unused and suboptimal habitat in the area to enhance its foraging value for the Ballyouneen whooper swan population. This enhancement land and adjoining lands (totalling 21.02ha) will be managed for foraging whooper swan for the lifetime of the proposed development. A detailed Whooper Swan Enhancement Plan is included as Appendix 7-7 to this EIAR. The location of the proposed whooper swan enhancement lands are shown in Figure 4.18.



Map Legend

- EIAR Study Area
- Land Parcel
- Proposed Enhancement Area

N

Drawing Title: Proposed enhancement land	
Project Title: Ballynagare wind farm	
Drawn by: SD	Checked By: PC
Project No.: 200512	Drawing No.: Figure 4.18
Scale: 1:32000	Date: 18.11.21

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4.3.12 Site Activities

4.3.12.1 Environmental Management

All proposed activities on the site of the proposed development will be provided for in an environmental management plan. A Construction and Environmental Management Plan (CEMP) has been prepared for the proposed development, and is included in Appendix 4-2 of this EIAR. The CEMP includes details of drainage, peat and overburden management and waste management. The CEMP will set out all measures necessary to ensure works are carried out in accordance with the mitigation measures set out in this EIAR, and will set out the monitoring and inspections procedures and frequencies. The environmental management plan will also make provision for a suitably qualified individual such as an environmental clerk of works who will oversee the site works, and provide on-site advice on the mitigation measures necessary to ensure the project proceeds as intended in this EIAR.

It is intended that the CEMP would be updated prior to the commencement of the development, to include all mitigation measures, conditions and or alterations to the EIAR and application documents that may emerge during the course of the planning process and would be submitted to the Planning Authority for written approval. The CEMP will also require updating by the selected contractor in order to identify, assess and satisfy the contract performance criteria as set out by the various stakeholders. The CEMP due to its structure and nature will also require constant updating and revision throughout the construction period as set out below. Therefore, this is a working document and will be developed further prior to and during construction.

4.3.12.2 Peat Management

Peat and other overburden material as described and quantified in Section 4.3.4 above, will be excavated from where they are found, and transported either directly to the borrow pit for permanent storage, or to one of the temporary peat repository areas as described in Section 4.3.4 for storage until such time as sufficient capacity has been developed within the borrow pit. Excavators will load the peat and overburden directly into dump trucks, which will be used to transport the material to the repository area. Some side casting of peat and other materials at the edges of areas where they are excavated from may occur at appropriate locations decided by the site geotechnical engineer.

4.3.12.3 Refuelling

Wherever possible, vehicles will be refuelled off-site. This will be the case for regular, road-going vehicles. However, for construction machinery that will be based on-site continuously, a limited amount of fuel will have to be stored on site.

On-site refuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site, and will be towed around the site by a 4x4 jeep to where machinery is located. It is not practical for all vehicles to travel back to a single refuelling point, given the size of the cranes, excavators, etc. that will be used during the construction of the proposed wind farm. The 4x4 jeep will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use. Only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations.

4.3.12.4 Concrete Deliveries

Only ready-mixed concrete will be used during the construction phase, with all concrete being delivered from local batching plants in sealed concrete delivery trucks. The use of ready-mixed concrete deliveries will eliminate any potential environmental risks of on-site batching. When concrete is delivered to site, only the chute of the delivery truck will be cleaned, using the smallest volume of water necessary, before leaving the site. Concrete trucks will be washed out fully at the batching plant, where facilities are already in place.

The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a temporary lined impermeable containment area, or a Siltbuster-type concrete wash unit (http://www.siltbuster.com/sheets/RCW.pdf) or equivalent. This type of Siltbuster unit catches the solid concrete and filters and holds wash liquid for pH adjustment and further solids separation. The residual liquids and solids can be disposed of off-site at an appropriate waste facility. Where temporary lined impermeable containment areas are used, such containment areas are typically built using straw bales and lined with an impermeable membrane. Two examples are shown in Plates 4.7 and 4.8 below.

Plate 4.6 Concrete washout area

Plate 4.7 Concrete washout area

The areas are generally covered when not in use to prevent rainwater collecting. In periods of dry weather, the areas can be uncovered to allow much of the water to be lost to evaporation. At the end of the concrete pours, any of the remaining liquid contents is tankered off-site. Any solid contents that will have been cleaned down from the chute will have solidified and can be broken up and disposed of along with other construction waste.

Due to the volume of concrete required for each turbine foundations, and the requirement for the concrete pours to be continuous, deliveries are often carried out outside normal working hours in order to limit the traffic impact on other road users, particularly peak period school and work commuter traffic. Such activities are limited to the day of turbine foundation concrete pours, which are complete in a single day per turbine.

The risks of pollution arising from concrete deliveries will be further reduced by the following:

- Concrete trucks will not be washed out on the site, but will be directed back to their batching plant for washout.
- Site roads will be constructed to a high standard to allow transport of the turbine components around the site, and hence, concrete delivery trucks will be able to access all areas where the concrete will be needed. No concrete will be transported around the site in open trailers or dumpers so as to avoid spillage while in transport. All concrete used in the construction of turbine bases will be pumped directly into the shuttered formwork from the delivery truck. If this is not practical, the concrete will be pumped from the delivery truck into a hydraulic concrete pump or into the bucket of an excavator, which will transfer the concrete to the location where it is needed.
- The arrangements for concrete deliveries to the site will be discussed with suppliers before work starts, agreeing routes, prohibiting on-site washout and discussing emergency procedures.
- Clearly visible signage will be placed in prominent locations close to concrete pour areas specifically stating washout of concrete lorries is not permitted on the site.

4.3.12.5 Concrete Pouring

Because of the scale of the main concrete pours that will be required to construct the proposed wind farm, the main pours will be planned days or weeks in advance. Special procedures will be adopted in advance of and during all concrete pours to minimise the risk of pollution. These may include:

- Using weather forecasting to assist in planning large concrete pours, and avoiding large pours where prolonged periods of heavy rain is forecast.
- Restricting concrete pumps and machine buckets from slewing over watercourses while placing concrete.
- Ensuring that excavations are sufficiently dewatered before concreting begins and that dewatering continues while concrete sets.
- Ensuring that covers are available for freshly placed concrete to avoid the surface washing away in heavy rain.
- Disposing of surplus concrete after completion of a pour in agreed suitable locations away from any watercourse or sensitive habitats.

4.3.12.6 Dust Suppression

In periods of extended dry weather, dust suppression may be necessary along haul roads and around the borrow pit area to ensure dust does not cause a nuisance. If necessary, water will be taken from stilling ponds in the site's drainage system, and will be pumped into a bowser or water spreader to dampen down haul roads and site compounds to prevent the generation of dust. Silty or oily water will not be used for dust suppression, because this would transfer the pollutants to the haul roads and generate polluted runoff or more dust. Water bowser movements will be carefully monitored, as the application of too much water may lead to increased runoff.

4.3.12.7 Vehicle Washing

Wheels or vehicle underbodies are often washed before leaving sites to prevent the build-up of mud on public (and site) roads. It is not anticipated that vehicle or wheel washing will be required as part of the construction phase of the proposed development because site roads will be already formed using on-site materials before other road-going trucks begin to make regular or frequent deliveries to the site (e.g. with steel or concrete). The site roads will be well finished with compacted hardcore, and so the public road-going vehicles will not be travelling over soft or muddy ground where they might pick up mud or dirt.

A road sweeper will be available if any section of the public roads were to be dirtied by trucks associated with the proposed development.

4.3.12.8 Waste Management

The CEMP, Appendix 4-2 of this EIAR, includes a waste management plan (WMP) which outlines the best practice procedures during the demolition, excavation and construction phases of the project. The WMP outlines the methods of waste prevention and minimisation by recycling, recovery and reuse at each stage of construction of the proposed development. Disposal of waste will be seen as a last resort.

The Waste Management Act 1996 and its subsequent amendments provide for measures to improve performance in relation to waste management, recycling and recovery. The Act also provides a regulatory framework for meeting higher environmental standards set out by other national and EU legislation.

The Act requires that any person engaging in a waste related activity must have all necessary licenses and authorisations. It will be the duty of the Construction Waste Manager on the site of the development to ensure that all contractors hired to remove waste from the site have valid Waste Collection Permits. It will then be necessary to ensure that the waste is delivered to a licensed or permitted waste facility. The hired waste contractors and subsequent receiving facilities must adhere to the conditions set out in their respective permits and authorisations.

Prior to the commencement of the development, a Construction Waste Manager will be appointed by the Contractor. The Construction Waste Manager will be in charge of the implementation of the objectives of the WMP, ensuring that all hired waste contractors have the necessary authorisations and that the waste management hierarchy is adhered to. The person appointed must have sufficient authority so that they can ensure everyone working on the development adheres to the WMP.

The WMP provides systems that will enable all arisings, movements and treatments of construction waste to be recorded. This system will enable the contractor to measure and record the quantity of waste being generated. It highlights the areas from which most waste occurs and allows the measurement of arisings against performance targets. The WMP can then be adapted with changes that are seen through record keeping.

4.4 Access & Transportation

4.4.1 Site Entrances

There are seven proposed site entrances into the site from the local roads in the area. The site will be accessed from the R557 via the local road (L6055) travelling north from the R557 in the townland of Monument to the east of Lixnaw. Initially the site is accessed via a new site entrance by turning northwest off this local road. It is from this new entrance that the borrow pit, construction compound, and substation are accessed. The proposed layout of this site entrance is shown on Figures 4.19.

The main site entrance link road continues northwest and crosses the existing Clogher Road from Lixnaw to Ballyduff to the north of the village of Lixnaw. The second and third site proposed site entrances are on either side of this local. These site entrances facilitate the crossing of the local road and will provide access to Turbines 5, 6, and 7. The proposed layout of these site entrances is shown on Figures 4.20. Once the construction phase is complete it is intended that the third site entrance will become the main entrance for the wind farm.

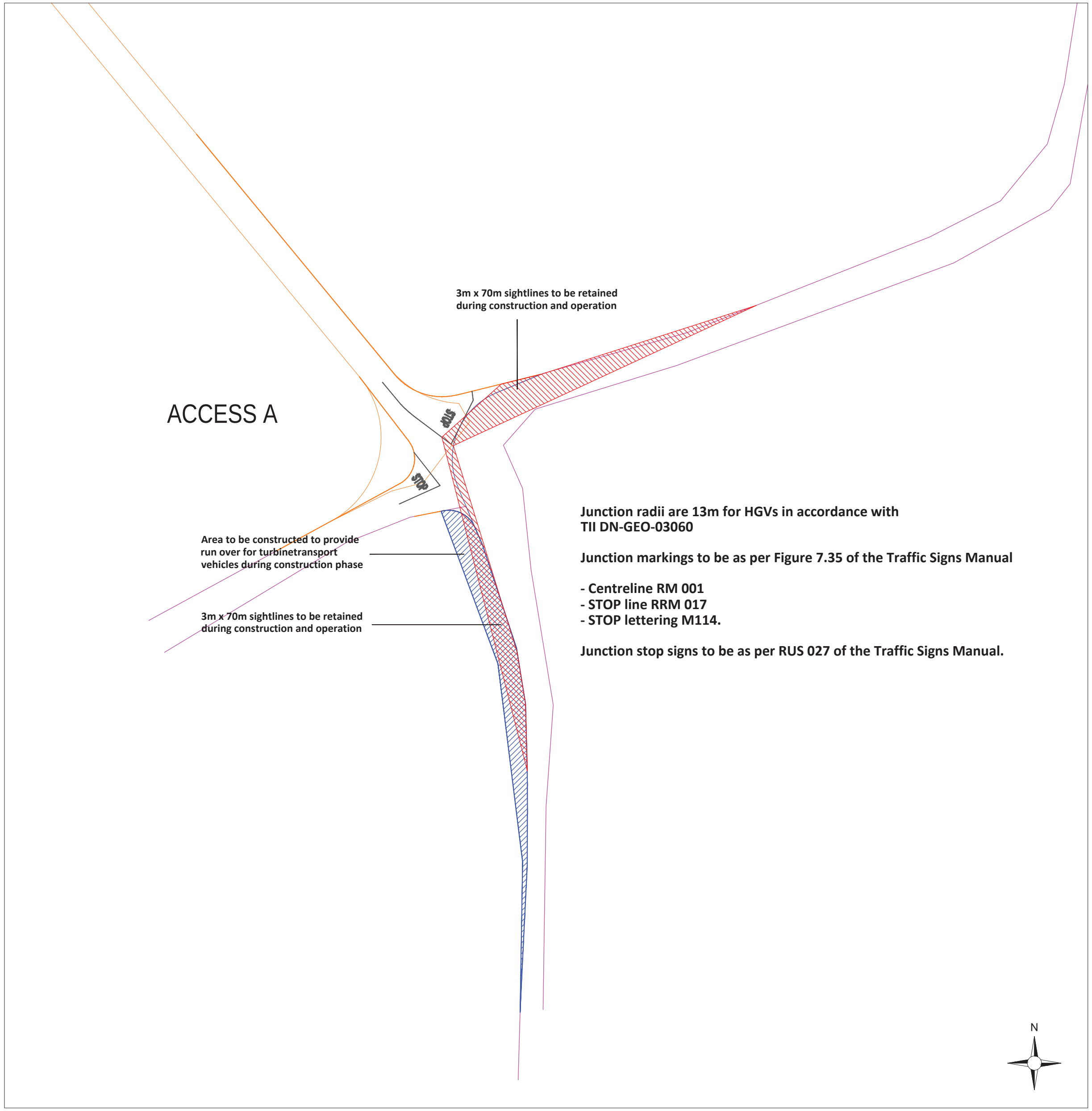
The fourth and fifth proposed site entrances are located on either side of the existing Lixnaw to Ballyduff road that bisects the centre of the site. These site entrances provide access to Turbine 4 and all associated works areas. The proposed layout of these site entrances is shown on Figures 4.21.

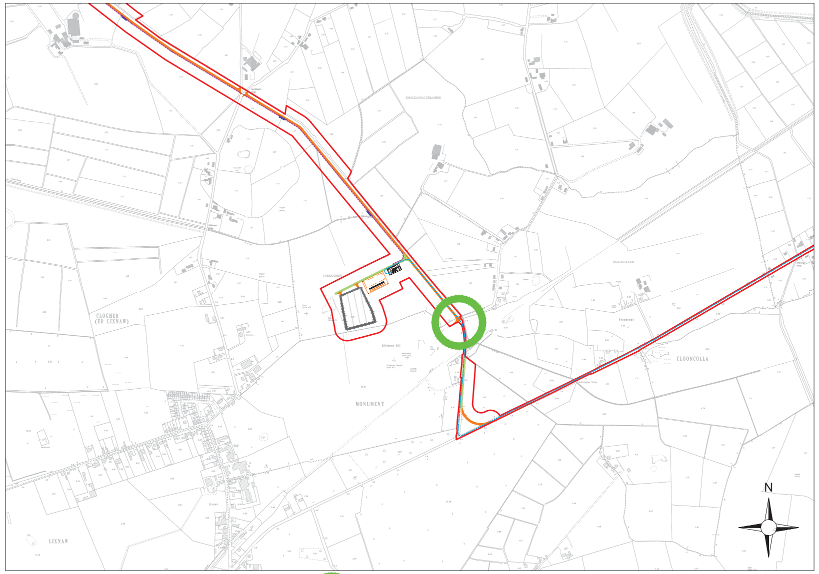
The sixth and seventh proposed site entrances are in the western portion of the site and are also located on either side of the either side of the existing Lixnaw to Ballyduff road that bisects the centre of the site. These site entrances will provide access to Turbines 1, 2, and 3 and all associated works areas. The proposed layout of these site entrances is shown on Figures 4.22

The location of these entrances is shown on the site layout drawing in Figure 4.1. The proposed layout of the site entrances is shown on Figures 4.19 to 4.22.

Drawing Legend

- Existing Road Edge
- Proposed New Road
- Transport Runover Area
- Sight Line





1:10,000 Location on Context Map

Figure 4.19

DRAWING TITLE: **Proposed Access Junction A**	
PROJECT TITLE: **Ballynagare Wind Farm, Co. Kerry**	
DRAWING BY: Joseph O Brien	CHECKED BY: Thomas Blackwell
PROJECT No.: 200512	DRAWING No.: 200512 - 39
SCALE: 1:500 @ A1	DATE: 08.10.2021

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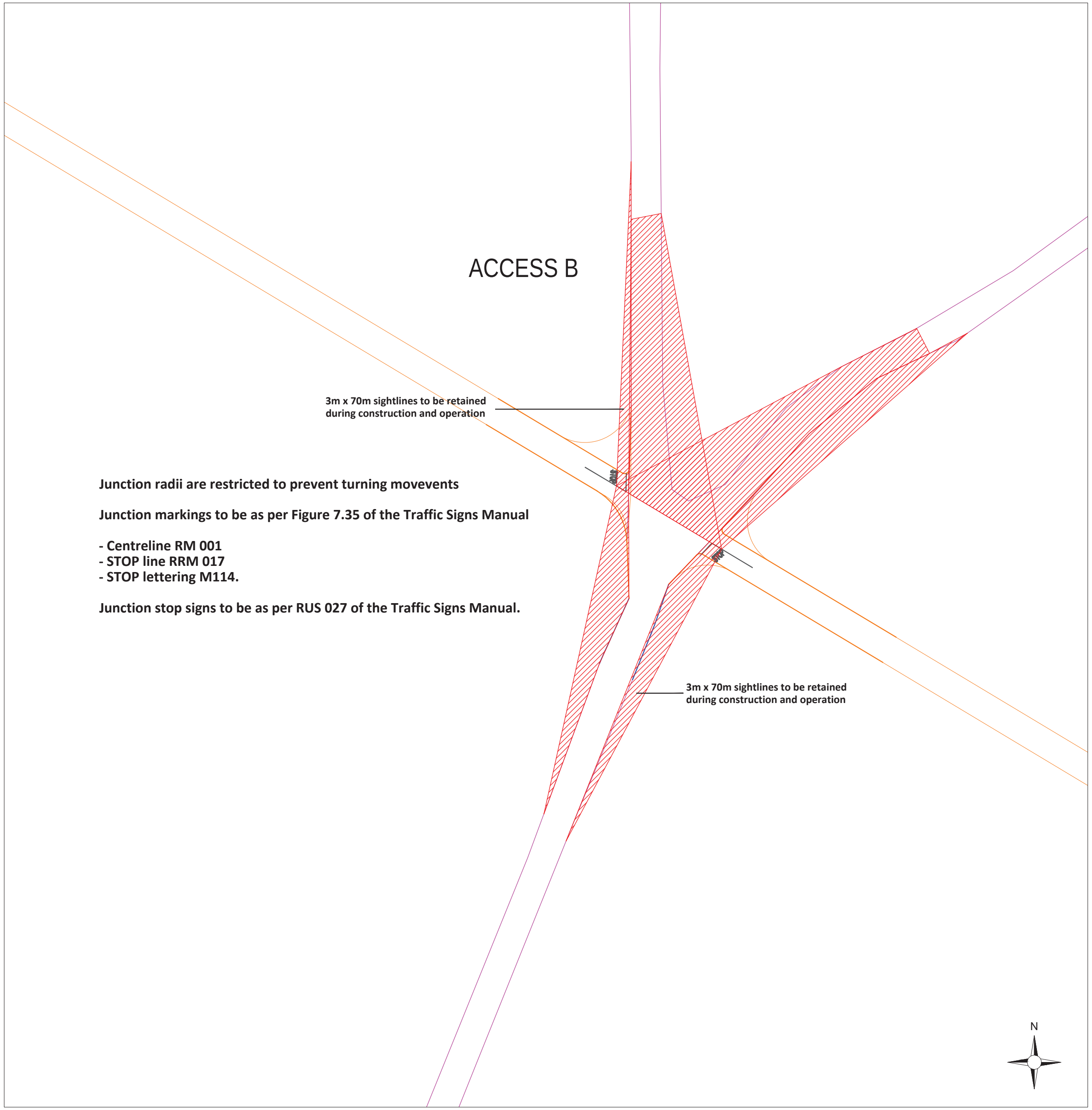
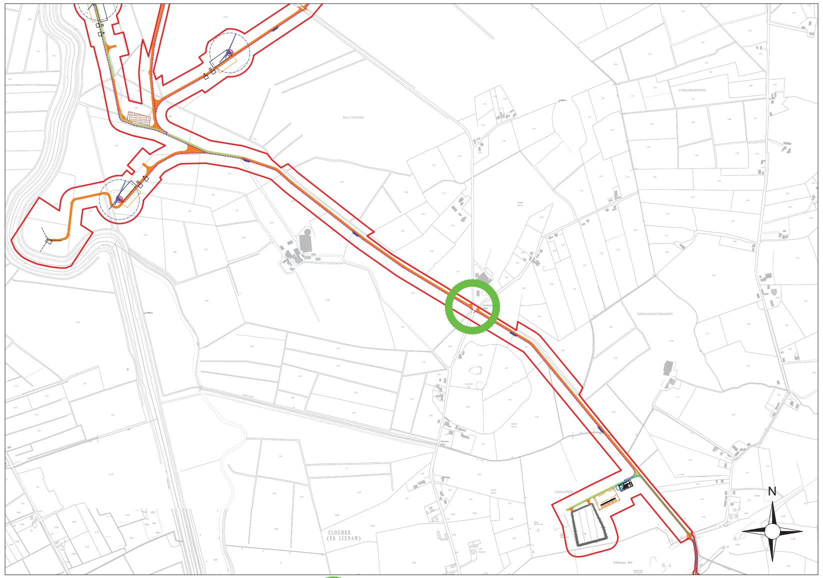
Drawing Legend

Existing Road Edge

Proposed New Road

Sight Line





1:10,000 Location on Context Map

Figure 4.20

DRAWING TITLE:
Proposed Access Junction B

PROJECT TITLE:
Ballynagare Wind Farm, Co. Kerry

DRAWING BY: Joseph O Brien	CHECKED BY: Thomas Blackwell
PROJECT No.: 200512	DRAWING No.: 200512 - 40
SCALE: 1:500 @ A1	DATE: 08.10.2021

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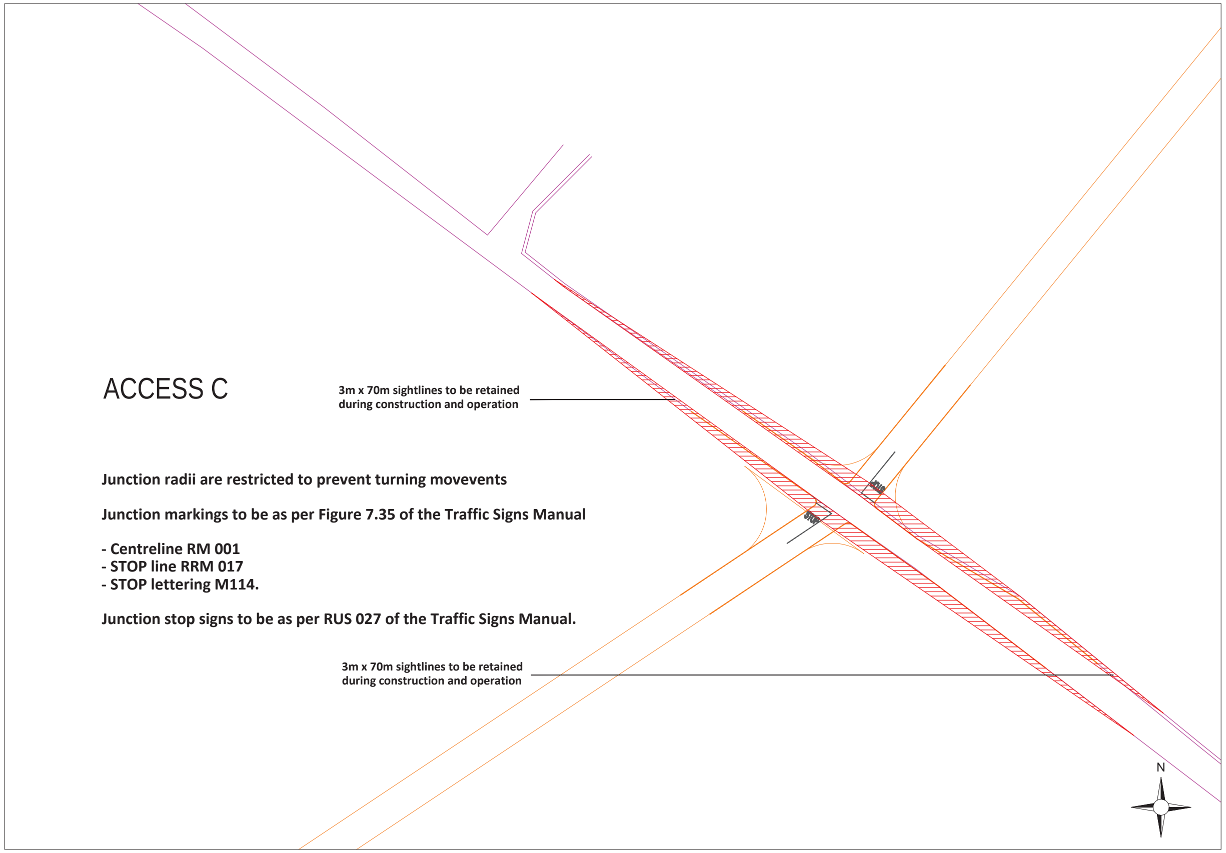
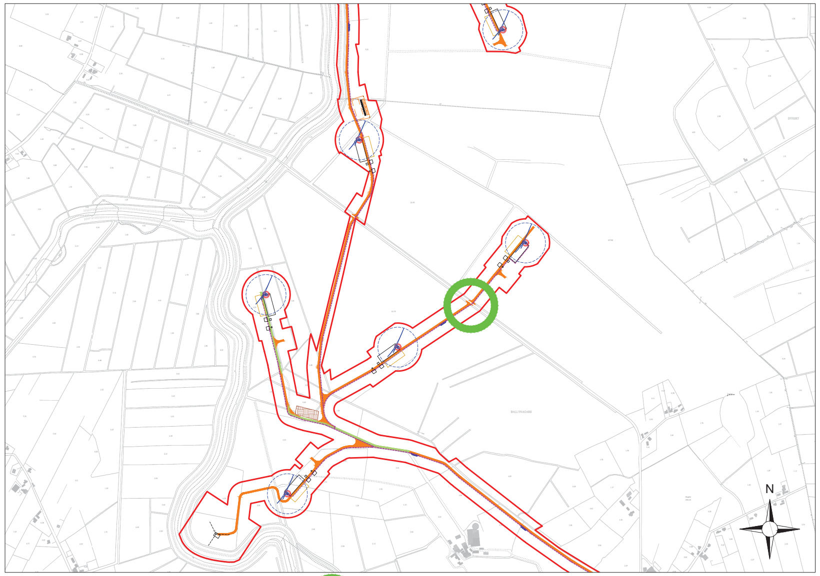
Drawing Legend

- Existing Road Edge
- Proposed New Road
- Sight Line





1:10,000 Location on Context Map

Figure 4.21

DRAWING TITLE:
Proposed Access Junction C

PROJECT TITLE:
Ballynagare Wind Farm, Co. Kerry

DRAWING BY: Joseph O Brien	CHECKED BY: Thomas Blackwell
PROJECT No.: 200512	DRAWING No.: 200512 - 41
SCALE: 1:500 @ A1	DATE: 08.10.2021

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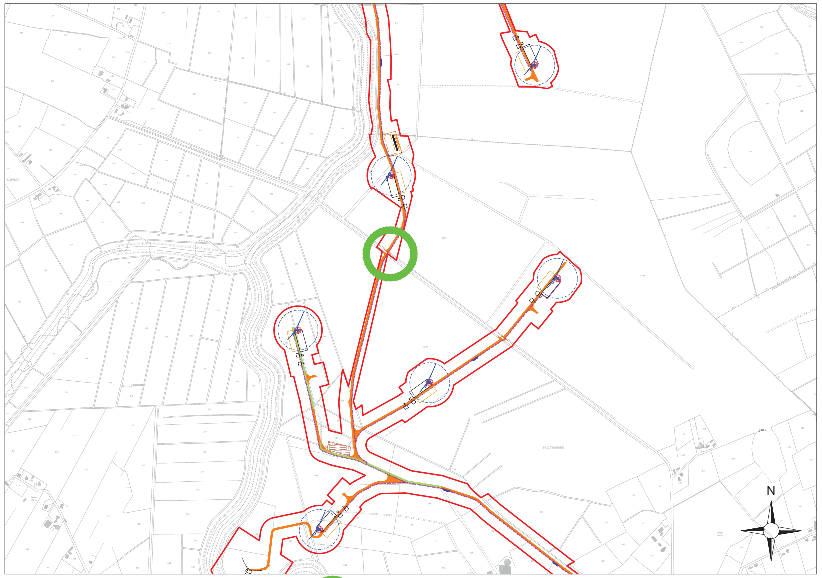
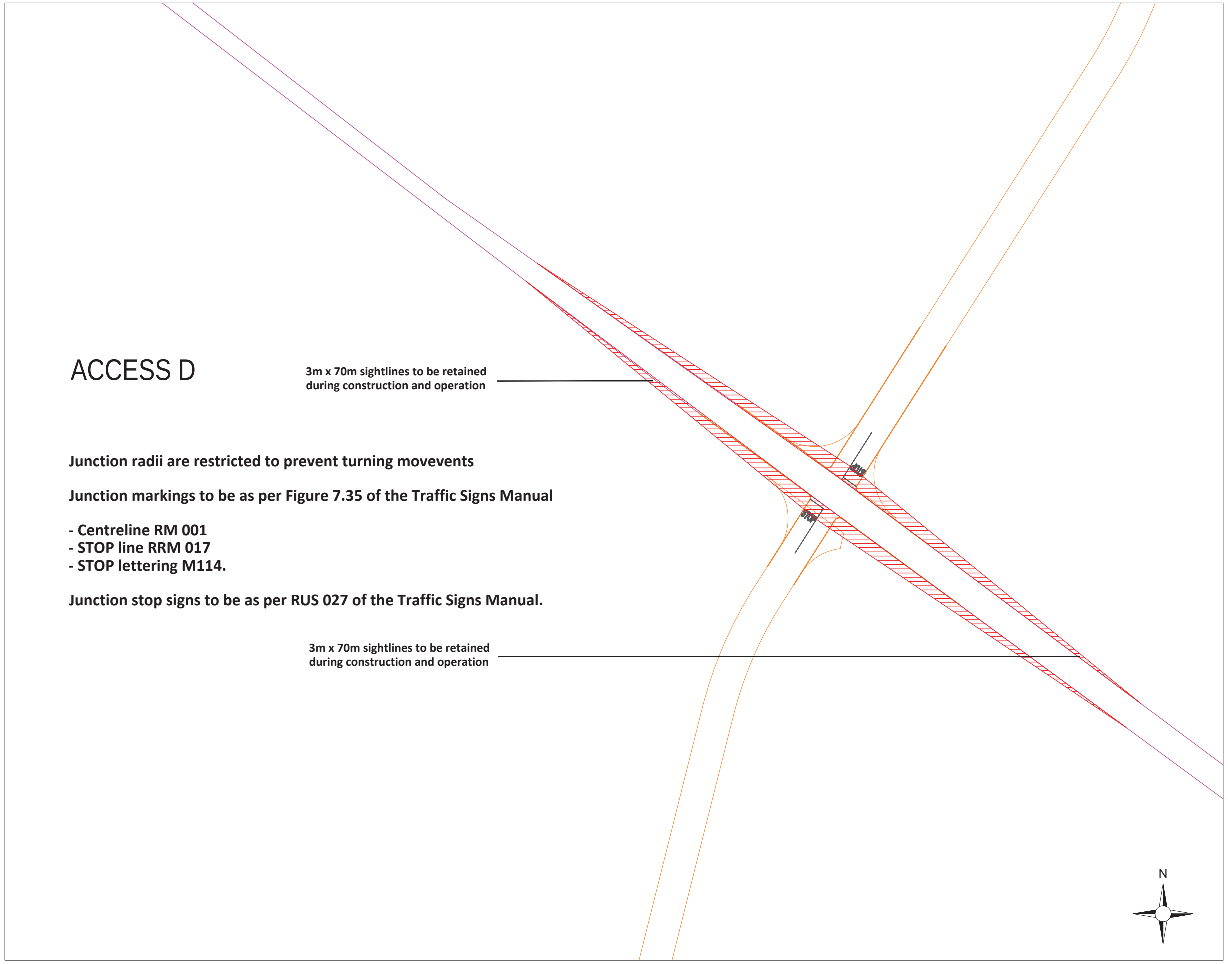
Drawing Legend

- Existing Road Edge
- Proposed New Road
- Sight Line



1:10,000 Location on Context Map

ACCESS D



Junction radii are restricted to prevent turning movevents

Junction markings to be as per Figure 7.35 of the Traffic Signs Manual

- Centreline RM 001
- STOP line RRM 017
- STOP lettering M114.

Junction stop signs to be as per RUS 027 of the Traffic Signs Manual.

Figure 4.22	
DRAWING TITLE: **Proposed Access Junction D**	
PROJECT TITLE: **Ballynagare Wind Farm, Co. Kerry**	
DRAWING BY: **Joseph O Brien**	CHECKED BY: **Thomas Blackwell**
PROJECT No.: **200512**	DRAWING No.: **200512 - 42**
SCALE: **1:500 @ A1**	DATE: **08.10.2021**

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4.4.2 Turbine and Construction Materials Transport Route

The proposed turbine transport route from the N69 National Secondary Road to the proposed development site is shown on Figure 4.23. From Foynes port, the turbines will be transported south on the N21 National Primary Road towards Newcastle West. The turbines will then travel west on the N21 towards Tralee and turn right at the roundabout before Tralee and on to the N69 traveling north east. The turbines will continue north east on the N69 and then turn left on to the local road at Mountcoal cross before travelling northwest to the R557. The turbines will then turn left onto the R557 and continue northwest towards the proposed development site.

Construction materials such as concrete and steel will follow the same transport route as the wind turbines from both north and south of the N69 to the proposed development site.

All deliveries of turbine components and other construction materials to the site will only be by way of the proposed transport route outlined in Figure 4.23. No other public road route will be used as part of the construction phase of the proposed development for the transport of materials. The number of construction vehicles that will be generated during the construction phase of the proposed development are outlined as part of the traffic and transport assessment in Chapter 14 of this EIAR.

4.4.3 Required Works along Transport Route

Works such as road widening are sometimes required along proposed turbine transport routes to accommodate the large vehicles used to transport turbine components to wind farm sites. The proposed transport route for the proposed development has been the subject of a route assessment to determine if any widening works are required along its length. Required works along the transport route are minor and are all located within the existing road corridor. Full details of the assessment are included as part of the traffic impact assessment set out in Chapter 14, Section 14.1 of this EIAR.

4.4.3.1 Construction of Temporary Junction Accommodation Works

The construction methodology of the temporary junction accommodation works along the turbine delivery route will be as outlined below:

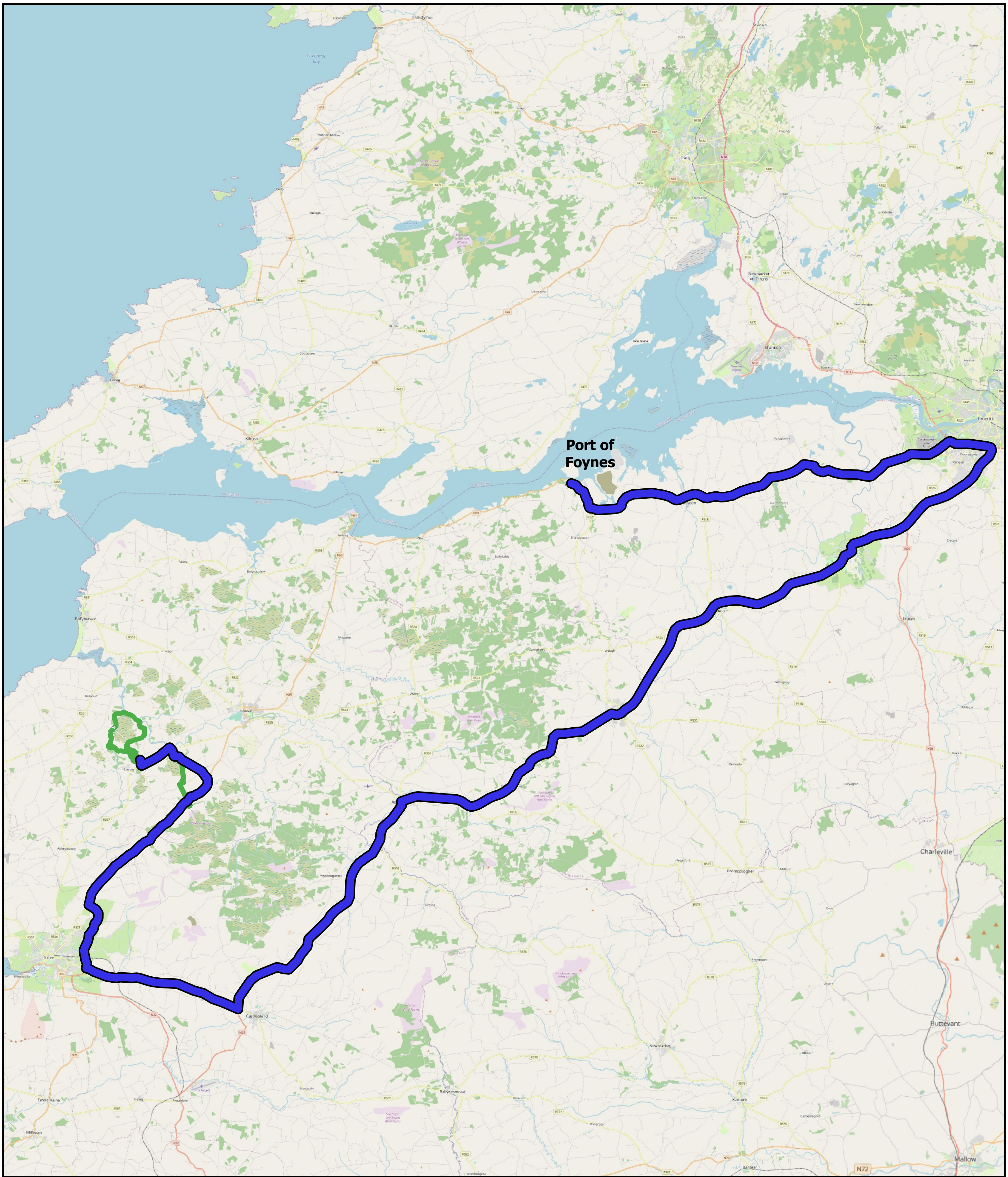
- Overburden within the required areas for the junction accommodation works will be excavated and temporarily stockpiled adjacent to the works area, where possible, until a competent stratum is reached.
- Any excess excavated overburden will be removed from the works area to the on-site peat management areas or a licenced tip or, if suitable, stockpiled and reused for backfilling where appropriate.
- A layer of geogrid/geotextile may be required at the surface of the competent stratum to provide further structural formation.
- The competent stratum will be overlain with granular fill sourced from local quarries.
- A final surface running layer will be placed over the granular fill to provide a suitable surface to accommodate the turbine delivery/abnormal load vehicles.
- The temporary junction accommodation works along the turbine delivery route will only be used by the turbine delivery/abnormal load vehicles and other vehicles associated with the delivery process.
- The temporary junction accommodation works location along the turbine delivery route, when not in use, will be cordoned off from the public road, using bollards, where the temporary removal of kerbing, barriers and fencing has occurred.
- Upon completion of the turbine delivery phase of the proposed wind farm the temporary junction accommodation works location along the turbine delivery route will revert back to its existing condition prior to the commencement of the temporary junction accommodation works (i.e. kerbing, barriers and fencing will be replaced.)

Leaving the granular fill and final surface running layer in place within the accommodation areas will allow these to be used again in the future should it become necessary (i.e. at decommissioning stage for turbine removal, or in the unlikely event of having to swap out a blade component during the operational phase). Should this be required the boundary treatments will again be temporarily removed and managed as set out above.

4.4.4 Traffic Management

A turbine with a blade length of 73.65 metres has been used in assessing the traffic impact of the proposed development. The blade transporter for such a turbine blade would have a total length of approximately 79 metres, including the blade which overhangs the back of the vehicle. The total length of the tower transporter is 46.6 metres with the axles located at the front and rear of the load with no overhang. The vehicles used to transport the nacelles will be similar to the tower transporter. All other vehicles requiring access to the site will be smaller than the design test vehicles. The turbine delivery vehicles have been modelled accurately in the Autotrack assessments for the site, as detailed in Chapter 14 of this EIAR.

The need to transport a wind turbine blade on the public roads is not an everyday occurrence in the vicinity of the site of the proposed development. However, the procedures for transporting abnormal size loads on the country's roads are well established. While every operation to transport abnormal loads is different and requires careful consideration and planning, escort vehicles, traffic management plans, drive tests, road marshals and convoy escorts from the Garda Traffic Corps are all measures that are regularly employed to gets unusual loads from origin to destination. With over 1,800MW of wind farms already built and operating in Ireland, transport challenges are something the wind energy industry and specialist transport sector has become particularly adept in finding solutions to.



Map Legend

EIAR Study Area

Proposed Turbine Delivery R

N

Drawing Title

Turbine Delivery Route

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
TB	MW
Project No. 200512	Drawing No. Figure 4.23
Scale 1:400000	Date 13.10.2021

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A preliminary traffic management plan has been prepared as part of the traffic impact assessment set out in Section 14.1 of this EIAR. Prior to the construction of the proposed development, a detailed traffic management plan will be prepared by the haulage company and submitted to Kerry County Council for approval. The plan will include:

- A delivery schedule.
- Details of temporary works or any other minor alteration identified.
- A dry run of the route using vehicles with similar dimensions.

The deliveries of turbine components to the site will be made in convoys of three to four vehicles at a time, and mostly at night when roads are quietest. Convoys will be accompanied by escorts at the front and rear operating a "stop and go" system. Although the turbine delivery vehicles are large, they will not prevent other road users or emergency vehicles passing, should the need arise. The delivery escort vehicles will ensure the turbine transport is carried out in a safe and efficient manner with minimal delay or inconvenience for other road users.

It is not anticipated that any section of the local road network will be closed during transport of turbines, although there will be some delays to local traffic at pinch points. During these periods it may be necessary to operate local diversions for through traffic. All deliveries comprising abnormally large loads will be made outside the normal peak traffic periods to avoid disruption to work and school-related traffic.

Prior to the Traffic Management Plan being finalised, a full dry run of the transport operation along the proposed route will be completed using vehicles with attachments to simulate the dimensions of the wind turbine transportation vehicles. This dry run will inform the final traffic management plan. All turbine deliveries will be provided for in a transport management plan which will have to be prepared in advance of the construction stage, when the exact transport arrangements are known, delivery dates confirmed and escort proposals in place. Such a transport management plan is typically submitted to the Planning Authority for agreement in advance of any abnormal loads using the local roads, and will provide for all necessary safety measures, including a convoy and Garda escort as required, off-peak turning/reversing movements and any necessary safety controls.

4.5 Community Gain Proposal

Ballynagare Wind Farm has the potential to bring significant positive benefit to the local community. The project will create sustainable local employment, it will contribute annual rates to the local authority, and it will provide opportunity for local community investment in the project in line with the new Renewable Energy Support Scheme. As with all wind farm projects which EMPower develop, a community benefit fund will be put in place for the duration of the RESS (15 years) to provide direct funding to those areas surrounding the project.

4.5.1 Renewable Energy Support Scheme

The Renewable Energy Support Scheme (RESS) Terms and Conditions, published by the Department of Communications, Climate Action and Environment on in February 2020, make some high-level provisions for how this type of benefit fund will work. Any project which wants to export electricity to the national grid must abide by these broad principles. These include the following:

1. *a minimum of €1,000 shall be paid to each household located within a distance of a 1 kilometre radius from the Project;*
2. *a minimum of 40% of the funds shall be paid to not-for-profit community enterprises whose primary focus or aim is the promotion of initiatives towards the delivery of the*

UN Sustainable Development Goals, in particular Goals 4, 7, 11 and 13, including education, energy efficiency, sustainable energy and climate action initiatives;

3. *a maximum of 10% of the funds may be spent on administration. This is to ensure successful outcomes and good governance of the Community Benefit Fund.*
4. *the balance of the funds shall be spent on initiatives successful in the annual application process, as proposed by clubs and societies and similar not-for-profit entities, and in respect of Onshore Wind RESS 1 Projects, on "near neighbour payments" for households located outside a distance of 1 kilometre from the Project but within a distance of 2 kilometres from such Project.*

4.5.2 Community Benefit Fund

Ballynagare Wind Farm will also provide a community fund calculated in accordance with the Renewable Electricity Support Scheme (RESS) Terms and Conditions at €2 per MWh of electricity produced by the project. This is to be made available to the local community for the duration of the RESS (15 years). Assuming an average capacity factor of 35%, and a capacity of 42 MW, the community benefit fund would amount to an average of €257,544 per annum. The actual fund will vary around the average from year to year, depending on wind conditions.

Onsite wind measurements suggest that Ballynagare will be capable of achieving an above average capacity factor, and therefore a larger community fund. If this project is constructed as currently designed, we estimate that a total of approximately €3.1 million will be available in the local area for community funding over the first 15 years of the project. The above figure is indicative only and will be dependent on the generation capacity of the wind farm which is influenced by a number of factors including:

1. *Number of wind turbines.*
2. *Capacity and availability of energy production of those turbines.*
3. *Quantity of wind.*

4.5.2.1 Administration of the Benefit Fund

The Community Benefit Fund belongs to the local community. The premise of the fund is that it should be used to bring about significant, positive change in the local area. To make this happen, our first task will be to form a benefit fund development working group that clearly represents both the close neighbours to the project as well as nearby communities. This group will then work on designing the governance and structure of a community entity that would administer the Community Benefit Fund. Ballynagare Wind Farm Ltd. aim to commence this work in summer 2022.

4.6 Site Drainage

4.6.1 Introduction

The protection of the watercourses within and surrounding the site, and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the site of the proposed development. The proposed development's drainage design has therefore been proposed specifically with the intention of having no negative impact on the water quality of the site and nearby or adjacent rivers and watercourses, and consequently no impact on downstream catchments and ecological ecosystems. No routes of any natural drainage features will be altered as part of the proposed development and only three new watercourse crossings are proposed as part of the proposed development. Turbine locations and associated roadways were originally selected to avoid natural watercourses, and existing roads are to be used wherever possible. There will be no direct discharges to any natural watercourses, with all drainage waters being dispersed as overland flows. All discharges from the proposed works areas will be made over vegetation filters at a minimum of 50 metres distance from natural watercourses. Buffer zones around the existing natural drainage features have informed, wherever possible, the layout of the proposed development. Where there is infrastructure proposed within 50 metres of a natural watercourse, stringent drainage measures will be put in place to ensure the protection of the water quality of the natural watercourse.

4.6.2 Existing Drainage Features

The routes of any natural drainage features will not be altered as part of the proposed development. Turbine locations have been selected to avoid natural watercourses. The proposed development has also been designed to only require three new watercourse crossings. Some new or extended culverts may be required under existing roadways to manage drainage waters, and these will be sufficiently sized to accommodate peak flows from storm events.

There will be no direct discharges to natural watercourses. All discharges from the proposed works areas or from interceptor drains will be made over vegetated ground at a minimum of 50 metres distance from natural watercourses, or directly into artificial drainage ditches but only after silt traps, check dams and/or stilling ponds have been added to these drainage ditches. Buffer zones around the existing natural drainage features have informed the layout of the proposed development, and are indicated on the drainage design drawings.

Where artificial drains are currently in place in the vicinity of proposed works areas, these drains may have to be diverted around the proposed works areas to minimise the amount of water in the vicinity of works areas. Where it is not possible to divert artificial drains around proposed work areas, the drains will be blocked to ensure potentially sediment laden water from the works areas has no direct route to other watercourses. Where drains have to be blocked, the blocking will only take place after an alternative drainage system to handle the same water has been put in place.

Existing artificial drains in the vicinity of existing site roads will be maintained in their present location where possible. If it is expected that these artificial drains will receive drainage water from works areas, check dams will be added (as specified below) to control flows and sediment loads in these existing artificial drains. If road widening or improvement works are necessary along the existing roads, where possible, the works will take place on the opposite side of the road to the drain.

4.6.3 Drainage Design Principles

The key principles of drainage design that will be implemented and adhered to as part of the Proposed Development are as follows:

- Keep clean water clean by intercepting it where possible, upgradient of works areas, and divert it around the works areas for discharge as diffuse overland flow or for rewetting of land.
- Collect potentially silt-laden runoff from works areas via downgradient collector drains and manage via series of avoidance, source, in-line, treatment and outfall controls prior to controlled diffuse release as overland flow or for rewetting of land.
- No direct hydraulic connectivity from construction areas to watercourses, or drains connecting to watercourses.
- Where possible, maintain 50-metre watercourse buffer zones for the wind turbines.
- No alteration of natural watercourses.
- Maintain the existing hydrology of the site.
- Blocking of existing manmade forestry drainage as appropriate.
- Daily inspection and recording of surface water management system by on-site clerk of works and immediate remedial measures to be carried out as required and works temporarily ceased if a retained stormwater/sediment load is identified to have the potential to migrate from the site.
- Use of siltbuster if required.

Drainage water from any works areas of the site of the proposed development will not be directed to any natural watercourses within the site. Two distinct methods will be employed to manage drainage water within the site. The first method involves keeping clean water clean by avoiding disturbance to natural drainage features, minimising any works in or around artificial drainage features, and diverting clean surface water flow around excavations and construction areas. The second method involves collecting any drainage waters from works areas within the site that might carry silt or sediment, to allow attenuation and settlement prior to controlled diffuse release.

The drainage design is intended to maximise erosion control, which is more effective than having to control sediment during high rainfall. Such a system also requires less maintenance. The area of exposed ground will be minimised. The drainage measures will prevent runoff from entering the works areas of the site from adjacent ground, to minimise the volume of sediment-laden water that has to be managed. Discoloured run-off from any construction area will be isolated from natural clean run-off.

A schematic line drawing of the proposed drainage design is presented in Figure 4.24 below.

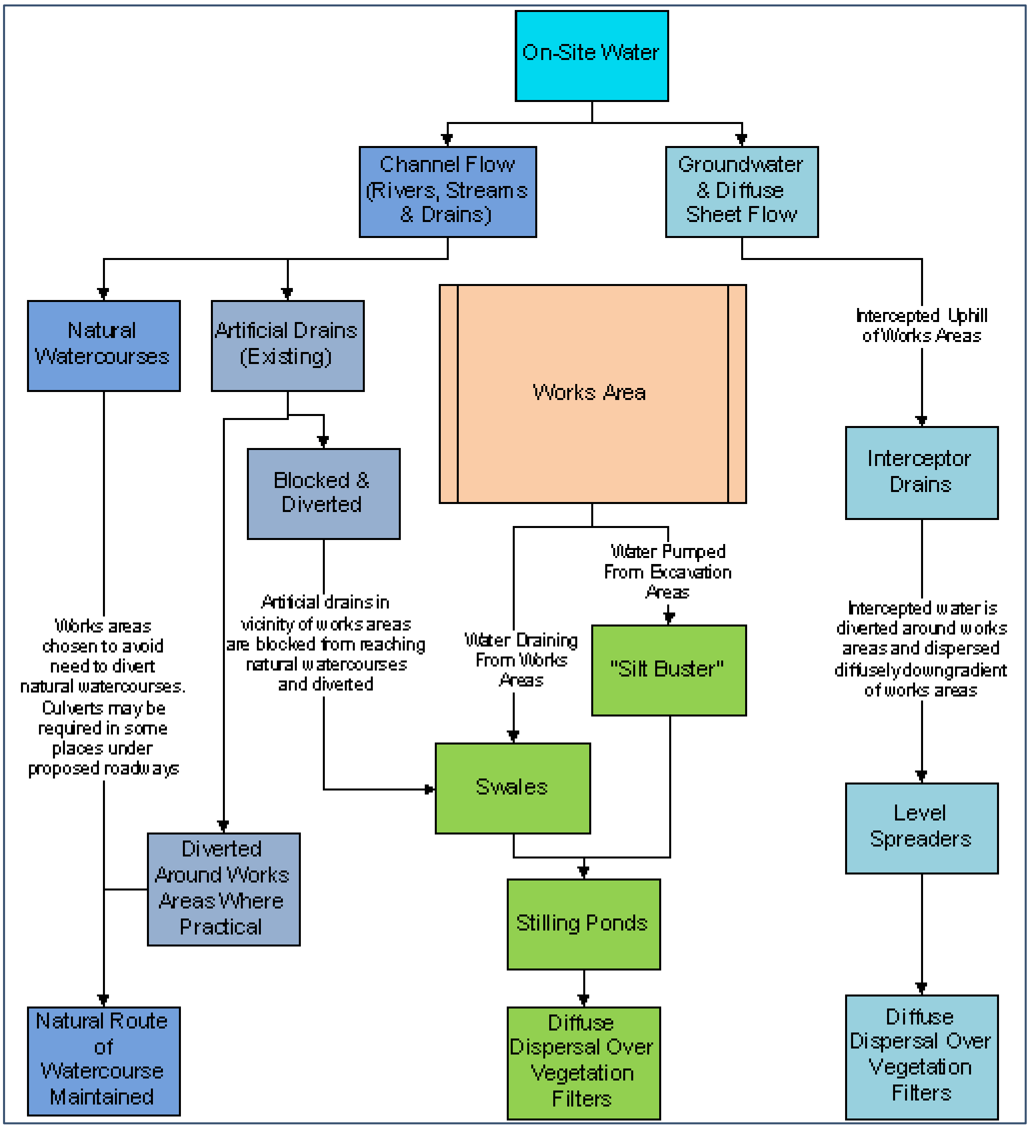


Figure 4.24 Proposed Development Drainage Process Flow

4.6.4 Drainage Design

A drainage design for the proposed development, incorporating all principles and measures outlined in this drainage design description, has been prepared, and is included in Appendix 4-4 to this EIAR. The drainage design employs the various measures further described below and is cognisant of the following guidance documents:

- Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte (2009): Forest Operations & Water Protection Guidelines;
- Forest Services (Draft) Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures;
- Forest Service (2000): Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford;
- COFORD (2004): Forest Road Manual – Guidelines for the Design, Construction and Management of Forest Roads;
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Watercourses;
- Good Practice During Wind Farm Construction (Scottish Natural Heritage, 2010);
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);
- CIRIA (Construction Industry Research and Information Association) 2006: Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006); and,
- CIRIA 2006: Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2006.

4.6.4.1 Interceptor Drains

Interceptor drains will be installed upgradient of any works areas to collect surface flow runoff and prevent it reaching excavations and construction areas of the site where it might otherwise have come into contact with exposed surfaces and picked up silt and sediment. The drains will be used to divert upslope runoff around the works area to a location where it can be redistributed over the ground surface as sheet flow. This will minimise the volume of potentially silty runoff to be managed within the construction area.

The interceptor drains will be installed in advance of any main construction works commencing. The material excavated to make the drain will be compacted on the downslope edge of the drain to form a diversion dike. On completion of the construction phase works, it is envisaged that the majority of the interceptor drains could be removed. At that stage, there will be no open excavations or large areas of exposed ground that are likely to give rise to large volumes of potentially silt-laden run off. Any areas in which works were carried out to construct roads, turbine bases or hardstands, will have been built up with large grade hardcore, which even when compacted in place, will retain sufficient void space to allow water infiltrate the subsurface of these constructed areas. It is not anticipated that roadways or other installed site infrastructure will intercept ground-conveyed surface water runoff to any significant extent that would result in scouring or over-topping or spill over. Where the drains are to be removed, they will be backfilled with the material from the diversion dike. Interceptor drains may have to be retained in certain locations, for example where roadways are to be installed on slopes, to prevent the roadways acting of conduits for water that might infiltrate the roadway sub-base. In these cases, interceptor drains would be maintained in localised areas along the roadway with culverts under the roadway, which would allow the intercepted water to be discharged to vegetation filters downgradient of the roadway. Similarly, in localised hollows where water is likely to be funnelled at greater concentrations than on broader slopes, interceptor drains and culverts may be left in situ following construction. Figure 4.25 shows an illustrative drawing of an interceptor drain.

The velocity of flow in the interceptor will be controlled by check dams (see Section 4.6.5.3 below), which will be installed at regular intervals along the drains to ensure flow in the channel is non-erosive. On steeper sections where erosion risks are greater, a geotextile membrane will be added to the channel.

Interceptor drains will be installed horizontally across slopes to run in parallel with the natural contour line of the slope. Intercepted water will travel along the interceptor drains to areas downgradient of works areas, where the drain will terminate at a level spreader (see Section 4.6.5.4 below). Across the entire length of the interceptor drains, the design elevation of the water surface along the route of the drains will not be lower than the design elevation of the water surface in the outlet at the level spreader.

4.6.4.2 Swales

Drainage swales are shallow drains that will be used to intercept and collect run off from construction areas of the site during the construction phase. Drainage swales will remain in place to collect runoff from roads and hardstanding areas of the proposed development during the operational phase. A swale is an excavated drainage channel located along the downgradient perimeter of construction areas, used to collect and carry any sediment-laden runoff to a sediment-trapping facility and stabilised outlet. Swales are proven to be most effective when a dike is installed on the downhill side. They are similar in design to interceptor drains and collector drains described above. Figure 4.25 shows an illustrative example of a drainage swale.

Drainage swales will be installed downgradient of any works areas to collect surface flow runoff where it might have come into contact with exposed surfaces and picked up silt and sediment. Swales will intercept the potentially silt-laden water from the excavations and construction areas of the site and prevent it reaching natural watercourses.

Drainage swales will be installed in advance of any main construction works commencing. The material excavated to make the swale will be compacted on the downslope edge of the drain to form a diversion dike.

4.6.4.3 Check Dams

The velocity of flow in the interceptor drains and drainage swales, particularly on sloped sections of the channel, will be controlled by check dams, which will be installed at regular intervals along the drains to ensure flow in the swale is non-erosive. Check dams will also be installed in some existing artificial drainage channels that will receive waters from works areas of the site.

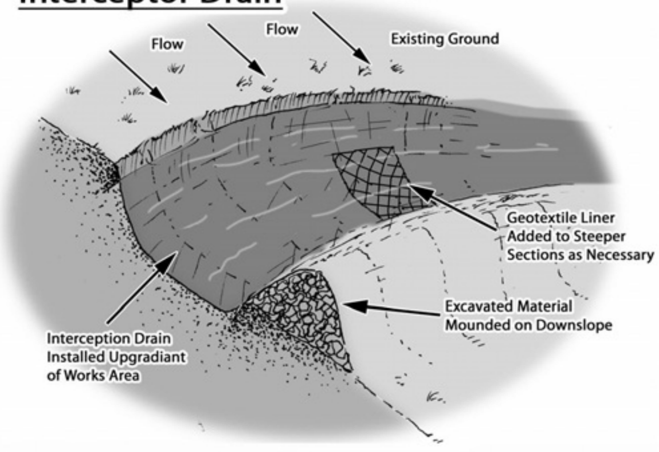
Check dams will restrict flow velocity, minimise channel erosion and promote sedimentation behind the dam. The check dams will be installed as the interceptor drains are being excavated. Check dams may also be installed in some of the existing artificial drainage channels on the site, downstream of where drainage swales connect in.

The proposed check dams will be made up of straw bales or stone, or a combination of both depending on the size of the drainage swale it is being installed in. Where straw bales are to be used, they will be secured to the bottom of the drainage swale with stakes. Clean 4-6 inch stone will be built up on either side and over the straw bale to a maximum height of 600mm over the bottom of the interceptor drain. In smaller channels, a stone check dam will be installed and pressed down into place in the bottom of the drainage swale with the bucket of an excavator.

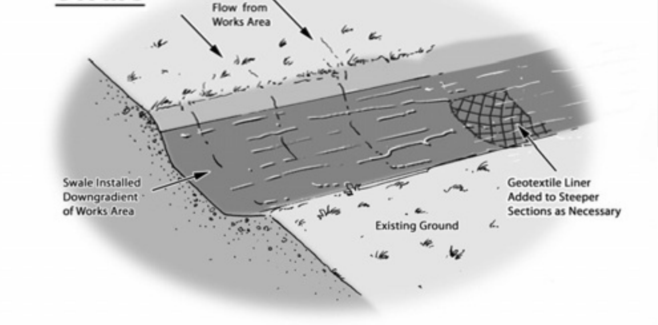
The check dams will be installed at regular intervals along the interceptor drains to ensure the bottom elevation of the upper check dam is at the same level as the top elevation of the next down-gradient check dam in the drain. The centre of the check dam will be approximately 150mm lower than the edges to allow excess water to overtop the dam in flood conditions rather than cause upstream flooding or scouring around the dams.

Drainage Design Measures

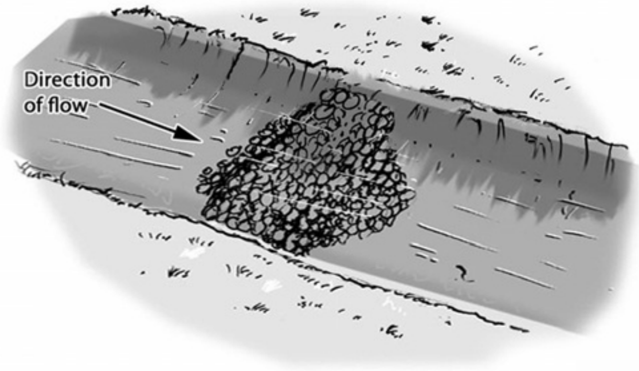
Interceptor Drain



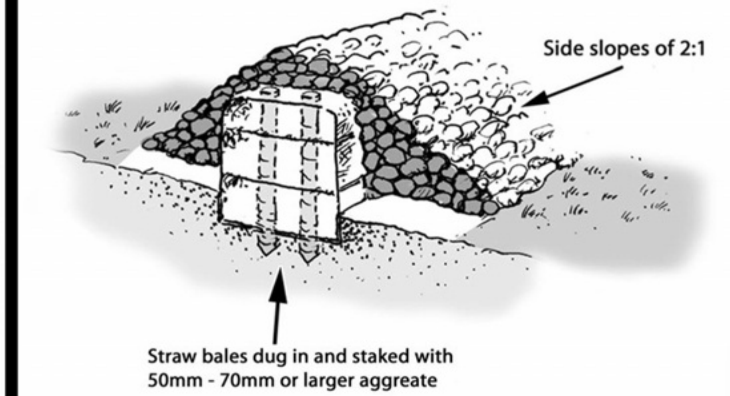
Swale



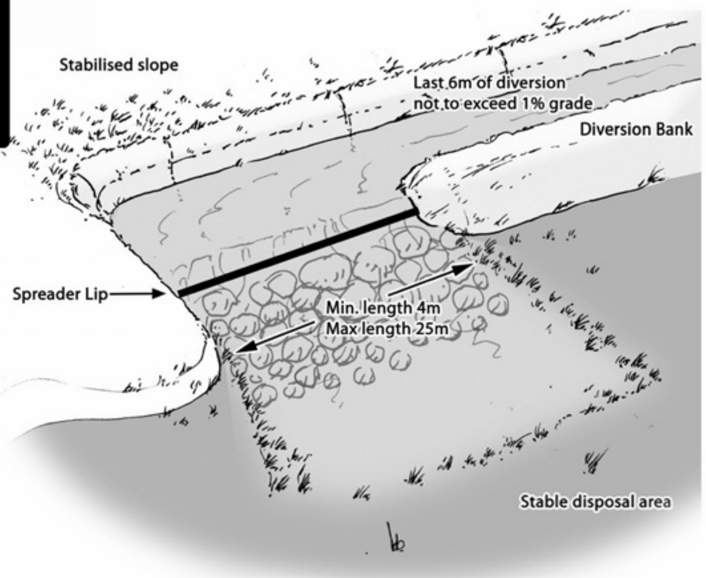
Check Dam (Stone Dam in Drain)



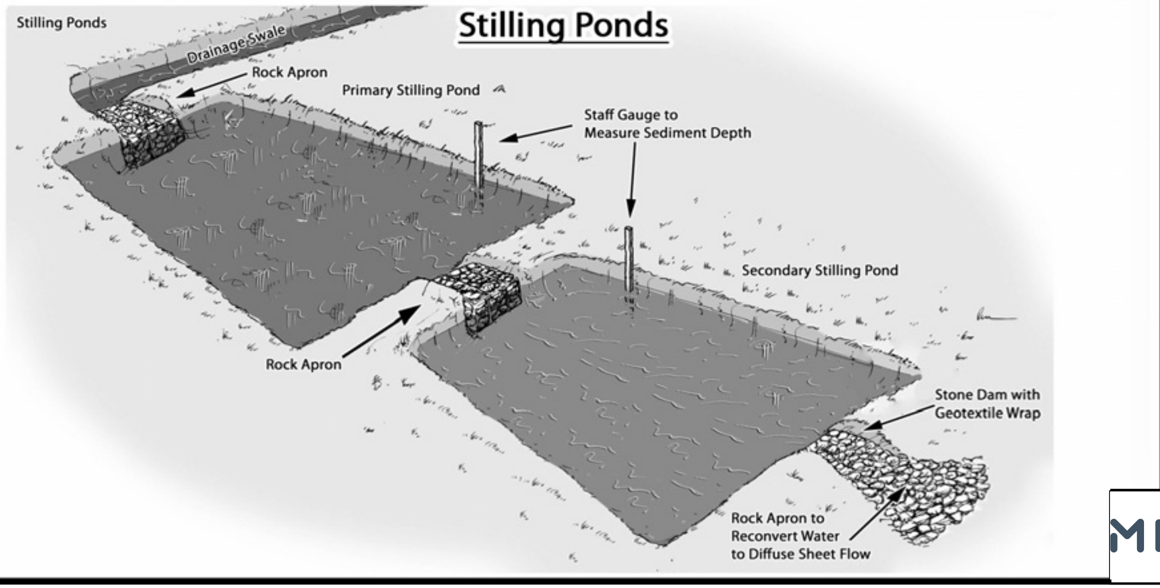
Check Dam
(Straw Bale & Stone Dam - Cross Section)



Level Spreader



Stilling Ponds



Drawing Title	Drainage Design Illustations	Drawing No.	Figure 4.25	Scale	NTS
Project Title	Ballynagare Wind Farm			Date	13.10.2021
Drawn By	JO'B	Checked By	TB	Project No.	200512

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Check dams will not be used in any natural watercourses, only artificial drainage channels and interceptor drains. The check dams will be left in place at the end of the construction phase to limit erosive linear flow in the drainage swales during extreme rainfall events.

Check dams are designed to reduce velocity and control erosion and are not specifically designed or intended to trap sediment, although sediment is likely to build up. If necessary, any excess sediment build up behind the dams will be removed. For this reason, check dams will be inspected and maintained regularly to insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.

4.6.4.4 Level Spreaders

A level spreader will be constructed at the end of each interceptor drain to convert concentrated flows in the drain, into diffuse sheet flow on areas of vegetated ground. The levels spreaders will be located downgradient of any proposed works areas in locations where they are not likely to contribute further to water ingress to construction areas of the site.

The water carried in interceptor drains will not have come in contact with works areas of the site, and therefore should be free of silt and sediment. The level spreaders will distribute clean drainage water onto vegetated areas where the water will not be reconcentrated into a flow channel immediately below the point of discharge. The discharge point will be on level or only very gently sloping ground rather than on a steep slope so as to prevent erosion. Figure 4.25 shows an illustrative example of a level spreader.

The slope in the channel leading into the spreader will be less than or equal to 1%. The slope downgradient of the spreader onto which the water will dissipate will have a grade of less than 6%. The availability of slopes with a grade of 6% or less will determine the locations of level spreaders.

The spreader lip over which the water will spill will be made of a concrete kerb, wooden board, pipe, or other similar piece of material that can create a level edge similar in effect to a weir. The spreader will be level across the top and bottom to prevent channelised flow leaving the spreader or ponding occurring behind the spreader. The top of the spreader lip will be 150mm above the ground behind it. The length of the spreader will be a minimum of four metres and a maximum length of 25 metres, with the actual length of each spreader to be determined by the size of the contributing catchment, slope and ground conditions.

Clean four-inch stone can be placed on the outside of the spreader lip, and pressed into the ground mechanically to further dissipate the flow leaving the level spreader over a larger area.

4.6.4.5 Vegetation Filters

Vegetation filters are the existing vegetated areas of land that will be used to accept surface water runoff from upgradient areas. The selection of suitable areas to use as vegetation filters will be determined by the size of the contributing catchment, slope and ground conditions.

Vegetation filters will carry outflow from the level spreaders as overland sheet flow, removing any suspended solids and discharging to the groundwater system by diffuse infiltration.

Vegetation filters will not be used in isolation for waters that are likely to have higher silt loadings. In such cases, silt-bearing water will already have passed through stilling ponds prior to diffuse discharge to the vegetation filters via a level spreader.

4.6.4.6 Stilling Ponds (Settlement Ponds)

Stilling ponds will be used to attenuate runoff from works areas of the site during the construction phase, and will remain in place to handle runoff from roads and hardstanding areas of the proposed development during the operational phase. The purpose of the stilling ponds is to intercept runoff potentially laden with sediment and to reduce the amount of sediment leaving the disturbed area by reducing runoff velocity. Reducing runoff velocity will allow larger particles to settle out in the stilling ponds, before the run-off water is redistributed as diffuse sheet flow in filter strips downgradient of any works areas.

Stilling ponds will be excavated/constructed at each required location as two separate ponds in sequence, a primary pond and a secondary pond. The points at which water enters and exits the stilling ponds will be stabilised with rock aprons, which will trap sediment, dissipate the energy of the water flowing through the stilling pond system, and prevent erosion. The primary stilling pond will reduce the velocity of flows to less than 0.5 metres per second to allow settlement of silt to occur. Water will then pass from the primary pond to the secondary pond via another rock apron. The secondary stilling pond will reduce the velocity of flows to less than 0.3 metres per second. Water will flow out of the secondary stilling pond through a stone dam, partially wrapped in geo-textile membrane, which will control flow velocities and trap any sediment that has not settled out. Figure 4.25 shows an illustrative example of a stilling pond system.

Water will flow by gravity through the stilling pond system. The stilling ponds will be sized according to the size of the area they will be receiving water from, but will be sufficiently large to accommodate peak flows storm events. The stilling ponds will be dimensioned so that the length to width ratio will be greater than 2:1, where the length is the distance between the inlet and the outlet. Where ground conditions allow, stilling ponds will be constructed in a wedge shape, with the inlet located at the narrow end of the wedge. Each stilling pond will be a minimum of 1-1.5 metres in depth. Deeper ponds will be used to minimise the excavation area needed for the required volume.

The embankment that forms the sloped sides of the stilling ponds will be stabilised with vegetated turves, which will have been removed during the excavation of the stilling ponds area.

Stilling ponds will be located towards the end of swales, close to where the water will be reconverted to diffuse sheet flow. Upon exiting the stilling pond system, water will be immediately reconverted to diffuse flow via a fan-shaped rock apron if there is adequate space and ground conditions allow. Otherwise, a swale will be used to carry water exiting the stilling pond system to a level spreader to reconvert the flow to diffuse sheet flow.

A water level indicator such as a staff gauge will be installed in each stilling pond with marks to identify when sediment is at 10% of the stilling pond capacity. Sediment will be cleaned out of the stilling pond when it exceeds 10% of pond capacity. Stilling ponds will be inspected weekly and following rainfall events i.e after events of >25mm rainfall in any 24-hour period. Inlet and outlets will be checked for sediment accumulation and anything else that might interfere with flows.

4.6.4.7 Siltbuster

A "siltbuster" or similar equivalent piece of equipment will be available to filter any water pumped out of excavation areas if necessary, prior to its discharge to stilling ponds or swales.

Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. The mobile units are specifically designed for use on construction sites.

The unit stills the incoming water/solids mix and routes it upwards between a set of inclined plates for separation. Fine particles settle onto the plates and slide down to the base for collection, whilst treated water flows to an outlet weir after passing below a scum board to retain any floating material. The inclined plates dramatically increase the effective settling area of the unit giving it a very small footprint on site and making it highly mobile. Figure 4.26 below shows an illustrative diagram of the Siltbuster.

The Siltbuster units are now considered best practice for the management of dirty water pumped from construction sites. The UK Environment Agency and the Scottish Environmental Protection Agency have all recommended/specified the use of Siltbuster units on construction projects.

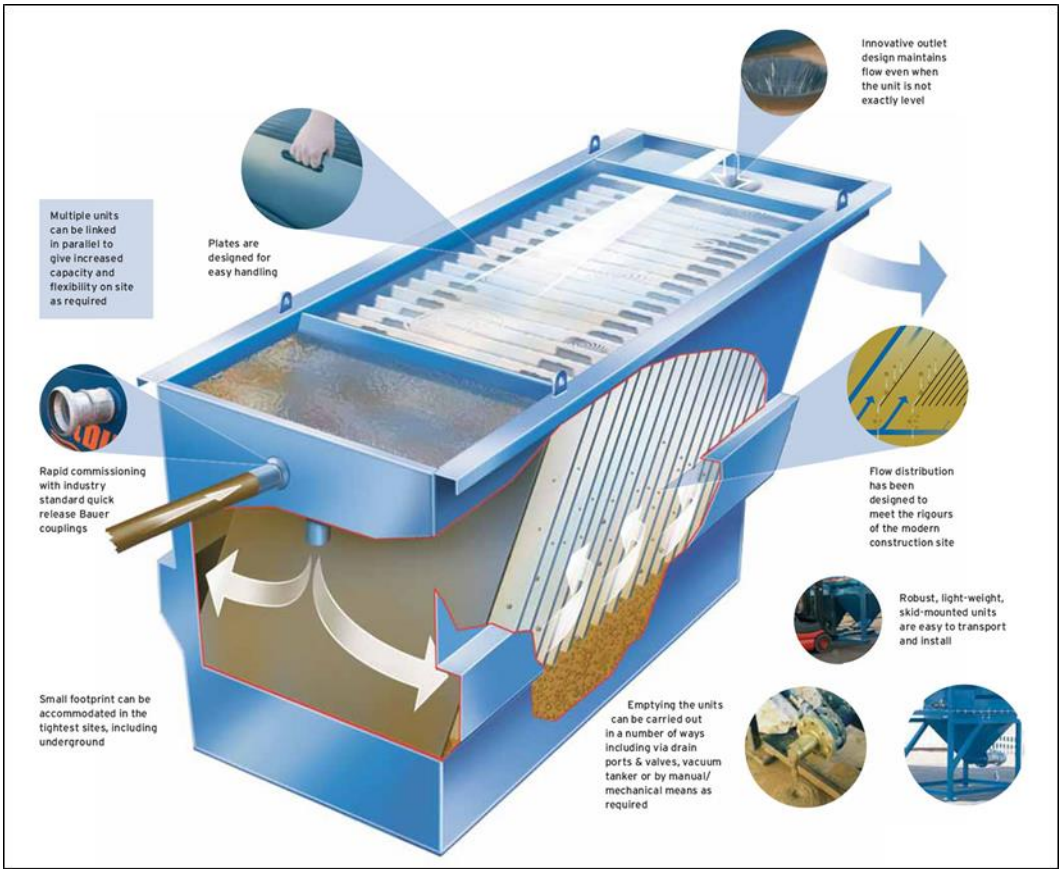


Figure 4.26 Siltbuster

4.6.4.8 Culverts

All new proposed culverts and proposed culvert upgrades will be suitably sized for the expected peak flows in the watercourse.

Some culverts may be installed to manage drainage waters from works areas of the proposed development, particularly where the waters have to be taken from one side of an existing roadway to the other for discharge. The size of culverts will be influenced by the depth of the track or road sub-base. In some cases, two or more smaller diameter culverts may be used where this depth is limited, though this will be avoided as they will have a higher associated risk of blockage than a single, larger pipe. In all cases, culverts will be oversized to allow mammals to pass through the culvert.

Culverts will be installed with a minimum internal gradient of 1% (1 in 100). Smaller culverts will have a smooth internal surface. Larger culverts may have corrugated surfaces which will trap silt and contribute to the stream ecosystem. Depending on the management of water on the downstream side of the culvert, large stone may be used to interrupt the flow of water. This will help dissipate its energy and help prevent problems of erosion. Smaller water crossings will simply consist of an appropriately sized pipe buried in the sub-base of the road at the necessary invert level to ensure ponding or pooling doesn't occur above or below the culvert and water can continue to flow as necessary.

All culverts will be inspected regularly to ensure they are not blocked by debris, vegetation or any other material that may impede conveyance.

4.6.4.9 Silt Fences

Silt fences will be installed as an additional water protection measure around existing watercourses in certain locations, particularly where works are proposed within the 50-metre buffer zone from natural watercourses, which is inevitable where existing roads in proximity to watercourses are to be upgraded as part of the proposed development. These areas include around existing culverts, around the headwaters of watercourses, and the proposed locations are indicated on the detailed drainage design drawings included in Appendix 4-4.

Silt fences will be installed as single, double or a series of triple silt fences, depending on the space available and the anticipated sediment loading. The silt fence designs follow the technical guidance document 'Control of Water Pollution from Linear Construction Projects' published by CIRIA (Ciria, No. C648, 1996). Up to three silt fences may be deployed in series..

The Stage 1 (Coarse) silt fence will consist of a geotextile fabric such as Terram 1000 attached by staples to fixed stakes. The Terram sheets will be folded in an L shape with one metre extending horizontally in towards the works area. This horizontal section will be buried at a distance of approximately 150mm beneath a clean stone surface. Terram 1000 is a permeable fabric through which water can pass, but through which sediment particles cannot. It does however, impede water flow and can lead to the backing up of water and sediment, which reduce its effectiveness.

The Stage 2 (Medium) silt fence will consist of straw bales, embedded 100mm into the soil/ground and fixed in place with stakes. A geotextile fabric will be pegged and stapled to the straw bales and stakes.

The Stage 3 (Fine) silt fence will be similar to the Stage 1 fence, with the addition of a course sand and/or fine gravel at the base of the geotextile.

In the case of all three types of fence, the geotextile fabric will be embedded at least 150mm below the ground surface.

In a small number of locations around the proposed site where space between the works areas and watercourses may be limited, silt fence designs will be combined to increase their effectiveness. For example, a straw bale silt fence (Stage 2) may be double wrapped with geotextile fabric (Stage 1) and course sand/fine gravel added on the upgradient side (Stage 3). The most suitable type, number or combination of silt fences will be determined on a location specific basis for the various parts of the site. Although they may be indicated in the drainage designs shown in Appendix 4-4 to be just a single line, silt fences may be installed in series on the ground.

Site fences will be inspected regularly to ensure water is continuing to flow through the Terram, and the fence is not coming under strain from water backing up behind it.

4.6.5 Borrow Pit Drainage

While surface water will be contained in the borrow pit area, the design proposal is to control the level of water in the borrow pit area by creating a single point outlet from the basin-like area that will ensure the water does not overtop the pit area. Run-off from the proposed borrow pit area will be controlled via a single outlet that will be installed at the edge of the borrow pit. The single outfall point will be constructed to handle runoff from the borrow pit and its immediate surrounds. Interceptor drains will already have been installed upgradient of the borrow pit area before any extraction begins.

Run off from the single outlet point will be diverted via a drainage swale to a series of settlement ponds and onwards to a level spreader, which will convert concentrated flows in the drain, into diffuse sheet flow on areas of vegetated ground. The management of surface runoff from the borrow pit area by converting it to diffuse sheet flow removes the risk of contamination of surface water drains and removes the requirement for silt traps leading from this particular area.

During the construction phase of the project, it will be necessary to keep the borrow pit area free of standing water while rock is still being extracted. This will be achieved by using a mobile pump, which will pump water into the same series of drains, settlement ponds and level spreader, which will receive the water from the single outlet.

4.6.6 Peat Repository Area Drainage

The containment bund that makes up the peat storage cells will be constructed with granular fill material, either sourced on site or imported to site if necessary. Water will be able to filter out through the containment cell bund, and will be collected in a series of drainage channels to be installed around each cell, before being directed to the other drainage measure as outlined above.

4.6.7 Floating Road Drainage

Where sections of floating road are to be installed instead of excavated roads, cross drains will be installed beneath the road construction corridor to maintain existing clean water drainage paths. Large surface water drainage pipes will be placed at these locations below the level of the proposed road sub-base. These drainage pipes will be extended each side of the proposed road and cable trench construction corridor, along the paths of the existing drains.

With the exception of the installation of cross drains under the floating road corridor, minimal additional drainage will be installed to run parallel to the roads, in order to maintain the natural hydrology of the peatland areas over which the roads will be floated.

4.6.8 Cable Trench Drainage

Cable trenches are typically developed in short sections, thereby minimising the amount of ground disturbed at any one time, and minimising the potential for drainage runoff to pick up silt or suspended solids. Each short section of trench is excavated, ducting installed and bedded, and backfilled with the appropriate materials, before work on the next section commences.

To efficiently control drainage runoff from cable trench works areas, excavated material is stored on the upgradient side of the trench. Should any rainfall cause runoff from the excavated material, the material is contained in the downgradient cable trench. Excess subsoil is removed from the cable trench works area immediately upon excavation, and in the case of the proposed development, would be transported to one of the on-site borrow pit repository areas or used for landscaping and reinstatements of other areas elsewhere on site.

On steeper slopes, silt fences, as detailed in Section 4.6.5.9 of the EIAR will be installed temporarily downgradient of the cable trench works area, or on the downhill slope below where excavated material is being temporarily stored to control run-off.

4.6.9 Site and Drainage Management

4.6.9.1 Preparative Site Drainage Management

All materials and equipment necessary to implement the drainage measures outlined above, will be brought on-site in advance of any works commencing.

An adequate amount of straw bales, clean stone, terram, stakes, etc will be kept on site at all times to implement the drainage design measures as necessary. The drainage measures outlined in the above will be installed prior to, or at the same time as the works they are intended to drain.

4.6.9.2 Pre-emptive Site Drainage Management

The works programme for the groundworks part of the construction phase of the project will also take account of weather forecasts, and predicted rainfall in particular. Large excavations, large movements of overburden or large scale overburden or soil stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

4.6.9.3 Reactive Site Drainage Management

The final drainage design prepared for the proposed development prior to commencement of construction will have to provide for reactive management of drainage measures. The effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treat silt-laden water from the works areas, will be monitored continuously by the environmental clerk of works or supervising hydrologist on-site. The environmental clerk of works or supervising hydrologist will respond to changing weather, ground or drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained in so far as is possible. This may require the installation of additional check dams, interceptor drains or swales as deemed necessary on-site. The drainage design may have to be modified on the ground as necessary, and the modifications will draw on the various features outlined above in whatever combinations are deemed to be most appropriate to the situation on the ground as a particular time.

In the event that works are giving rise to discharges of silt to watercourses, the environmental clerk of works or supervising hydrologist will stop all works in the immediate area around where the siltation is evident. The source of the siltation will be identified and additional drainage measures such as those outlined above will be installed in advance of works recommencing.

4.6.10 Drainage Maintenance

An inspection and maintenance plan for the drainage system onsite will be prepared in advance of commencement of any works. Regular inspections of all installed drainage features will be necessary, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water at parts of the systems where it is not intended. The inspection of the drainage system will be the responsibility of the environmental clerk of works or the supervising hydrologist.

If necessary, any excess sediment build up behind check dams will be removed. For this reason, check dams will be inspected and maintained weekly during the construction phase of the project to insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.

Check dams will also be inspected weekly during the construction phase of the project and following rainfall events to ensure the structure of the dam is still effective in controlling flow. Any scouring around the edges of the check dams or overtopping of the dam in normal flow conditions will be rectified be reinforcement of the check dam.

Drainage swales will be regularly inspected for evidence of erosion along the length of the swale. If any evidence of erosion is detected, additional check dams will be installed to limit the velocity of flow in the channel and reduce the likelihood of erosion occurring in the future.

A water level indicator such as a simple staff gauge or level marker will be installed in each silt trap with marks to identify when sediment is at 50% of the trap's capacity. Sediment will be cleaned out of the silt trap when it exceeds 50% of trap capacity. Silt traps will be inspected weekly during the construction phase of the project and following rainfall events. Inlet and outlets will be checked for sediment accumulation and anything else that might interfere with flows.

The frequency of drainage system inspections will be reduced following completion of the construction phase of the project. Weekly inspections during the construction phase will be reduced to monthly, bi-monthly and eventually quarterly inspections during the operational phase. The frequency will be increased or decreased depending on the effectiveness of the measures in place and the amount of remedial action required in any given period.

4.7 Construction Management

4.7.1 Construction Timing

It is estimated that the construction phase will take approximately 24 months from starting on site to the commissioning of the electrical system.

4.7.2 Construction Sequencing

The construction phase can be broken down into three main phases, 1) civil engineering works - 18 months, 2) electrical works - 9 months, and 3) turbine erection and commissioning - 6 months. The main task items under each of the three phases are outlined below. The three phases can be undertaken concurrently

Civil Engineering Works

- Install meteorological mast.
- Clear and hardcore area for temporary site offices. Install same.
- Construct bunded area for oil tanks.
- Construct new site roads and hard-standings and crane pads.
- Construct drainage ditches, culverts etc. integral to road construction.
- Excavate for turbine bases. Store soil locally for backfilling and re-use. Place blinding concrete to turbine bases. Fix reinforcing steel and anchorage system for tower section. Construct shuttering. Fix any ducts etc. to be cast in. Pour concrete bases. Cure concrete. Remove shutters after 1-2 days.

Electrical Works

- Construct bases/plinths for transformer.
- Excavate trenches for site cables, lay cables and backfill. Provide ducts at road crossings.
- Erect transformers at compound.
- Erect fencing at transformer compound.

Turbine Erection and Commissioning

- Erect towers, nacelles and blades.
- Backfill tower foundations and cover with previously stored topsoil.
- Complete electrical installation.
- Grid connection.
- Commission and test turbines.
- Complete site works, reinstate site.
- Remove temporary site offices. Provide any gates, landscaping, signs etc. which may be required.

All relevant Site Health & Safety procedures, in accordance with the relevant Health and Safety Legislation and guidance (listed in Section 5.9.2.1 of this EIAR), including the preparation of the Health & Safety Plan, erection of the relevant and appropriate signage on site, inductions and toolbox talks will take place prior to and throughout the construction phase of the proposed development. Further details of on-site health, safety and welfare are included in Chapter 5 of this EIAR.

The phasing and scheduling of the main construction task items are outlined in Figure 4.27 below, where 1st September 2025 has been selected as an arbitrary start date for construction activities.

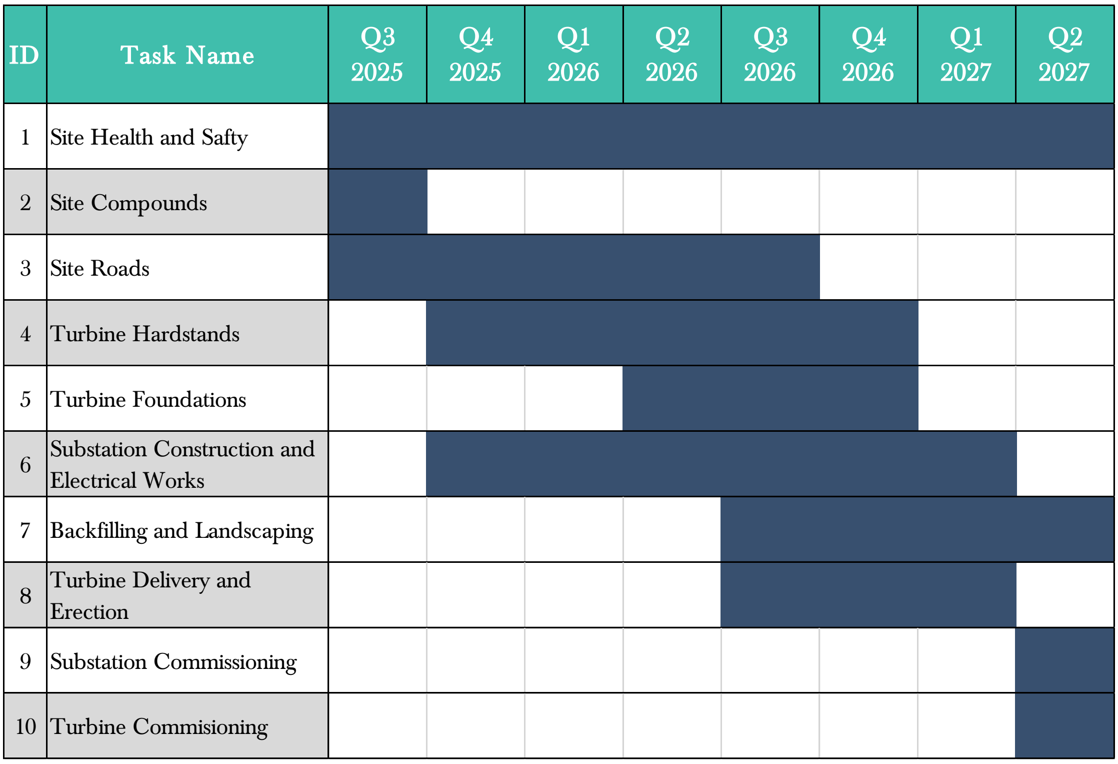


Figure 4.27 Indicative Construction Schedule

4.7.3 Construction Phase Monitoring & Oversight

The requirement for a Construction Environmental Management Plan (CEMP) to be prepared in advance of any construction works commencing on any wind farm site and submitted for agreement to the Planning Authority is now well-established. The proposed procedures for the implementation of the mitigation measures outlined in such an EMP and their effectiveness and completion is typically audited by way of an Environmental Management Plan (EMP) Audit Report. The EMP Audit Report effectively lists all mitigation measures prescribed in any of the planning documentation, all conditions attached to the grant of planning permission and any further mitigation measures proposed during the detailed design stage, and allows them to be audited on a systematic and regular basis. The first assessment is a simply Yes/No question, has the mitigation measure been employed on-site or not? Following confirmation that the mitigation measure has been implemented, the effectiveness of the mitigation measures has to be the subject of regular review and audit during the full construction stage of the project. If some remedial actions are needed to improve the effectiveness of the mitigation measure, then these are notified to the site staff immediately during the audit site visit, and in writing by way of the circulation of the audit report. Depending on the importance and urgency of rectifying the issue, the construction site manager is given a timeframe by when the remedial works need to be completed.

The on-site construction staff will be responsible for implementing the mitigation measures specified in the EIAR and compiled in the Audit Report. Their implementation will be overseen by supervising hydrogeologists, environmental scientists, ecologists or geotechnical engineers, depending on who is best placed to advise on the implementation. The system of auditing referred to above ensures that the mitigation measures are maintained for the duration of the construction phase, and into the operational phase where necessary. The Audit Reports are usually submitted to the Planning Authority as a condition of planning and will be proposed as part of the Environmental Management Plan and Audit System that that is typically proposed to and agreed with the Planning Authority in advance of construction works commencing.

4.8 Construction Methodologies

4.8.1 Shallow Turbine Foundations

Each of the turbines to be erected on site will have a reinforced concrete base. Overburden will be stripped off the foundation area to a suitable formation using a 360° excavator with most being removed to the onsite borrow pit while some will be stored locally for later reuse in backfilling around the turbine foundation. A five metre wide working area will be required around each turbine base, with the sides of the excavated areas sloped sufficiently to ensure that slippage does not occur. Material excavated to create the working area will be stored locally for later reuse in backfilling the working area around the turbine foundation. The excavated material will be surrounded by silt fences to ensure sediment-laden run-off does not occur.

The formation material will have to be approved by an engineer as meeting the turbine manufacturer's requirements. If the formation level is reached at a depth greater than the depth of the foundation, the ground level will have to be raised with clause 804 or similar hardcore material, compacted in 250 millimetres (mm) layers, with sufficient compacted effort (i.e. compacted with seven passes using 12 tonne roller). Drainage measures will be installed to protect the formation by forming an interceptor drain around the perimeter of the base which will outfall out at the lowest point level spreader or settlement pond.

An embankment approximately 600 mm high will be constructed around the perimeter of each turbine base and a fence will be erected to prevent construction traffic from driving into the excavated hole and to demarcate the working area. All necessary health and safety signage will be erected to warn of deep excavations etc. Access to and from excavated bases will be formed by excavating a pedestrian walkway to 1:12 grade.

There will be a minimum of 100 mm of blinding concrete laid on the formation material positioned using concrete skip and 360° excavator to protect ground formation and to give a safe working platform.

The anchor cage is delivered to site in 2 or more parts depending on the turbine type. A 360° excavator with suitable approved lifting equipment will be used to unload sections of the anchor cage and reinforcing steel. The anchor cage is positioned in the middle of the turbine base and is assembled accordingly. When the anchor cage is in final position it is checked and levelled by using an appropriate instrument. The anchor cage is positioned 250mm – 300mm from formation level by use of adjustable legs. Reinforcement bars are then placed around the anchor cage, first radial bars, then concentric bars, shear bars and finally the superior group of bars. Earthing material is attached during the steel foundation build up. The level of the anchor cage will be checked again prior to the concrete pour and during the concrete pour.

Formwork to concrete bases will be propped/supported sufficiently so as to prevent failure. Concrete for bases will be poured using a concrete pump. Each base will be poured in three stages. Stage 1 will see the concrete being poured and vibrated in the centre of the anchor cage to bring the concrete up to the required level inside the cage. Stage 2 will see the centre of the steel foundation being poured and vibrated to the required level. Stage 3 will see the remaining concrete being poured around the steel foundation to bring it up to the required finished level. After a period of time when the concrete has set sufficiently the top surface of the concrete surface is to be finished with a power float.

Once the base has sufficient curing time it will be backfilled with suitable fill up to existing ground level and finished with the original material that was excavated.

4.8.2 Piled Turbine Foundation

Due to the depth of peat at some turbine locations, it is anticipated that some turbine foundations may have to be piled. Piled foundations have been successfully proposed and used on other wind farm sites in Ireland. The construction methodology to be used for the piled foundation scenario is as follows:

- Using geogrid and imported stone as required, a temporary access ramp and temporary platform for a piling rig, shown in Plate 4.8, is to be constructed above the turbine base location.
- A piling rig is then to be mobilised on the piling rig platform.
- Piles are to be constructed to extend through the peat and silt layers and to penetrate the underlying rockhead by approximately 5 metres.
- Peat, silt and rock cored upwards during the piling process shall be removed to a suitable material storage location.
- Concrete delivery trucks and pumps feeding the pile construction will operate from the finished hardstand.
- On completion of the piles, (approx 14-20 per base) the piling rig will de-rig and remobilise at a separate base.
- A low ground bearing pressure tracked excavator will excavate peat at the foundation to 300mm below blinding level.
- Using geogrid as required and a cleaning layer of stone beneath the blinding layer, a layer of blinding will then be placed.
- Concrete within the piles is then to be broken down to blinding level, exposing the reinforcement steel within the piles onto which the reinforcement steel of the foundation is to be fixed.
- On completion of the steel cage, the foundation pour is to be completed as normal.
- Weathered rock removed either during the piling process or from other areas of the site is to be used as backfill over the foundation.

Plate 4.8 below shows an example of piling being undertaken on a wind farm in Co. Kerry, in that particular case to depths of 17 metres.

Plate 4.8 Piling Rig on a piling platform at a turbine foundation

4.8.3 Site Roads and Crane Pad Areas

Site roads will be constructed to each turbine base and at each base a crane hard standing will be constructed to the turbine manufacturer's specifications and the largest predicted area has been assessed in this EIAR. Tracked excavators will carry out excavation for roads with appropriate equipment attached. The excavations shall follow a logical route working away from the borrow pit locations. Excavated material will be transported back to the borrow pits in haul trucks. A two to three-metre-wide working area will be required around each hardstanding area, with the sides of the excavated areas sloped sufficiently to ensure that slippage does not occur. Material excavated to create the working area will be stored locally for later reuse in backfilling the working area around the turbine foundation. The excavated material will be covered with polythene sheets and surrounded by silt fences to ensure sediment-laden run-off does not occur.

When the formation layer has been reached, stone from the on-site borrow pit shall be placed to form the road foundation. In the event of large clay deposits being encountered in sections of road, a geotextile layer will be required at sub-base level. The sub grade will be compacted with the use of a roller. The final wearing course will not be provided until all bases have been poured. This prevents damage to the wearing course due to stone and concrete trucks movements. The road will be upgraded prior to the arrival of the first turbine. All roads will be maintained for the duration of the operation of the proposed development.

4.8.4 Hardstand Areas in Deeper Peat

In areas of deeper peat, a sheet piled solution to construct turbine hardstands can also be employed. The construction methodology for the construction of sheet piled hardstands would be as follows;

- The proposed footprint of the hardstanding is to be set out on the ground.
- Existing surface water flows are to be diverted around the hardstanding and foundation footprint through new engineered drainage channels.
- The low point of the hardstanding is to be identified, and a drainage solution is to be identified from the proposed excavated level at this location, in order that the hardstanding does not act as a large sink for surface water once constructed (which would increase pore water pressures on the peat adjacent to the hardstanding).
- Suitable environmental protection measures/silt traps are to be placed along the proposed drainage solution from the hardstandings.
- Using a low ground bearing tracked excavator, sheet piles are to be pushed vertically through the peat into the underlying silt layer beneath the peat.
- The sheet piles are to be set into the ground at a distance outside of the set out hardstanding extents equal to the depth of the peat in that area (care shall be taken that any subsurface drainage solution, if used as part of point 2 above, is not damaged).
- The sheet piles are to extend into the silt layer a minimum of 3m or until refusal.
- The sheet piles are to be pushed into the silt layer, and not vibrated in as is sometimes the practice for inserting sheet piles at coffer dam locations. No vibration is to take place in the vicinity of the peat.
- The hardstanding is to be constructed by excavating and replacing on a cell by cell basis i.e. each 20m2 of surface area excavated to the silt layer must be backfilled with suitable stone prior to excavating an adjacent cell.
- The excavator must be working from either the existing floating road, or an existing backfilled cell at all times. The excavator may require the use of an extended arm to reach deeper pockets of peat.
- For the initial four cells in each hardstand, the excavator is to place excavated material into low ground bearing transport vehicles for removal to the peat storage areas. This is to avoid the loading of large volumes onto transport lorries sitting on the floating road location adjacent to open excavations.
- For the initial four cells in each hardstand, low ground bearing transport vehicles are to transport large boulders and coarse engineering fill for the build-up of that cell. It is only

when the first 4 cells are in place that transport lorries may be used for the transport of stone. This is to avoid concentrated loads from tipper trucks on the floating road adjacent to open excavations, and impact loads on the floating roads from the discharge of loads from these tipper trucks. Unloading of tipper trucks in the vicinity of these excavations is only permitted on and to an excavated and replaced cell.

- The excavator is to place excavated material into transport lorries for removal to the peat storage areas. Transport lorries are not to be filled above 75% capacity. Once permitted to do so as above, transport lorries will transport large stone material or boulders for the base of the hardstand to the hardstand area. The excavator will place the large boulders into the excavated cell and push them into place. Again, transport lorries are not to be filled above 75% capacity during stone deliveries to the hardstand area.
- Stone must be filled to a minimum of three metres above the silt layer prior to moving to the adjoining cell for excavation. Additional bracing of the sheet piles may also be incorporated as shown in Plate 4.9 and 4.10 below. The design for the actual bracing system to be used will be completed prior to construction.
- The final top metre of the hardstand may incorporate layers of geogrid. Compaction shall be carried out in layers of no more than 300mm.
- In order to avoid excessive amounts of fill, the final layer of the hardstand may be set below the top of the foundation level by as much as two metres. This will have the effect of reducing the footprint of the excavation also as the effective area of the hardstand is splayed at 45 degrees for load bearing. (For every metre above the silt layer that the hardstand rises, the footprint is widened by two metres).
- The ineffective areas of the excavated and replaced footprint are to be backfilled with peat such that heavy machinery will not be placed thereon.
- The sheet piles can then be removed for use on the next base in a similar fashion.
- Load spreading bogmats or light flatracks may be used to store some of the lighter components on areas adjacent to the piled foundations, to minimise the area that has to be piled. Such flatracks are shown below in Plate 4.11 prior to delivery to a wind farm where they have been used for the above purpose.

Plate 4.9 Sheet piling a hardstand in Cumbria, UK

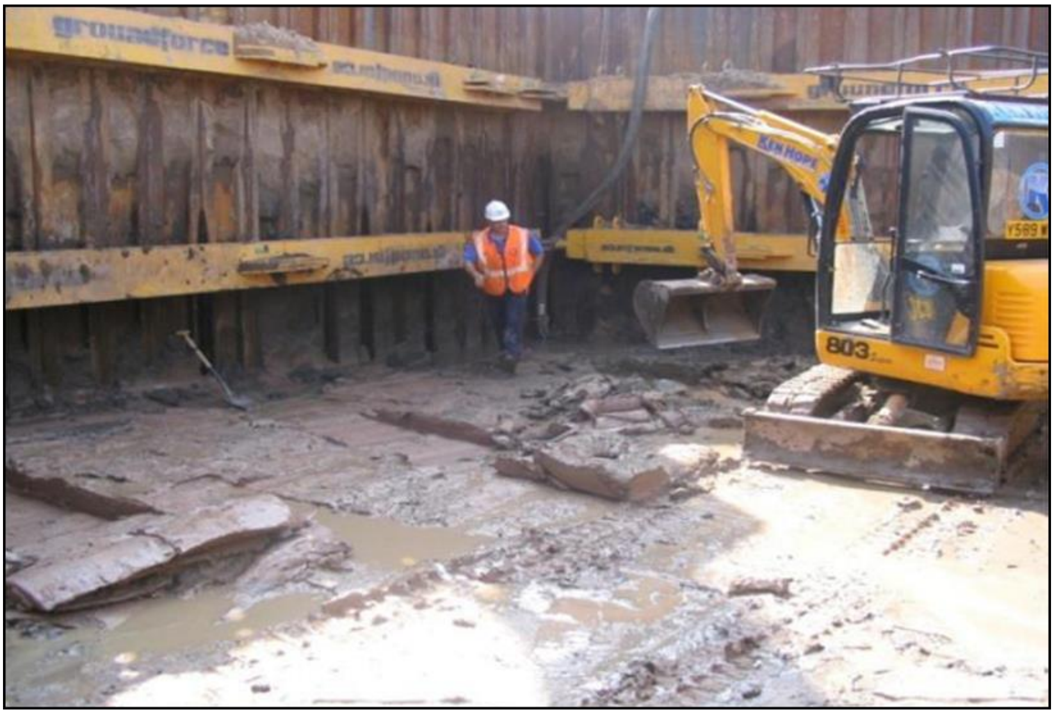


Plate 4.10 Sheet piling a hardstand in Cumbria, UK

Plate 4.11 Flatracks for spreading load at laydown areas

4.8.5 Floating Roads

In localised areas across the site, it may be necessary to construct some floating roads over peat. The floating road design will be used typically in areas with two metres of peat depth or greater. The most suitable type of road construction will be selected at the detailed design stage based on shear strength, slope, peat depth and factor of safety of the peat over which the road must traverse.

Floating roads minimise impact on the peat, particularly peat hydrology, and significantly reduce the volumes of peat requiring management as there is no excavation required and no peat arisings are generated.

The following methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability:

- Prior to commencing floating road construction movement monitoring posts will be installed in areas where the peat depth is greater than three metres.
- Floating road construction will be to the line and level requirements as per detailed engineering design.
- Base geogrid to be laid directly onto the existing peat surface along the line of the road in accordance with geogrid provider's requirements.
- Construction of road to be in accordance with appropriate design from the designer.
- The typical make-up of the new floated access road is 500 to 750mm of selected granular fill with 2 no. layers of geogrid.
- Following the detailed design of the floated access roads it may be deemed necessary to include pressure berms either side of the access road in some of the deeper peat areas. The inclusion of a 2 to 5m wide pressure berm (typically 0.5m in height) either side of the access road will reduce the likelihood of potential bearing failures beneath the access road.

- Stone delivered to the floating road construction shall be end-tipped onto the constructed floating road. Direct tipping of stone on to the peat shall not be carried out.
- To avoid excessive impact loading on the peat due to concentrated end-tipping all stone delivered to the floating road shall be tipped over at least a ten metres length of constructed floating road.
- Where it is not possible to end-tip over a 10m length of constructed floating road then dumpers delivering stone to the floating road shall carry a reduced stone load (not greater than half full) until such time as end-tipping can be carried out over a ten metre length of constructed floating road.
- Following end-tipping a suitable bull-dozer shall be employed to spread and place the tipped stone over the base geogrid along the line of the road.
- A final surface layer shall be placed over the floating road, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.

4.8.6 Proposed Clear-span Watercourse Crossings

It is proposed to construct clear-span watercourse crossings along the wind farm access roads at 2 no. locations using either corrugated metal arches or pre-cast concrete clearspan bridges. The locations of these crossings are shown on the layout drawings included in Appendix 4-3 of this EIAR. The clearspan watercourse crossing methodologies presented below will ensure that no instream works are necessary.

The typical construction methodology for the installation of a pre-cast concrete clear-span bridge is presented below:

- The access road on the approach to the watercourse will be completed to a formation level which is suitable for the passing of plant and equipment required for the installation of the watercourse crossing.
- All drainage measures along the proposed road will be installed in advance of the works.
- The abutment will consist of concrete panels which will be installed on a concrete lean mix foundation to provide a suitable base. The base will be excavated to rock or competent ground with a mechanical excavator with the foundation formed in-situ using a semi-dry concrete lean mix. The base will be excavated along the stream bank with no instream works required.
- Access to the opposite side of the river for excavation and foundation installation will require the installation of pre-cast concrete slab across the river to provide temporary access for the excavator.
- All pre-cast concrete panels and slabs/beams will be installed using a crane which will be set up on the bank of the watercourse and will be lifted into place from the bank with no contact with the watercourse.
- A concrete deck will be poured over the beams/slabs which span across the river. This will be shuttered, sealed and water tested before concrete pouring can commence.

A typical design drawing of a pre-cast concrete, clear span crossing is shown in Figure 1.2 of Appendix 4-3.

The watercourse crossings will be constructed to the specifications of the OPW bridge design guidelines ‘Construction, Replacement or Alteration of Bridges and Culverts - A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945’, and in consultation with Inland Fisheries Ireland. Abutments will be constructed from precast units combined with in-situ foundations, placed within an acceptable backfill material.

4.8.7 Onsite Electricity Substation and Control Building

The onsite substation will be constructed by the following methodology:

- The area of the onsite substation will be marked out using ranging rods or wooden posts and the soil and overburden stripped and removed to nearby temporary storage area for later use in landscaping. Any excess material will be sent to one of the on-site peat repositories or the proposed borrow pit, for reinstatement purposes.
- The dimensions of the onsite substation area have been designed to meet the requirements of Eirgrid and the necessary equipment to safely and efficiently operate the proposed wind farm.
- A control building will be built within the onsite substation compound.
- The foundations will be excavated down to the level indicated by the designer and appropriately shuttered reinforced concrete will be laid over it. An anti-bleeding admixture will be included in the concrete mix.
- The block work walls will be built up from the footings to DPC level and the floor slab constructed, having first located any ducts or trenches required by the follow on mechanical and electrical contractors.
- The block work will then be raised to wall plate level and the gables & internal partition walls formed. Scaffold will be erected around the outside of the building for this operation;
- The roof slabs will be lifted into position using an adequately sized mobile crane.
- The timber roof trusses will then be lifted into position using a telescopic load all or mobile crane depending on site conditions. The roof trusses will then be felted, battened, tiled and sealed against the weather.
- The electrical equipment will be installed and commissioned.
- Perimeter fencing will be erected.
- The construction and components of the substation are to Eirgrid specifications.

4.8.8 Temporary Construction Compounds

The temporary construction compounds will be constructed as follows:

- The area to be used as the compound will be marked out at the corners using ranging rods or timber posts. Drainage runs and associated settlement ponds will be installed around the perimeter;
- The compound platform will be established using a similar technique as the construction of the substation platform discussed above;
- A layer of geo-grid will be installed, and compacted layers of well graded granular material will be spread and lightly compacted to provide a hard area for site offices and storage containers;
- Areas within the compound will be constructed as site roads and used as vehicle hardstandings during deliveries and for parking;
- The compound will be fenced and secured with locked gates if necessary; and,
- Upon completion of the proposed development the temporary construction compound will be decommissioned by backfilling the area with the material arising during excavation, landscaping with topsoil as required.

4.8.9 Grid Connection Cable Trench

4.8.9.1 Excavation and Duct Installation

The following construction methodologies will be employed in relation to the grid connection cable route. A detailed construction methodology for the installation of the proposed 38kV grid connection is included as Appendix 4-6.

4.8.9.1.1 Parallel Road Excavations inroad & in Grass margin

- The area where excavations are planned will be surveyed and all existing services will be identified.
- All relevant bodies i.e. ESB, Eircom, Kerry County Council etc. will be contacted and all drawings for all existing services sought.
- A traffic management plan will be set up prior to any works commencing.
- A road opening licence will be obtained where required and all plant operators and general operatives will be inducted and informed as to the location of any services.
- A rubber tracked 360-degree excavator will be used to excavate the trench to the dimensions specified in the ESB Networks "Specification for the Installation of Ducts and Structures for Underground Power Cables and Communications Cables".
- All excavated material will either be removed to the on-site peat repository areas or to a licenced tip or, if suitable, stockpiled and reused for backfilling where appropriate. All excavated material not used for backfilling will be removed from site using trucks.
- The trench depth is specified at 1220mm and trench support will not be required, however where depths exceed 1250mm trench support will be installed or the trench sides will be benched or battered back where appropriate.
- Any ingress of ground water will be removed from the trench using submersible pumps.
- A silt filtration system will be used to prevent contamination of any watercourse.
- Once the trench has been excavated a base layer of 15 N CBM4 concrete will be installed and compacted. All concrete will be offloaded directly from the concrete truck directly into the trench.
- Ducting will then be placed in the trench as per specification, approved cable ties will be used where required to secure the trefoil ducts together (at 3 metre centres).
- Once the trefoil ducts have been installed couplers will be fitted and capped to prevent any dirt etc. entering the duct. In poor ground conditions the end of the trefoil ducts will be shimmed up off of the bed of the trench to prevent any possible ingress of water dirt. The shims will be removed again once the next length has been connected.
- Extreme care will be taken to ensure that all duct collars (both ends) are clean and in good condition prior to ducts being joined.
- The as built location of the ducting will be surveyed using a total station/GPS.
- 15 Newton CBM4 concrete will be carefully installed so as not to displace the ducting to the underside of the communications duct and compacted as per approved detail. See Plate 4.14.
- Spacers will be used to ensure that the correct cover is achieved at both sides of the trefoil ducting.
- ESB marker board will be fitted above the trefoil ducting.
- The Communication duct will be fitted and kept to one side of the trench ensuring that the minimum cover is achieved and 15 Newton CBM4 concrete will be placed to the specified cover and compacted, see Plate 4.14.
- ESB red marker board will be installed and the remainder of trench will be backfilled in two compacted layers with approved material (lean mix concrete/clause 804).
- Yellow marker tape will be installed as per approved detail specifications, 300 mm maximum below finished road/ground level.
- Topsoil will be permanently reinstated where required or Clause 804 stone used to finish the trench on grass margins where appropriate to give a more trafficable surface.

Plate 4.12 Cable Trench and Conduit

Plate 4.13 Cable Trench and Conduit

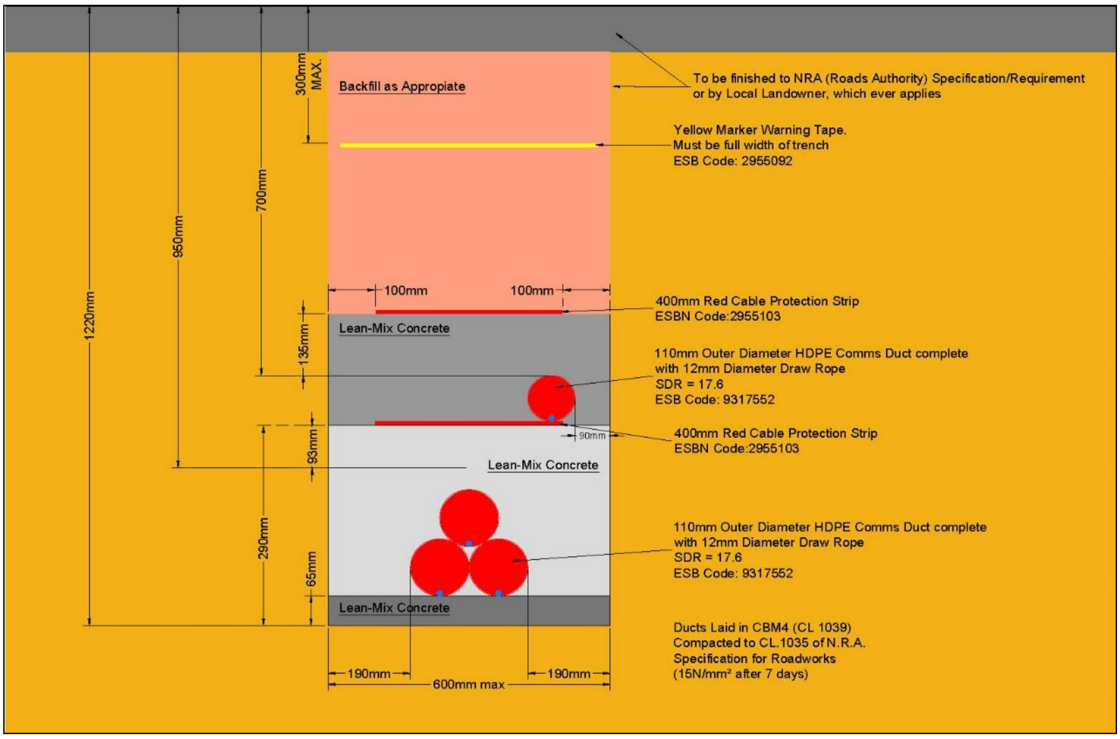


Plate 4.14 Trench layout single circuit (4-way) trefoil

4.8.9.1.2 Road Crossing

- A traffic management plan will be set up prior to any works commencing.
- The area where excavations are planned will be surveyed and all existing services will be identified.
- A road opening licence will be obtained where required and any conditions complied with.
- The road will be cut to the required width of trench using road saw.
- A truck will be used to remove excavated material from work area.
- A rubber tracked 360-degree excavator will be used to excavate the trench to the dimensions specified in the ESB Networks manual for the ''Specification for the Installation of Ducts and Structures for Underground Power Cables and Communication Cables''.
- Trench support will be installed where required.
- All excavated material from road crossing will be removed off site to an approved tip or if suitable stored for reuse.
- A base layer of 15 Newton CBM4 concrete will be installed and compacted.
- Ducting will then be placed in the trench as per specification, approved cable ties will be used where required to secure trefoil ducts together (at 3 meter centres).
- Extreme care will be taken to ensure that all duct collars (both ends) are clean and in good condition prior to ducts being joined.
- The ducting will then be surveyed for both level and grid location using a total station/GPS.
- 15 Newton CBM4 concrete will be carefully installed to the underside of the communications ducts and compacted.
- ESB marker board will then be placed at this level in the trench.
- Communication ducts will then be fitted and backfilled to the correct level with 15 Newton concrete and spacer boards to ensure correct cover is achieved.
- ESB marker board will be installed again at this level and the remainder of trench backfilled in two compacted layers of 15 Newton CBM4 concrete / Clause 804 material.
- Yellow marker tape will be installed at a maximum of 300 mm from the finished road level.
- The road surface will be temporarily reinstated with a blinding layer/cold mix tarmacadam.
- The road surface will then be permanently reinstated at a later date (2 – 3 weeks).

4.8.9.2 Existing Underground Services

Any underground services encountered along the cable routes will be surveyed for level and the ducting will pass over the service provided adequate cover is available. A minimum clearance of 300mm will be required between the bottom of the ducts and the service in question. If the clearance cannot be achieved the ducting will pass under the service and again 300 mm clearance between the top of the communications duct and bottom of the service will be achieved. In deeper excavations an additional layer of marker tape will be installed between the communications duct and top level yellow marker tape. If the required separation distances cannot be achieved then a number of alternative options are available such as using steel plates laid across the width of the trench and using 35N concrete surrounding the ESB ducts where adjacent services are within 600mm, with marker tape on the side of the trench. Back fill around any utility services will be with dead sand/pea shingle where appropriate. All excavations will be kept within the roadway boundaries, i.e. in road or grass margin.

4.8.9.3 Joint Bays

Joint bays are pre-cast concrete chambers where lengths of cable will be joined to form one continuous cable. They will be located at various points along the ducting route approximately every 700 - 750 meters. Where possible, joint bays will be located in areas where there is a natural widening/wide grass margin on the road in order to accommodate easier construction, cable installation and create less traffic congestion. During construction the joint bay locations will be completely fenced off and will be incorporated into the traffic management system. Once they have been constructed they will be backfilled temporarily until cables are being installed. Exact location of cable/joint bay in the road curtilage to be subject to ESB specifications and agreement with Kerry County Council.

4.8.9.4 Watercourse/Culvert Crossings

There are a total of 5 major watercourse and culvert crossings along the proposed grid connection route. The remaining crossings along the grid connection route are classified as minor culverts.

The construction methodology has been designed to eliminate the requirement for in-stream works. A general description of the various construction methods employed at watercourse/ culvert crossings are described in the following paragraphs below. A list of the stream crossings along the grid connection route and the proposed crossing method at each location are provided in Table 4.3 below.

The crossing methodologies to be employed at the other culvert crossings along the grid connection cable route, will be selected from the suite of watercourse crossing options outlined below, as appropriate, depending on culvert type, depth, size and local ground conditions.

The stream crossing locations are shown in Figure 4.28..

4.8.9.4.1 *Piped Culvert Crossings over Culvert– Option 1*

Watercourses will not be directly impacted upon since no instream works or bridge/culvert alterations are proposed. Where sufficient cover exists above the culvert, the trench will be excavated above the culvert and the ducts will be installed in the trefoil arrangement passing over the sealed pipe where no contact will be made with the watercourse. This method of duct installation is further detailed in Figure 4.29.

4.8.9.4.2 *Piped Culvert Crossings under Culvert – Option 2*

Where the culvert consists of a socketed concrete or sealed plastic pipe where sufficient cover over the culvert does not exist to accommodate the cable trench, a trench will then be excavated beneath the culvert and cable ducts will be installed in the trefoil arrangement under the sealed pipe.

If these duct installation methods cannot be achieved or utilised, the ducts will be installed by alternative means as set out in the following sections. This method of duct installation is further detailed in Figure 4.30.

4.8.9.4.3 *Flatbed Formation over Culverts – Option 3*

Where cable ducts are to be installed over an existing culvert/bridge where sufficient cover cannot be achieved by installing the ducts in a trefoil arrangement, the ducts will be laid in a much shallower trench the depth of which will be determined by the location of the top of the culvert or the depth that can be achieved in the deck of a bridge structure. The ducts will be laid in this trench in a flatbed formation over the existing culvert/bridge and will be encased in 6mm thick steel galvanized plate with a 35N concrete surround as per ESB Networks specification.

After the crossing over the culvert has been achieved, the ducts will resume to the trefoil arrangement within a standard trench.

Where a bridge or culvert has insufficient deck cover to fully accommodate the required ducts, the ducts can be laid in a flatbed formation partially within the existing road make up. Where this option is to be employed, the ducts will also be encased in steel with a concrete surround as per Eirgrid and/or ESB Networks specifications. In order to achieve cover over these ducts and restore the carriageway of the road, it may be necessary to locally raise the pavement level to fully cover the ducts. The increase road level will be achieved by overlaying the existing pavement with a new wearing course as required. Any addition of a new pavement will be tied back into the existing road pavement at grade. After the crossing over the culvert has been achieved, the ducts will resume to the trefoil arrangement within a standard trench. This method of duct installation is further detailed in Figure 4.31.

The flatbed formation methodology will also be used at bridge structures where there is an existing footpath. The cables will be installed in the same flatbed arrangement where the existing footpath will be excavated to allow for the installation of the cables. The footpath will be reinstated after cable ducts have been installed. Where there is no existing footpath, it is proposed to install a footpath to encase the cable ducts after they have been laid in the flatbed formation.

4.8.9.4.4 *Horizontal Directional Drilling – Option 4*

In the event that none of the above methods are appropriate, directional drilling will be utilised.

The directional drilling method of duct installation will be carried out using Vermeer D36 x 50 Directional Drill (approximately 22 tonnes), or similar plant, will be utilised for the horizontal directional drilling at watercourse/culvert crossings listed below. The launch and reception pits will be approximately 2m wide, 3m long and 1 m deep. The pits will be excavated with a suitably sized excavator. The drilling rig will be securely anchored to the ground by means of anchor pins which will be attached to the front of the machine. The drill head will then be secured to the first drill rod and the operator shall commence to drill into the launch pit to a suitable angle which will enable him to obtain the depths and pitch required to the line and level of the required profile. Drilling of the pilot bore shall continue with the addition of 3.0m long drill rods, mechanically loaded and connected into position.

During the drilling process, a mixture of a natural, inert and fully biodegradable drilling fluid such as Clear Bore™ (environmentally friendly product (not toxic to aquatic organisms)) and water is pumped through the centre of the drill rods to the reamer head and is forced into void and enables the annulus which has been created to support the surrounding sub soil and thus prevent collapse of the reamed length. Depending on the prevalent ground conditions, it may be necessary to repeat the drilling process by incrementally increasing the size of the reamers. When the reamer enters the launch pit, it is removed from the drill rods which are then passed back up the bore to the reception pit and the next size reamer is attached to the drill rods and the process is repeated until the required bore with the allowable tolerance is achieved.

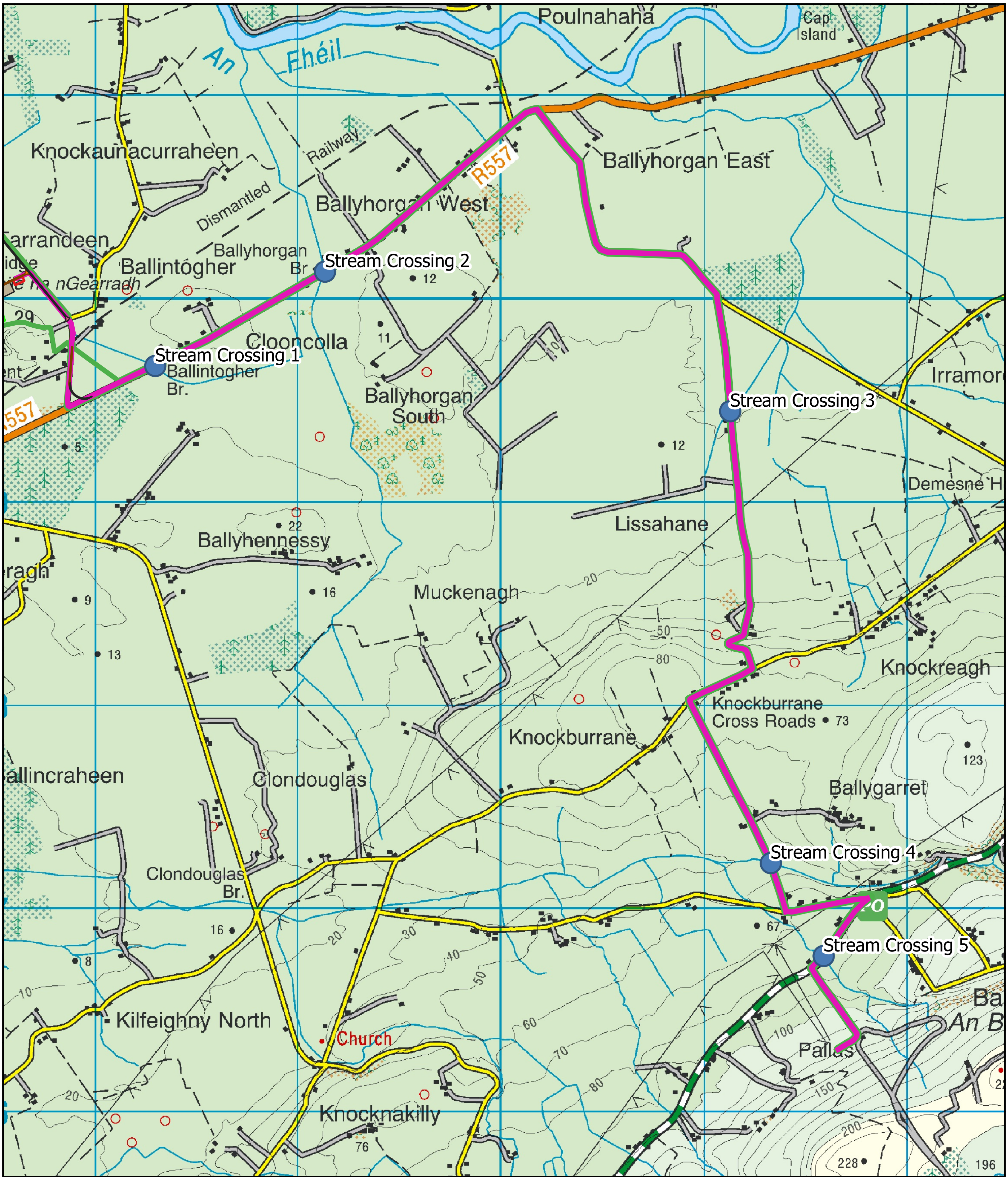
The use of a natural, inert and biodegradable drilling fluid such as Clear Bore™ is intended to negate any adverse effects arising from the use of other, traditional polymer-based drilling fluids and will be used sparingly as part of the drilling operations. It will be appropriately stored prior to use and deployed in the required amounts to avoid surplus. Should any excess drilling fluid accumulate in the reception or drilling pits, it will be contained and removed from the site in the same manner as other subsoil materials associated with the drilling process to an approved licensed waste facility.

Backfilling of launch & reception pits will be conducted in accordance with the normal specification for backfilling excavated trenches. The directional drilling methodology is further detailed in Figure 4.32.

Table 4.4 Stream crossing methodology – Grid Route

Crossing no.	Type and size	Cover from road level to top of culvert/bridge	Maximum depth of trench from road level under watercourse	Description	Watercourse Crossing Option	Extent of In-stream Works
1	1500mm high stone singe arch bridge	200mm	n/a	Due to the lack of cover over the existing bridge, the cable will be installed under the watercourse by means of directional drilling which will ensure that no contact will be made with the watercourse during the works.	Option 4	None. No in-stream works required.
2	1500mm high stone arch bridge	0 mm	n/a	Due to the lack of cover over the existing bridge, the cable will be installed under the watercourse by means of directional drilling which will ensure that no contact will be made with the watercourse during the works.	Option 4	None. No in-stream works required.
3	500mm internal Ø concrete pipe	<200mm	n/a	Due to the lack of cover over the existing pipe, the cable will be installed under the existing pipe. No contact will be made with the watercourse during the works.	Option 2	None. No in-stream works required.
4	1500mm high stone arch bridge	290mm	n/a	Due to the lack of cover over the existing bridge, the cable will be installed under the watercourse by	Option 4	None. No in-stream works required.

				means of directional drilling which will ensure that no contact will be made with the watercourse during the works.		
5	2000mm high stone arch bridge	350mm	n/a	Due to the lack of cover over the existing bridge, the cable will be installed under the watercourse by means of directional drilling which will ensure that no contact will be made with the watercourse during the works.	Option 4	None. No in-stream works required.



Map Legend

- EIAR Study Area
- Proposed 38kV Grid Connection
- Proposed Stream Crossings
- Proposed Substation

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Drawing Title: Grid Connection Stream Crossings	
Project Title: Ballynagare Wind Farm	
Drawn By: TB	Checked By: LW
Project No.: 200512	Drawing No.: Figure 4.28
Scale: 1:25000	Date: 30.09.21

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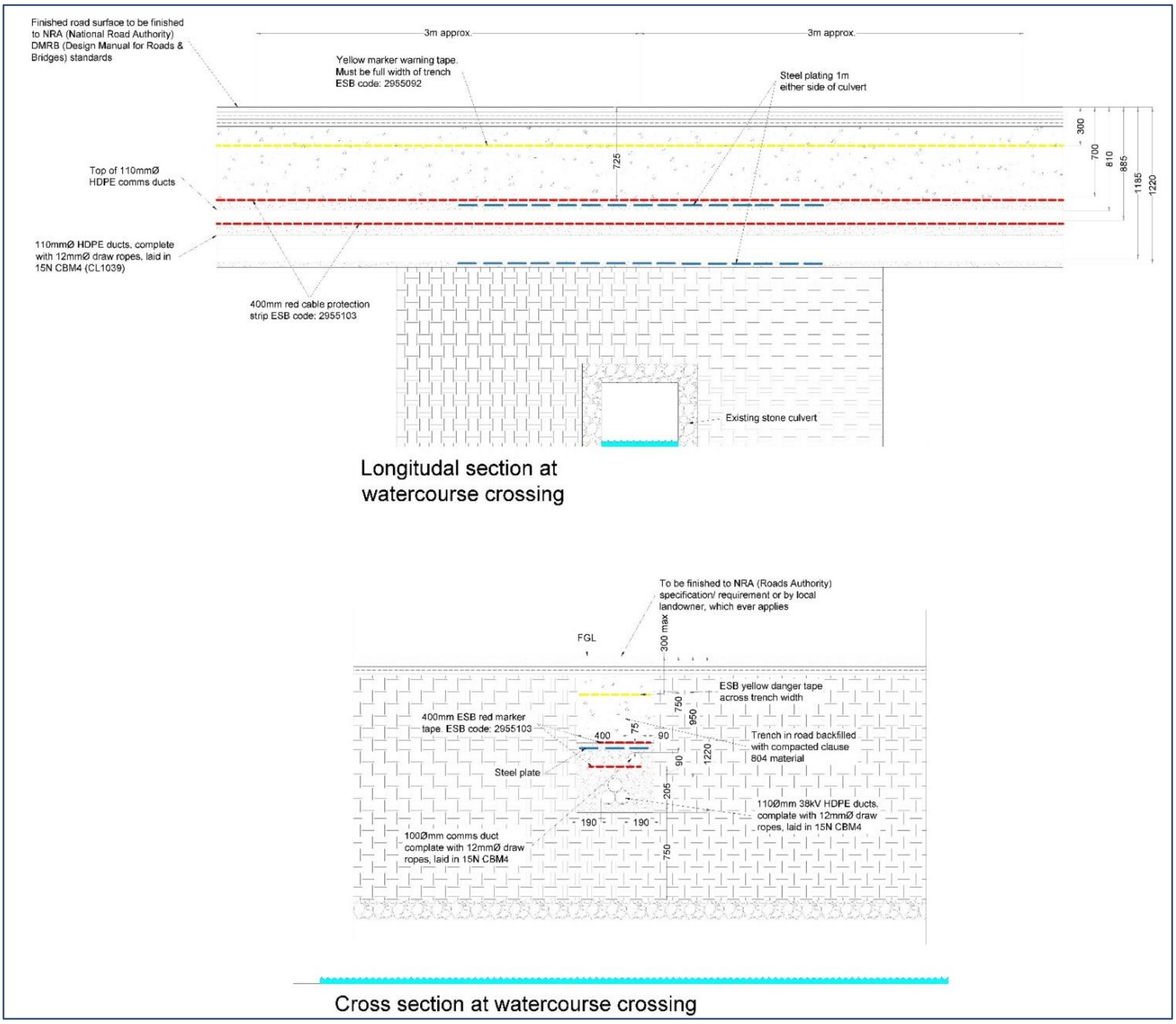

Figure 4.29 Culvert Crossing Option 1

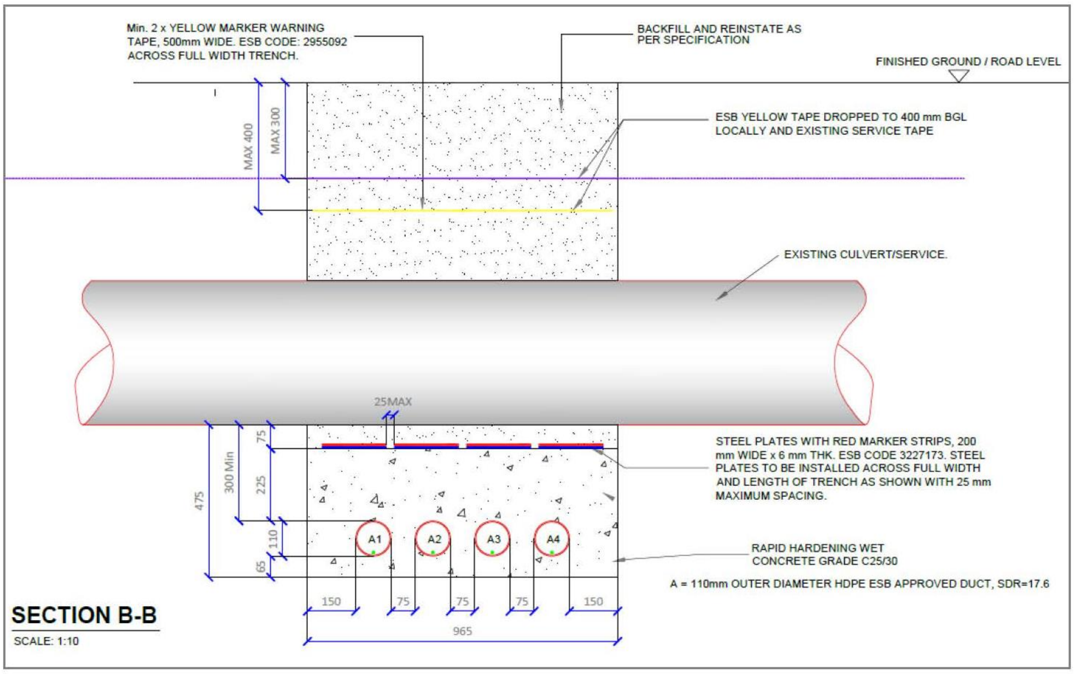

Figure 4.30 Culvert Crossing Option 2

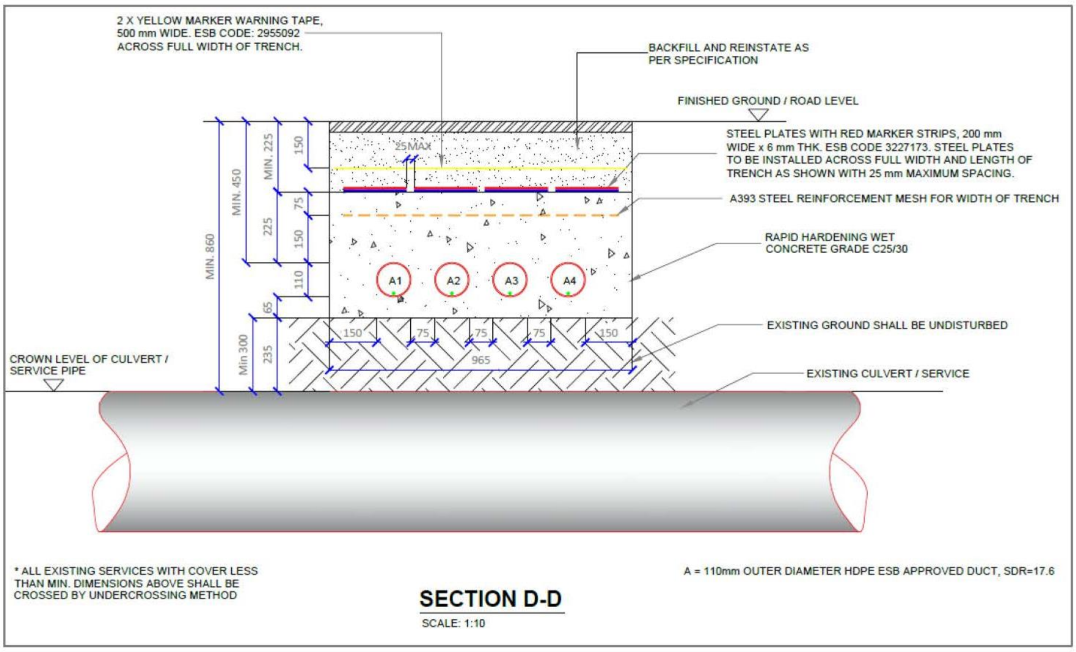

Figure 4.31 Culvert Crossing Option 3

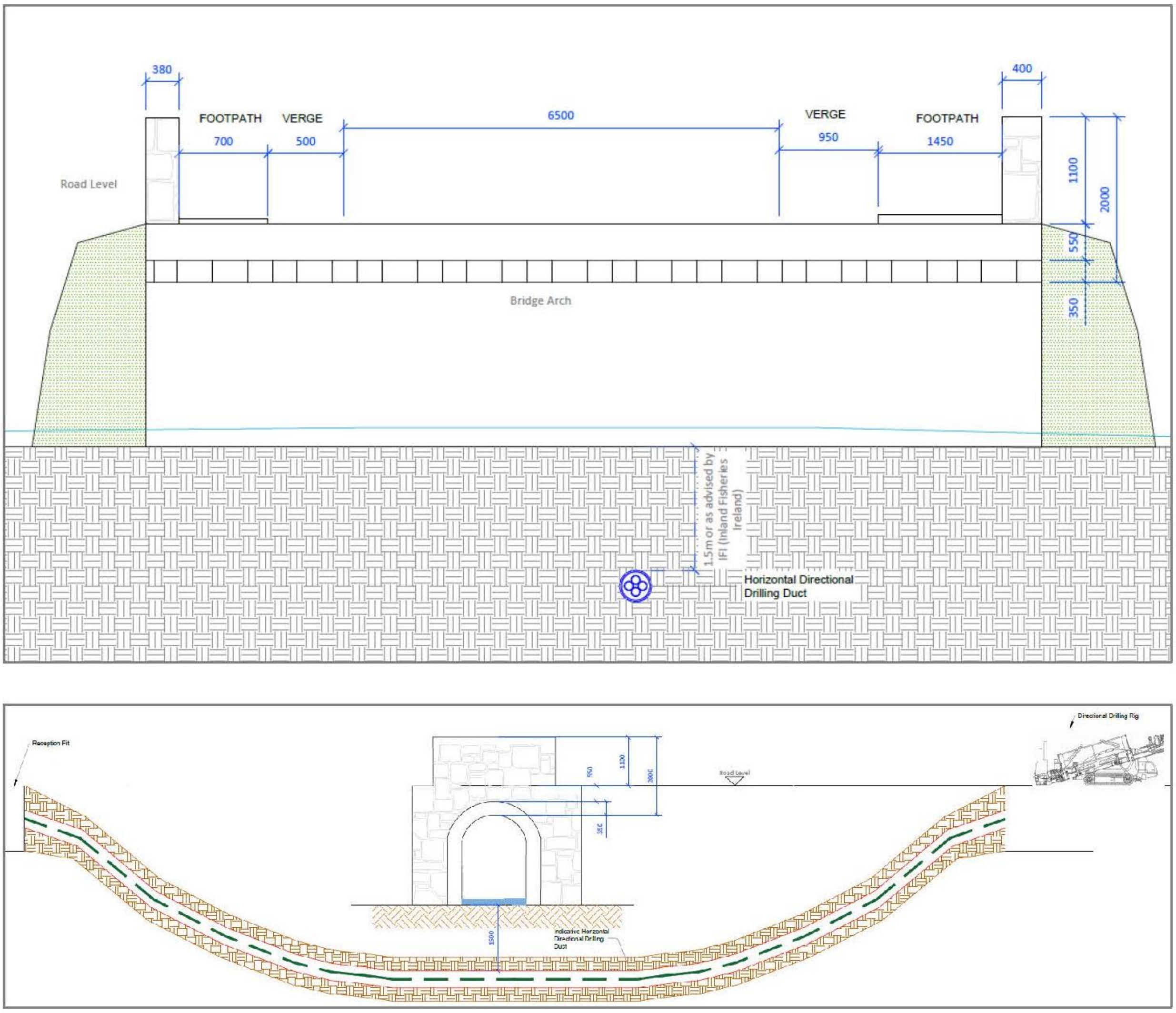

Figure 4.32 Culvert Crossing Option 4

4.8.9.5 General Precaution

Prior to any works commencing a dilapidation survey will be conducted of the entire route, photographing and noting any existing damage or defects to structure or road surfaces. A copy of this survey will be submitted to Kerry County Council prior to works commencing

Communication with the public, local residences and businesses as outlined in the CEMP along the route will be an important responsibility of the project supervisor. Keeping all affected parties up to date and informed both shortly prior and during the construction period at all times. Two to three weeks before any work commencing, reasonable efforts will be made to inform all affected parties of the oncoming works.

Signage will be erected in the weeks prior to any works commencing along and on adjacent roads to the proposed route notifying the public of the forthcoming construction. Contact details for the contractor and details of licence will also be posted along the proposed cable route during construction.

Every effort will be made to minimise the impact of the above works on local residences and traffic. Consideration will also be given to the agricultural community and works will be organised and sequenced so as not to inconvenience any such activities.

- All personnel will be inducted and made familiar with the method statements, risk assessments and traffic management plans involved.
- All site-specific safety rules will be adhered to.
- All plant operators will have appropriate CSCS training.
- All personnel will have FÁS Safe Pass training
- Fire extinguishers and first aid supplies will be available in the work area.
- The road way will be maintained in clean condition at all times.
- Helmets, High Visibility clothing and safety footwear will be worn at all times.
- A competent foreman will be on site at all times.
- Excavations are back filled at the end of each working day.
- The trench will not be over crowded.
- Unauthorised access will be monitored and prevented.
- Pipe work will be lifted into position manually.
- Hand dig will be used to expose any services detected during the survey.

4.9 Operation

The proposed wind farm development is expected to have a lifespan of approximately 35 years. During this period, on a day-to-day basis the wind turbines will operate automatically, responding by means of anemometry equipment and control systems to changes in wind speed and direction.

The wind turbines will be connected together and data relayed from the wind turbines to an off-site control centre. Each turbine will also be monitored off-site by the wind turbine supplier. The monitoring of turbine output, performance, wind speeds, and responses to any key alarms will be monitored at an off-site control centre 24-hours per day.

Each turbine would be subject to a routine maintenance programme involving a number of checks and changing of consumables, including oil changes. In addition, there will be a requirement for unscheduled maintenance, which could vary between resetting alarms to major component changes requiring a crane. Typically maintenance traffic will consist of four-wheel drive vehicles or vans. The electricity substations components and site tracks will also require periodic maintenance.

4.10 Decommissioning

The wind turbines proposed as part of the proposed development are expected to have a lifespan of approximately 35 years. Following the end of their useful life, the wind turbines may be replaced with a new set of machines, subject to planning permission being obtained, or the site may be decommissioned fully, with the exception of the electricity substation.

Upon decommissioning of the proposed wind farm, the wind turbines would be disassembled in reverse order to how they were erected. All above ground turbine components would be separated and removed off-site for recycling. Turbine foundations would remain in place underground and would be covered with earth and reseeded as appropriate. Leaving the turbine foundations in-situ is considered a more environmentally prudent option, as to remove that volume of reinforced concrete from the ground could result in significant environment nuisances such as noise, dust and/or vibration. Site roadways could be in use for other purposes other than the operation of the wind farm by the time the decommissioning of the project is to be considered, and therefore it may be more appropriate to leave the site roads in situ for future use. If it were to be confirmed that the roads were not required in the future for any other useful purpose, they could be removed.

The on-site electricity substation will not be removed at the end of the useful life of the wind farm project, as permanent planning permission is being sought for this element of the proposed development. By the time the decommissioning of the project is to be considered, the on-site substation will likely form an integral part of the local electricity network, with a number of supply connections and possibly some additional generation connection. Therefore, the substation will have to be retained as a permanent structure and will not be demolished.

As noted in the Scottish Natural Heritage report (SNH) Research and 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. According to the SNH guidance, 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".*

5. POPULATION AND HUMAN HEALTH

5.1 Introduction

This section of the Environmental Impact Assessment Report (EIAR) identifies, describes and assesses the potential significant, direct and indirect effects of the proposed Ballynagare Wind Farm development on population and human health, and has been completed in accordance with the EIA guidance and legislation set out in Chapter 1: Introduction. The full description of the Proposed Development is provided in Chapter 4 of this EIAR.

One of the principal concerns in the development process is that individuals or communities, should experience no significant diminution in their quality of life from the direct or indirect effects arising from the construction, operation and decommissioning of a development. Ultimately, all the impacts of a development impinge on human health, directly and indirectly, positively and negatively. The key issues examined in this chapter of the EIAR include population, human health, employment and economic activity, land-use, residential amenity, community facilities and services, tourism, property values, shadow flicker, noise, and health and safety.

5.1.1 Statement of Authority

This section of the EIAR has been prepared by Eoin Hurst and reviewed by Michael Watson, of MKO. Eoin Hurst is a Project Environmental Engineer with MKO with over 12 years of progressive experience in civil and environmental engineering consultancy. Eoin holds a BE in Civil Engineering from NUI Galway and a MSc in Environmental Technology from Imperial College London. Prior to starting with MKO in September 2019, Eoin worked as an Environmental Engineer with Tetra Tech in the United States.

Michael Watson is a Project Director with MKO; with over 18 years' experience in the environmental consulting sector. His project experience includes the management and delivery of Environmental Impact Statements / EIARs, with a particular focus on the renewable energy (wind) sector.

5.2 Population

5.2.1 Receiving Environment

Information regarding population and general socio-economic data were sourced from the Central Statistics Office (CSO), the Kerry County Development Plan 2015 – 2021, Fáilte Ireland and any other literature pertinent to the area. The study included an examination of the population and employment characteristics of the area. This information was sourced from the Census of Ireland 2016, which is the most recent census for which a complete dataset is available, also the Census of Ireland 2011, the Census of Agriculture 2010 and from the CSO website (www.cso.ie). Census information is divided into State, Provincial, County, Major Town and District Electoral Division (DED) level.

The proposed development is located within several townlands as listed in Table 1.1 of Section 1.1 of this EIAR. The proposed development is located approximately 8km west-southwest of the town of Listowel in County Kerry. Please refer to Figure 1-1 of Chapter 1: Introduction for the site location.

In order to assess the population in the vicinity of the proposed development, the Study Area for the Population section of this EIAR was defined in terms of the DEDs where the proposed development is located, as well as nearby DEDs which may be affected by the proposed development.

The site of the proposed development lies within the Lixnaw, Kiltomy and Drommartin DEDs as shown in Figure 5-1. The adjacent DEDs include Ballyduff, Ballyegan, Ballynagare, and Ennismore. All of these DEDs will collectively be referred to hereafter as the Study Area for this chapter. The Population Study Area has a population of 3,965 persons, as of 2016 and comprises a total land area of 109 km^2 (Source: CSO Census of the Population 2016).

In order to assess the population along the potential grid connection routes a review of properties and planning applications in the vicinity of the proposed grid works was carried out. The active construction area for the grid connection will be small, ranging from 150 to 300 metres in length at any one time, and it will be transient in nature as it moves along the route. Should separate crews be used during the construction phase they will generally be separated by one to two kilometres. The findings of the population review indicated that where development occurs along the route, the lands nearby comprise farm dwellings and associated farm buildings and derelict buildings and thus the population is relatively sparse. The land-use along the grid connection comprises commercial forestry, agriculture and public roads.

There are no dwellings within 500m of any turbines which is the recommended setback distance as per the 2006 Wind Energy Development Guidelines. The closest third-party dwelling will be located greater than 680m from the nearest proposed turbine i.e. greater than the recommended setback distance (i.e. 4 times the tip height, 680m), as per the Draft Revised Wind Energy Development Guidelines December 2019.

5.2.2 Population Trends

In the four years between the 2011 and the 2016 Census, the population of Ireland increased by 3.8%. During this time, the population of County Kerry grew by 1.5% to 147,707 persons. Further population statistics for the State, County Kerry and the Study Area have been obtained from the Central Statistics Office (CSO) and are presented in Table 5.1.

Table 5.1 Population 2011 – 2016 (Source: CSO)

Area	Population Change		% Population Change
	2011	2016	2011 - 2016
State	4,588,252	4,761,865	3.8
County Kerry	145,502	147,707	1.5
Study Area	3,988	3,965	-0.6

The data presented in Table 5.1 shows that the population of the Study Area decreased by 0.6% between 2011 and 2016. This rate of population growth is lower than that recorded at both the State level and the County level. When the population data is examined in closer detail, it shows that the rate of population change is unevenly distributed within the Study Area DEDs, with some areas experiencing significant increases, and others significant decreases. The highest increase in the population between 2011 and 2016 occurred within Ballyegan DED, which experienced a 9.5% population increase. In comparison, the populations of Ballyduff DED, Ennismore DED and Kiltomy DEDs experienced decreases of 3.0%, 7.0% and 4.5% respectively during the same time period.

Of the DEDs that form the Study Area for this assessment, the highest population during the 2016 Census was recorded in Lixnaw DED, with 1,050 persons reported. The lowest population within the Study Area was reported in Ballyegan DED, with 115 persons recorded.

Map Legend

- Population Study Area (DEDs)
- EIAR Study Area
- Proposed Turbine Locations

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Drawing Title: Population Study Area	
Project Title: Ballynagare Wind Farm	
Drawn By: TB	Checked By: MW
Project No.: 200512	Drawing No.: Figure 5.1
Scale: 1:75000	Date: 13.10.2021

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5.2.3 Population Density

The population densities recorded within the State, County Kerry and the Study Area during the 2016 Census are shown in Table 5.2.

Table 5-2 Population Density in 2016 (Source: CSO)

Area	Population Density (Persons per square kilometre)	
	2011	2016
State	67.5	70.1
County Kerry	30.3	30.7
Study Area	36.7	36.5

The population density of the Study Area recorded during the 2016 Census was 36.5 persons per km^2. This figure is significantly lower than the national population density of 70.05 persons per km^2 and representative of the county population density of 30.7 persons per km^2.

Similar to the observed population and household trends, the population density recorded across the Study Area varies between DEDs. Lixnaw DED had the highest reported population density of 89.9 persons per km^2 while Ballyegan DED, with a density of 8.7 persons per km^2 was the lowest.

5.2.4 Household Statistics

The number of households and average household size recorded within the State, County Kerry and the Study Area during the 2011 and 2016 Censuses are shown in Table 5.3.

Table 5-3 Number of Household and Average Household Size 2011 – 2016 (Source: CSO)

Area	2011		2016	
	No. of Households	Avg. Size (persons)	No. of Households	Avg. Size (persons)
State	1,654,208	2.8	1,702,289	2.8
County Kerry	53,306	2.6	54,493	2.6
Study Area	1,469	2.7	1,480	2.7

In general, the figures in Table 5.3 show that while the number of households within the State, County and the 7 DEDs has increased slightly, the average number of people per household remained unchanged within the Study Area. Average household size recorded within the Study Area during the 2011 and 2016 Censuses are in line with that observed at State and County level during the same time periods.

5.2.5 Age Structure

Table 5.4 presents the population percentages of the State, County Kerry and Study Area within different age groups as defined by the CSO during the 2016 Census. This data is also displayed in Figure 5.2.

Table 5-4 Population per Age Category in 2016 (Source: CSO)

Area	Age Category				
	0 - 14	15 – 24	25 - 44	45 - 64	65 +
State	1,006,552	576,452	1,406,291	1,135,003	637,567
County Kerry	28,791	15,821	38,548	39,513	25,034
Study Area	912	405	1,006	1,011	631

The proportion of the Study Area DED population within each age category is similar to those recorded at national and County level for most categories. For the Study Area, the greatest percentage of the population (25.5%) is within the 45-64 age category.

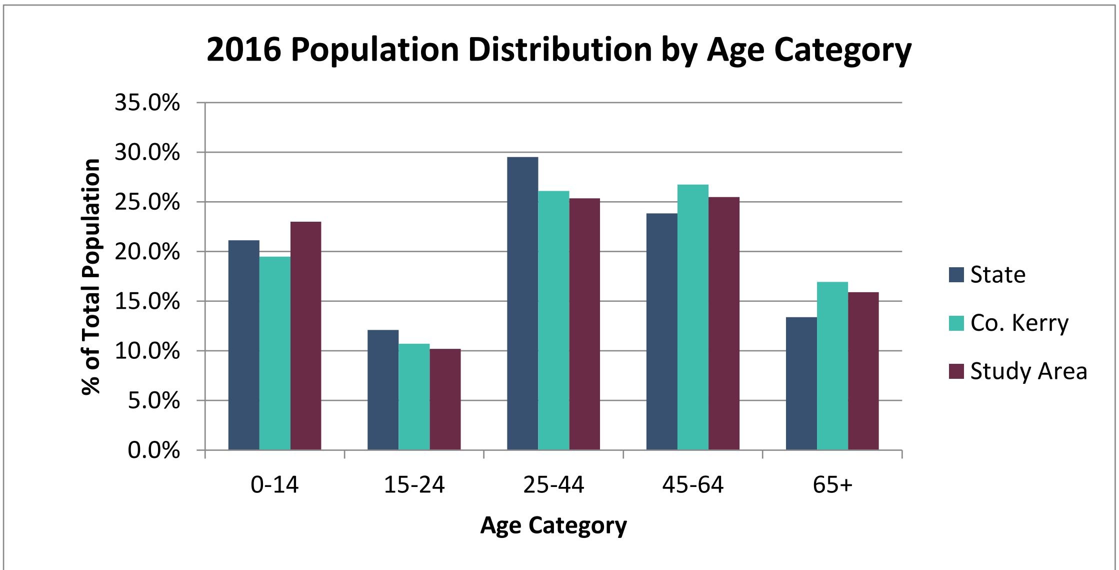

Figure 5-2 Population Distribution by Age Category in 2016 (Source: CSO)

5.2.6 Employment and Economic Activity

5.2.6.1 Employment by Socio-Economic Group

Socio-economic grouping divides the population into categories depending on the level of skill or educational attainment required. The 'Higher Professional' category includes scientists, engineers, solicitors, town planners and psychologists. The 'Lower Professional' category includes teachers, lab technicians, nurses, journalists, actors and driving instructors. Skilled occupations are divided into manual skilled such as bricklayers and building contractors; semi-skilled such as roofers and gardeners; and unskilled, which includes construction labourers, refuse collectors and window cleaners. Figure 5.3

shows the percentages of those employed in each socio-economic group in the State, County Kerry and the Study Area during 2016.

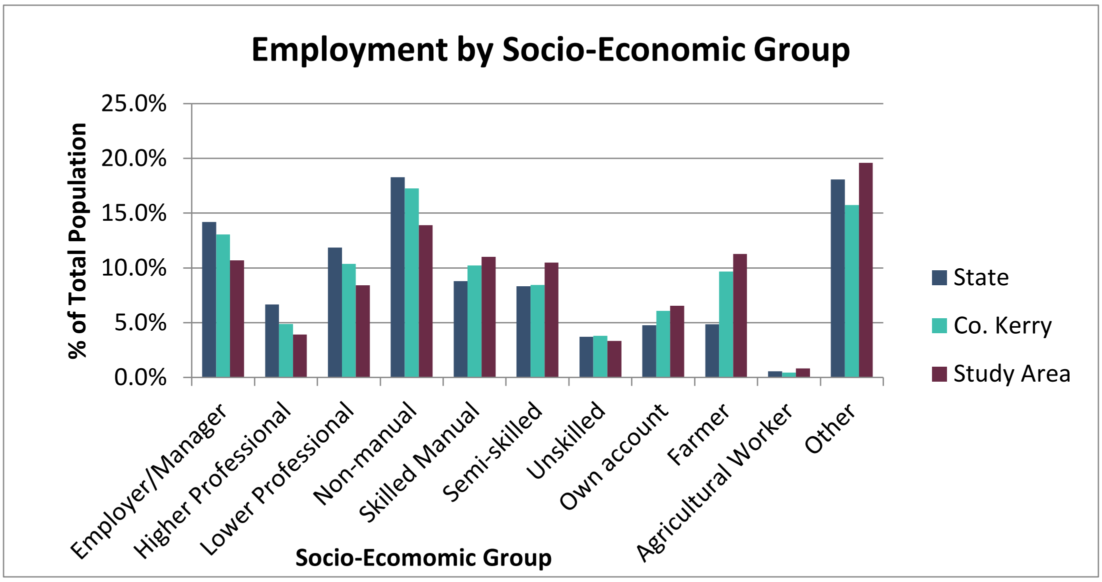

Figure 5-3 Employment by Socio-Economic Group in 2016 (Source: CSO)

The highest level of employment within the Study Area was recorded in the Non-Manual category. The levels of employment within the Employer/Manager, Higher Professional, Lower Professional, Non-Manual and Unskilled categories in the Study Area were lower than those recorded for the State and County Kerry, while those recorded within the Skilled Manual, Semi-Skilled, Farmer, Agricultural Worker, and Own Account categories were higher.

The CSO employment figures grouped by socio-economic status includes the entire population for the Study Area, County and State in their respective categories. As such, the socio-economic category of 'Other' is skewed to include those who are not in the labour force.

5.2.6.2 Employment and Investment Potential in the Irish Wind Energy Industry

5.2.6.2.1 *Background*

The Sustainable Energy Authority of Ireland estimates, in their *Wind Energy Roadmap 2011-2050*[1], that onshore and offshore wind could create 20,000 direct installation and operation/maintenance jobs by 2040 and that the wind industry would also have an annual investment potential of €6-12 billion by the same year.

A 2014 report *The Value of Wind Energy to Ireland*[2], published by Pőyry, stated that growth of the wind sector in Ireland could support 23,850 jobs (construction and operational phases) by 2030. If Ireland instead chooses to not develop any more wind, by 2030 the country will be reliant on natural gas for most of our electricity generation, at a cost of €671 million per annum in fuel import costs.

[1] *Sustainable Energy Authority of Ireland 2011, Wind Energy Roadmap to 2050 Available at: https://www.seai.ie/publications/Wind_Energy_Roadmap_2011-2050.pdf*

[2] *Poyry Management Consulting: The Value of Wind Energy to Ireland': A report to Irish Wind Energy Association 2014. Available at: https://windenergyireland.com/images/files/9660bd6b05ed16be59431aa0625855d5f7dca1.pdf*

Siemens, in conjunction with the WEI, published a report in 2014 titled *An Enterprising Wind: An economic analysis of the job creation potential of the wind sector in Ireland*[3], which concluded, *'a major programme of investment in wind could have a sizeable positive effect on the labour market, resulting in substantial growth in employment.'*

The report considers the three potential types of direct employment created, as a result of increased investment in wind energy, to be:

- Wind Energy Industry Employment:
  - Installation
  - Development
  - Planning
  - Operation and Maintenance
  - Investor activity
- Electricity Grid Network Employment
- Potential Wind Turbine Manufacturing Employment

Wind Energy Ireland (WEI) released a report in March 2021 *Our Climate Neutral Future Zero by 50* [4] in light of the Government's announcement of new, ambitious energy targets in the same month. The report outlines the potential for 50,000 jobs to be created in the renewable energy industry in order to meet the build out requirements to achieve a Net -Zero carbon emissions by 2050. The report estimates that at least 25,000 jobs will be in the onshore and off shore wind energy sector.

KPMG released a report with WEI in April 2021 titled '*Economic impact of onshore wind in Ireland*[5] which states that the wind sector currently supports 5,130 jobs (not including employment in grid development) with a '*with a strong foothold in rural Ireland*...[...]... *through its direct and indirect activities and employment, the sector supports payment of labour incomes totalling €225 million'.*

As of May 2021, there were over 5,510 Megawatts (MW) of wind energy capacity installed on the island of Ireland. Of this, 4,235 MW was installed in the Republic of Ireland, with 1,276 MW installed in Northern Ireland. The majority of the Republic of Ireland's installed wind energy capacity is located in Counties Mayo, Galway, Cork and Kerry.

5.2.6.2.2 Economic Value

A 2009 Deloitte report in conjunction with the Irish Wind Energy Association (now Wind Energy Ireland, WEI) titled 'Jobs and Investment in Irish Wind Energy – Powering Ireland's Economy'[6] states that the construction and development of wind energy projects across the island of Ireland would involve approximately €14.75 billion of investment from 2009 up to 2020, €5.1 billion of which would be retained in the Irish economy (€4.3 billion invested in the Republic of Ireland and €0.8 billion in Northern Ireland).

The report also states that increasing the share of our energy from renewable sources will deliver significant benefits for the electricity customer, the local economy and society. It estimates that between 25 and 30% of capital investment is retained in the local economy. This typically flows to companies in construction, legal, finance and other professional services. The report states:

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[3] *Siemens, IWEA 2014 An Enterprising Wind: An economic analysis of the job creation potential of the wind sector in Ireland. Available at: https://www.esri.ie/system/files/media/file-uploads/2015-07/BKMNEXT250.pdf*

[4] *Wind Energy Ireland, MaREI March 2021 Our Climate Neutral Future Zero by 50. Available at: https://windenergyireland.com/images/files/our-climate-neutral-future-0by50-final-report.pdf*

[5] *KPMG, Wind Energy Ireland April 2021 Economic impact of onshore wind in Ireland. Available at: https://windenergyireland.com/images/files/economic-impact-of-onshore-wind-in-ireland.pdf*

[6] *Deloitte, Irish Wind Energy Association 2009 Jobs and Investment in Irish Wind Energy Powering Ireland's Economy Available at: https://windenergyireland.com/images/files/9660bd5e72bcac538f47d1b02cc6658c97d41f.pdf*

".. the framework acknowledges the need to put the energy/climate change agenda at the heart of Ireland's economic renewal. Every new wind farm development provides a substantial contribution to the local and national economy through job creation, authority rates, land rents and increased demand for local support services. More wind on the system will also result in lower and more stable energy prices for consumers while helping us achieve our energy and emissions targets."

A 2019 report by Baringa, 'Wind for a Euro: Cost-benefit analysis of wind energy in Ireland 2000-2020', has analysed the financial impact for end consumers of the deployment of wind generation in Ireland over the period 2000-2020. The report calculates how the costs and benefits for consumers would have differed if no wind farms had been built. The analysis indicated that the deployment of 4.1 GW of wind generation capacity in Ireland between 2000 and 2020 (2018-2020 results being projective) 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 since 2000. Further cost benefit analysis noted that wind energy has delivered €2.3 billion in savings in the wholesale electricity market. As such, the economic benefit of renewable energy to consumers is greater than what would have been if Ireland did not invest in wind power.

The April 2021 KPMG report discussed above states that by 2030, the onshore wind industry along will bring an Additional Gross Value (GVA) of €550million per annum to the Irish economy, will contribute €305millon total payment in incomes across the supply chain and has the potential to contribute approximately €100millon to local authority rates, if 2030 targets are reached. Furthermore, it is estimated that €2.7billion in capital would be invested in the country through to 2030 if Climate Action Plan targets are reached.

If consented, the proposed development will be contributing to the economic value that renewable energy brings to the country.

5.2.6.2.3 Energy Targets

The Climate Action Plan 2019 (CAP) was published on the 1st of August 2019 by the Department of Communications, Climate Action and Environment. The CAP sets out an ambitious course of action over the coming years to address the impacts which climate may have on Irelands environment, society, economic and natural resources. The CAP includes a commitment that 70% of Ireland's electricity needs will come from renewable sources by 2030. It is envisaged that wind energy will provide the largest source of renewable energy in achieving this target.

In March 2021, the Government of Ireland approved the Climate Bill which aims for net-zero emissions by 2050 and an Interim Target of 51% reduction to be reached by 2030, relative to a baseline of 2018. The Government is required to adopt a series of economy-wide five-year carbon budgets, with the first two five-year carbon budgets correlating to the Interim Target. The Bill also provides the framework for Ireland to meet its international and EU climate commitments and to become a leader in addressing climate change. The Bill states that Local Authorities must prepare individual Climate Action Plans which will include both mitigation and adaptation measures and must be updated every five years. Local Authority Development Plans must align with their Climate Action Plan.

In order to achieve these targets, Ireland's dependency on fossil fuels needs to drop from 80% dependency today to 5% dependency in 2050. MaREI forecast that 25GW of renewable electricity capacity is needed by 2050, compared with 4.5GW that is currently available today[7].

[7] *Wind Energy Ireland, MaREI March 2021 Our Climate Neutral Future Zero by 50. Available at: https://windenergyireland.com/images/files/our-climate-neutral-future-0by50-final-report.pdf*

5.2.7 Land-Use

As previously noted, the majority of the proposed wind farm site comprises cutover bog and farmland, with a small proportion of commercial forestry also within the EIAR study area. The predominant surrounding land use within the population study area is that of farmland. The total area of farmland within the 7 DEDs around the proposed developemnt measures approximately 8,353 ha, comprising 76.8% of the Study Area, according to the CSO Census of Agriculture 2010. There are 258 farms located within the 7 DEDs, with an average farm size of 32.4 ha. This is in line with the 34.0 ha average farm size for Co. Kerry.

Within the Study Area, farming employs 468 people, and the majority of farms are family-owned and run. Table 5-5 shows the breakdown of farmed lands within the Study Area. Pasture accounts for the largest proportion of farmland, followed by silage.

Table 5-5 Farm Size and Classification within the Study Area in 2010 (Source: CSO)

Characteristic	Value
Size of Study Area	10,871 ha
Total Area Farmed within Study Area	8,353 ha
Farmland as % of Study Area	76.8%
Breakdown of Farmed Land [1]	**Area (hectares) [1]**
Total Pasture	4,385 ha
Total Silage	2,737 ha
Total Crops, Fruit & Horticulture	498 ha
Total Cereals	421 ha
Rough Grazing	390 ha
Total Hay	344 ha
Potatoes	21 ha

1. *Categories and areas as per CSO, 2010. Sum of category areas does not equal total area of farmland.*

5.2.8 Services

The proposed development is located within the functional area of the Tralee/Killarney HUB Functional Area Local Area Plan (FALAP) 2013 – 2019.

The nearest settlement to the proposed development site, as listed by the FALAP, is Lixnaw, located approximately 700m to the southwest. Lixnaw is described in the Plan as a north Kerry village consisting largely of residential developments. The FALAP states that Lixnaw functions primarily as a dormitory town for Tralee and to a lesser extent Listowel, and its population has increased steadily since 2006. The Plan also states that there are limited services/facilities and employment potential within the village, and hence it is envisaged that residents will continue to commute to the larger urban centres. Recent residential developments have primarily taken place on the south side of the village along the R557 regional road.

The wind farm site is located approximately 8km west-southwest of Listowel town in which the main services and local amenities are located.

5.2.8.1 Education

The nearest schools to the proposed development site are Scoil Mhuire Gan Smal and Scoil Naisiúnta Mhuire de Lourdes, located approximately 550m southwest and 1,100m south-southwest of the proposed development site respectively, both in the village of Lixnaw.

Other primary schools located around the site include:

- Ballyduff National School, 2.4km northwest of the proposed development
- Drommurrin National School, 3.2km northeast of the proposed development (closed)
- Killocrim National School, 3.5km east of the proposed development
- Dromclough National School, 5.4km east of the proposed development site.

The nearest secondary schools to the proposed development site are located in Listowel, approximately five kilometres northeast of the site. The secondary schools in Listowel include Presentation Secondary School, St Michael's College and Listowel Community College.

5.2.8.2 Access and Public Transport

The proposed development site is accessed via local roads from the R557 Regional Road to the south. The site is not served directly by public transport. The nearest bus station is in the village of lixnaw, approximately 1.25 kilometres south of the proposed development site. From Lixnaw, a number of Monday to Saturday connections are available, including to Tralee and Listowel.

5.2.8.3 Amenities and Community Facilities

The majority of amenities and community facilities, including GAA and other sports clubs, youth clubs and recreational areas available in the area are located in the centres of settlement throughout the wider area. Retail and personal services within the vicinity are provided in the larger settlements such as Listowel and Tralee. St. Michael's Church in Lixnaw is located approximately 2.0kilometres southeast of the proposed development site.

There are no designated walking or cycling routes located within the Study Area for the Human Beings assessment. The nearest designated walking route is the Dingle Way, which begins in Tralee approximately 17 kilometres southwest of the proposed development site at its nearest point.

5.3 Tourism

5.3.1 Tourism Numbers and Revenue

Tourism is one of the major contributors to the national economy and is a significant source of full time and seasonal employment. During 2019, total tourism revenue generated in Ireland was approximately €9.5 billion, an increase on the €9.1 billion revenue recorded in 2018. Overseas tourist visits to Ireland in 2019 grew by 0.7% to 9.7 million ('Key Tourism Facts 2019, Fáilte Ireland, March 2021). Ireland is divided into seven tourism regions. **Table 5.6** shows the total revenue and breakdown of overseas tourist numbers to each region in Ireland during 2019 ('Key Tourism Facts 2019, Fáilte Ireland, March 2021).

Table 5-6 Overseas Tourists Revenue and Numbers 2019 (Source: Fáilte Ireland)

Region	Total Revenue (€m)	Total Number of Overseas Tourists (000s)
Dublin	€2,210m	6,644
Mid East/Midlands	€348m	954
South-East	€261m	945
South-West	**€970m**	**2,335**
Mid West	€472m	1,432
West	€653m	1,943
Border	€259m	768
Total	**€5,173m**	**15,021**

The proposed development is located within the South-West Region. According to 'Regional tourism performance in 2019' (Fáilte Ireland, September 2019) the South West Region which comprises Counties Cork and Kerry, benefited from approximately 15.5% of the total number of overseas tourists to the country and approximately 18.6% of the associated tourism income generated in Ireland in 2019.

5.3.2 Tourist Attractions

There are no tourist attractions pertaining specifically to the primary EIAR study area. The nearest tourist centre to the proposed development site is within Listowel town, located approximately nine kilometres northeast of the site. Tourist attractions within Listowel include the Seanchaí Kerry Literary and Cultural Centre, the Lartigue Monorailway, fishing on the River Feale, Listowel Race Week and Harvest Festival during September, horse riding and golfing.

5.3.3 Tourist Attitudes to Wind Farms

5.3.3.1 Scottish Tourism Survey 2016

BiGGAR Economics undertook an independent study in 2016, entitled 'Wind Farms and Tourism Trends in Scotland', to understand the relationship, if any, that exists between the development of onshore wind energy and the sustainable tourism sector in Scotland. In recent years, the onshore wind sector and sustainable tourism sector have grown significantly in Scotland. However, it could be argued that if there was any relationship between the growth of onshore wind energy and tourism, it would be at a more local level. This study therefore considered the evidence at a local authority level and in the immediate vicinity of constructed wind farms.

Eight local authorities had seen a faster increase in wind energy deployment than the Scottish average. Of these, five also saw a larger increase in sustainable tourism employment than the Scottish average, while only three saw less growth than the Scottish average. The analysis presented in this report shows that, at the Local Authority level, the development of onshore wind energy does not have a detrimental impact on the tourism sector. It was found that in the majority of cases (66%) sustainable tourism employment performed better in areas surrounding wind farms than in the wider local authority area. There was no pattern emerging that would suggest that onshore wind farm development has had a detrimental impact on the tourism sector, even at the very local level.

Overall, the conclusion of this study is that published national statistics on employment in sustainable tourism demonstrate that there is no relationship between the development of onshore wind farms and tourism employment at the level of the Scottish economy, at local authority level, nor in the areas immediately surrounding wind farm development.

5.3.3.2 Fáilte Ireland Surveys 2007 and 2012

In 2007, Fáilte Ireland in association with the Northern Ireland Tourist Board carried out a survey of domestic and overseas holidaymakers to Ireland in order to determine their attitudes to wind farms. The purpose of the survey was to assess whether the development of wind farms impacts on the enjoyment of the Irish scenery by holidaymakers. The survey involved face-to-face interviews with 1,300 tourists (25% domestic and 75% overseas). The results of the survey are presented in the Fáilte Ireland Newsletter 2008/No.3 entitled 'Visitor Attitudes on the Environment: Wind Farms'.

The Fáilte Ireland survey results indicate that most visitors are broadly positive towards the idea of building wind farms in Ireland. There exists a sizeable minority (one in seven) however who are negative towards wind farms in any context. In terms of awareness of wind farms, the findings of the survey include the following:

- Almost half of those surveyed had seen at least one wind farm on their holiday to Ireland. Of these, two thirds had seen up to two wind farms during their holiday.
- Typically, wind farms are encountered in the landscape while driving or being driven (74%), while few have experienced a wind farm up close.
- Of the wind farms viewed, most contained less than ten turbines and 15% had less than five turbines.

Regarding the perceived impact of wind farms on sightseeing, the Fáilte Ireland report states:

> *"Despite the fact that almost half of the tourists interviewed had seen at least one wind farm on their holiday, most felt that their presence did not detract from the quality of their sightseeing, with the largest proportion (45%) saying that the presence of the wind farm had a positive impact on their enjoyment of sightseeing, with 15% claiming that they had a negative impact."*

In assessing the perceived impact of wind farms on beauty, visitors were asked to rate the beauty of five different landscapes types: Coastal, Mountain, Farmland, Bogland and Urban Industrial, and then rate on a scale of 1-5 the potential impact of a wind farm being sited in each landscape. The survey found that each potential wind farm must be assessed on its own merits. Overall, however, in looking at wind farm developments in different landscape types, the numbers claiming a positive impact on the landscape due to wind farms were greater than those claiming a negative impact, in all cases.

Regarding the perceived impact of wind farms on future visits to the area, the Fáilte Ireland survey states:

> *"Almost three quarters of respondents claim that potentially greater numbers of wind farms would either have no impact on their likelihood to visit or have a strong or fairly strong positive impact on future visits to the island of Ireland. Of those who feel that a potentially greater number of wind farms would positively impact on their likelihood to visit, the key driver is their support for renewable energy and potential decreased carbon emissions."*

The report goes on to state that while there is a generally positive disposition among tourists towards wind development in Ireland, it is important also to take account of the views of the one in seven tourists who are negatively disposed towards wind farms. This requires good planning on the part of the wind farm developer as well as the Local Authority. Good planning has been an integral component of the proposed development throughout the site design and assessment processes. Reference has been made to the 'Planning Guidelines on Wind Energy Development 2006' and the 'Draft Revised Wind

Energy Development Guidelines December 2019' in addition to IWEA best practice guidance, throughout all stages, including pre-planning consultation and scoping.

The 2007 survey findings are further upheld by a more recent report carried out by Fáilte Ireland on tourism attitudes to wind farms in 2012. The results of the updated study were published in the 'Fáilte Ireland Newsletter 2012/No.1 entitled 'Visitor Attitudes on the Environment: Wind Farms – Update on 2007 Research'. The updated survey found that of 1,000 domestic and foreign tourists who holidayed in Ireland during 2012, over half of tourists said that they had seen a wind turbine while travelling around the country. Of this number of tourists, 21% claimed wind turbines had a negative impact on the landscape. However, 32% said that it enhanced the surrounding landscape, while 47% said that it made no difference to the landscape. Almost three quarters of respondents claim that potentially greater numbers of wind farms would either have no impact on their likelihood to visit or have a strong or fairly strong positive impact on future visits to the island of Ireland.

Further details regarding the general public perception of wind energy, including those living in the vicinity of a wind farm, are presented in Section 5.5 below.

5.4 Public Perception of Wind Energy

5.4.1 Wind Energy Ireland Interactions Opinion Poll on Wind Energy

In January 2021 Wind Energy Ireland, the representative body for the Irish wind industry, published the results of their most recent nationwide annual poll on attitudes to wind energy, the Public Attitudes Monitor. The objective of the poll was to 'measure and track public perceptions and attitudes around wind energy amongst Irish adults.'

Between 12th – 18th November 2020, a representative sample of 1,004 Irish adults together with a booster sample of 203 rural residents participated in an online survey. The 2020 results reported that 50% of the nationally representative sample 'strongly favour', 32% 'tend to favour' and 15% 'neither favour nor oppose' wind power. Of the rural population surveyed 42% 'strongly favour', 40% 'tend to favour' and 14% 'neither favour nor oppose' wind power. The survey has been run annually since 2017 and while there has been a marginal decrease in those in favour of wind power nationally during this time (from 85% to 82%) there has been a marginal increase in those in favour from the rural population (from 79% to 82%).

Amongst those in favour of wind power, the majority cited environmental and climate concerns as their main reasons for supporting such developments. Other reasons cited for supporting wind energy developments include: 'economic benefits', 'reliable/efficient', 'positive experience with wind energy', and view that it as a 'safe resource'.

When questioned about wind energy developments in their local area, 54% of the nationally representative sample either 'favour' or 'tend to favour' such proposals compared to 52% of the rural population reporting the same. There was a high level of agreement with positive benefits concerning wind energy in the local area from both the nationwide and rural populations, with over 80% of each group in agreement that it 'reduces CO_2 emissions' and is 'good for the environment', with over 75% of each group agreeing that it leads to 'cheaper electricity'. Over 60% of each population group agreed that wind energy 'supports energy independence' and 'creates employment'.

The IWEA November 2020 survey follows the structure of previous national opinion polls on wind energy undertaken since 2017. The 2020 survey results are consistent with previous year's figures and thus indicate that approximately 4 out of 5 Irish adults have continued to support wind energy in recent years.

5.4.2 Sustainable Energy Ireland Survey 2003

5.4.2.1 Background

The results of a national survey entitled 'Attitudes Towards the Development of Wind Farms in Ireland' were published by the Sustainable Energy Authority of Ireland (SEAI) in 2003. A catchment area survey was also carried out by SEAI (formerly SEI) in order to focus specifically on people living with a wind farm in their locality, or in areas where wind farms are planned.

5.4.2.2 Findings

The SEAI survey found that the overall attitude to wind farms was very positive, with 84% of respondents rating it positively or very positively. One percent rated it negatively and 14% had no opinion either way. Approximately two thirds of respondents (67%) were found to be positively disposed to having a wind farm in their locality. Where negative attitudes were voiced towards wind farms, the visual impact of the turbines on the landscape was the strongest influence. The report also noted, however, that the findings obtained within wind farm catchment areas showed that impact on the landscape is not a major concern for those living near an existing wind farm.

With regards to the economic and environmental impacts of wind farm development, the national survey revealed that attitudes towards wind energy were influenced by a perception that wind is an attractive source of energy:

> *"Over 8 in 10 recognise wind as a non-polluting source of energy, while a similar number believe it can make a significant contribution to Ireland's energy requirements."*

The study revealed uncertainty among respondents with regards to the issues of noise levels, local benefits and the reliability or otherwise of wind power as an energy source. It went on to state, however, that the finding that people who have seen wind farms rate these economic and environmental factors more favourably is a further indication that some experience of the structures tends to translate into positive attitudes towards wind energy.

Similar to the national survey, the surveys of those living within the vicinity of a wind farm also found that the findings are generally positive towards wind farms. Perceptions of the impact of the development on the locality were generally positive, with some three-quarters of interviewees believing it had impacted positively.

In areas where a wind farm development had been granted planning permission but was not yet under construction, three quarters of the interviewees expressed themselves in favour of the wind farm being built in their area. Four per cent were against the development. The reasons cited by those who expressed themselves in favour of the wind farm included the fact that wind energy is clean (78%), it would provide local jobs (44%), it would help develop the area (32%) and that it would add to the landscape (13%). Those with direct experience of a wind farm in the locality are generally impressed with it as an additional feature in the landscape. The report states:

> *"It is particularly encouraging that those with experience of wind turbines are most favourable to their development and that wind farms are not solely seen as good in theory, but are also seen as beneficial when they are actually built."*

Few of those living in proximity either to an existing wind farm or one for which permission has been granted believe that the development damages the locality, either in terms of damage to tourism potential or to wildlife. The survey found that there is a clear preference for larger turbines in smaller numbers over smaller turbines in larger numbers.

5.4.2.3 Survey Update 2017

Additionally, a survey carried out by Interactions in October 2017, published by the SEAI, show 47% of Irish adults polled said they were are strongly in favour of wind power in Ireland while a further 38% favour it. Overall, this is a 4% increase in favourable attitudes towards wind power compared with similar research in 2013.

The SEAI survey found that the overall attitude to wind farms was very positive, with 84% of respondents in favour of the use of wind energy in Ireland. Approximately two thirds of respondents (70%) would prefer to power their home with renewable energy over fossil fuels, and 45% would be in favour of a wind farm development in their area.

The survey also captured the perceived benefits of wind power among the public. Of those surveyed three quarters selected good for the environment and reduced Carbon Dioxide emissions while fewer people, just over two in three, cited cheaper electricity.

5.4.2.4 Conclusions

The main findings of the SEAI survey indicate that the overall attitude to wind farms is "almost entirely positive". The study highlights that two-thirds of Irish adults are either very favourable or fairly favourable to having a wind farm built in their locality, with little evidence of a "Not In My Back Yard" (NIMBY) effect. The final section of the report states:

> *"The overwhelming indication from this study is that wind energy enjoys great support and, more specifically, that the development of wind farms is supported and welcomed. The single most powerful indicator of this is to be found among those living in proximity to an existing wind farm: over 60% would be in favour of a second wind farm or an extension of the existing one. This represents a strong vote in favour of wind farm developments – especially important since it is voiced by those who know from direct experience about the impact of such developments on their communities."*

5.4.3 Public Perceptions of Wind Power in Scotland and Ireland Survey 2005

5.4.3.1 Background

A survey of the public perception of wind power in Scotland and Ireland was carried out in 2003/2004 by researchers at the School of Geography & Geosciences, University of St. Andrews, Fife and The Macaulay Institute, Aberdeen ('Green on Green: Public Perceptions of Wind Power in Scotland and Ireland', Journal of Environmental Planning and Management, November 2005). The aims of the study were to ascertain the extent to which people support or oppose wind power, to investigate the reasons for these attitudes and to establish how public attitudes relate to factors such as personal experience of operational wind farms and their proximity to them.

5.4.3.2 Study Area

Surveys were carried out at two localities in the Scottish Borders region, one surrounding an existing wind farm and one around a site at which a wind farm had received planning permission but had not yet been built. Surveys were also carried out in Ireland, at two sites in Counties Cork and Kerry, each of which has two wind farms in proximity.

5.4.3.3 Findings

The survey of public attitudes at both the Scottish and Irish study sites concluded that large majorities of people are strongly in favour of their local wind farm, their personal experience having engendered positive attitudes. Attitudes towards the concept of wind energy were described as "overwhelmingly positive" at both study sites in Scotland, while the Irish survey results showed almost full support for renewable energy and 92% support for the development of wind energy in Ireland.

The results of the survey were found to agree with the findings of previous research, which show that positive attitudes to wind power increase through time and with proximity to wind farms. With regards to the NIMBY effect, the report states that where NIMBY-ism does occur, it is much more pronounced in relation to proposed wind farms than actual wind farms. The Scottish survey found that while positive attitudes towards wind power were observed among those living in proximity to both the proposed and existing wind farm sites, people around the proposed site were less convinced than those living in proximity to the existing site. Retrospective questioning regarding pre- and post-construction attitudes at the existing site found that attitudes remained unchanged for 65% of respondents. Of the 24% of people who altered their attitudes following experience of the wind farm, all but one became more positive. The report states:

> *"These results support earlier work which has found that opposition to wind farms arises in part from exaggerated perceptions of likely impact, and that the experience of living near a wind farm frequently dispels these fears. Prior to construction, locals typically expect the landscape impacts to be negative, whereas, once in operation, may people regard them as an attractive addition."*

The reasons that people gave for their positive attitude to the local wind farm were predominantly of a global kind, i.e. environmental protection and the promotion of renewable energy, together with opposition to a reliance on fossil fuels and nuclear power. Problems that are often cited as negative impacts of wind farms, such as interference with telecommunications and shadow flicker were not mentioned at either site. With regards to those who changed to a more positive attitude following construction of the wind farm, the reasons given were that the wind farm is *"not unattractive (62%), that there was no noise (15%), that community funding had been forthcoming (15%) and that it could be a tourist attraction (8%)".*

The findings of the Irish survey reinforce those obtained at the Scottish sites with regards to the increase in positive attitudes to wind power through time and proximity to wind farms. The survey of public attitudes at the sites in Cork and Kerry found that the highest levels of support for wind power were recorded in the innermost study zone (0 – 5 kilometres from a point in between the pair of wind farms). The data also suggests that *"those who see the wind farms most often are most accepting of the visual impact"*. The report also states that a previous Irish survey found that most of those with direct experience of wind farms do not consider that they have had any adverse impact on the scenic beauty of the area, or on wildlife, tourism or property values. Overall, the study data reveals *"a clear pattern of public attitudes becoming significantly more positive following personal experience of operational wind farms".*

With regards to wind farm size, the report notes that it is evident from this and previous research that wind farms with small numbers of large turbines are generally preferred to those with large numbers of smaller turbines.

5.4.3.4 Conclusions

The overall conclusions drawn from the survey findings and from the authors' review of previous studies show that local people become more favourable towards wind farms after construction, that the degree of acceptance increases with proximity to them, and that the NIMBY syndrome does not adequately explain variations in public attitudes due to the degree of subjectivity involved.

5.5 Health Impacts of Wind Farms

5.5.1 Health Impact Studies

While there are anecdotal reports of negative health effects on people who live very close to wind turbines, peer-reviewed research has not supported these statements. There is currently no published credible scientific evidence to positively link wind turbines with adverse health effects. The main publications supporting the view that there is no evidence of any direct link between wind turbines and health are summarised below.

1. ***'Wind Turbine Syndrome – An independent review of the state of knowledge about the alleged health condition', Expert Panel on behalf of Renewable UK, July 2010***

This report consists of three reviews carried out by independent experts to update and understand the available knowledge of the science relating to infrasound generated by wind turbines. This report was prepared following the publication of a book entitled 'Wind Turbine Syndrome', in 2009 by Dr. Pierpont, which received significant media attention at the time. The report discusses the methodology and assessment carried out in the 2009 publication and assessed the impact of low-frequency noise from wind turbines on humans. The independent review found that:

- *"The scientific and epidemiological methodology and conclusions drawn (in the 2009 book) are fundamentally flawed;*
- *The scientific and audiological assumptions presented by Dr. Pierpont relating infrasound to WTD are wrong; and*
- *Noise from Wind Turbines cannot contribute to the symptoms reported by Dr. Pierpont's respondents by the mechanisms proposed."*

Accordingly, the consistent and scientifically robust conclusion remains that there is no evidence to demonstrate any significant health effects in humans arising from noise at the levels of that generated by wind turbines.

2. ***'Wind Turbine Sound and Health Effects – An Expert Panel Review', American Wind Energy Association and Canadian Wind Energy Association, December 2009***

This expert panel undertook extensive review, analysis and discussion of the large body of peer-reviewed literature on sound and health effects in general, and on sound produced by wind turbines in particular. The panel assessed the plausible biological effects of exposure to wind turbine sound. Following review, analysis, and discussion of current knowledge, the panel reached consensus on the following conclusions:

- *"There is no evidence that the audible or sub-audible sounds emitted by wind turbines have any direct adverse physiological effects.*
- *The ground-borne vibrations from wind turbines are too weak to be detected by, or to affect, humans.*
- *The sounds emitted by wind turbines are not unique. There is no reason to believe, based on the levels and frequencies of the sounds and the panel's experience with sound exposures in occupational settings, that the sounds from wind turbines could plausibly have direct adverse health consequences."*

The report found, amongst other things, that:

- *"'Wind Turbine Syndrome' symptoms are the same as those seen in the general population due to stresses of daily life. They include headaches, insomnia, anxiety, dizziness, etc.*
- *Low frequency and very low frequency 'infrasound' produced by wind turbines are the same as those produced by vehicular traffic and home appliances, even by the beating of people's hearts. Such 'infrasounds' are not special and convey no risk factors;*
- *The power of suggestion, as conveyed by news media coverage of perceived 'wind-turbine sickness', might have triggered 'anticipatory fear' in those close to turbine installations."*

3. ***'A Rapid Review of the Evidence', Australian Government National Health and Medical Research Council (NHMRC) Wind Turbines & Health, July 2010***

The purpose of this paper was to review evidence from current literature on the issue of wind turbines and potential impacts on human health and to ascertain if the following statement, which is supported by the 'Wind Turbine Sound and Health Effects - An Expert Panel Review' (see Item 2 above), can be supported by the evidence: There are no direct pathological effects from wind farms and that any potential impact on humans can be minimised by following existing planning guidelines.

- *"This review of the available evidence, including journal articles, surveys, literature reviews and government reports, supports the statement that: There are no direct* *pathological effects from wind farms and that any potential impact on humans can be minimised by following existing planning guidelines."*

4. ***'Position Statement on Health and Wind Turbines', Climate and Health Alliance, February 2012***

The Climate and Health Alliance (CAHA) was established in August 2010 and is a coalition of health care stakeholders who wish to see the threat to human health from climate change and ecological degradation addressed through prompt policy action. In its Position Statement in February 2012, CAHA states that:

> *"To date, there is no credible peer reviewed scientific evidence that demonstrates a direct causal link between wind turbines and adverse health impacts in people living in proximity to them. There is no evidence for any adverse health effects from wind turbine shadow flicker or electromagnetic frequency. There is no evidence in the peer reviewed published scientific literature that suggests that there are any adverse health effects from infrasound (a component of low frequency sound) at the low levels that may be emitted by wind turbines."*

The Position Statement explores human perceptions of wind energy and notes that some people may be predisposed to some form of negative perception that itself may cause annoyance. It states that:

> *"Fear and anxious anticipation of potential negative impacts of wind farms can also contribute to stress responses, and result in physical and psychological stress symptoms... Local concerns about wind farms can be related to perceived threats from changes to their place and can be considered a form of "place-protection action", recognised in psychological research about the importance of place and people's sense of identity."*

CAHA notes the existence of *"misinformation about wind power"* and, in particular, states that:

> *"Some of the anxiety and concern in the community stems originally from a self-published book by an anti-wind farm activist in the United States which invented a syndrome, the so-called "wind turbine syndrome". This is not a recognised medical syndrome in any international index of disease, nor has this publication been subjected to peer review."*

CAHA notes that:

> *"Large scale commercial wind farms however have been in operation internationally for many decades, often in close proximity to thousands of people, and there has been no evidence of any significant rise in disease rates."*

This, it states, contrasts with the health impacts of fossil fuel energy generation.

5. ***'Wind Turbine Health Impact Study -Report of Independent Expert Panel' – Massachusetts Departments of Environmental Protection and Public Health (2012)***

An expert panel was established with the objective to, inter alia, evaluate information from peer-reviewed scientific studies, other reports, popular media and public comments and to assess the magnitude and frequency of any potential impacts and risks to human health associated with the design and operation of wind energy turbines. In its final report, the expert panel set out its conclusions under several headings, including noise and shadow flicker.

In relation to noise, the panel concluded that there was limited or no evidence to indicate any causal link between noise from wind turbines and health effects, including the following conclusions:

> *"There is no evidence for a set of health effects, from exposure to wind turbines that could be characterized as a 'Wind Turbine Syndrome'.*

The strongest epidemiological study suggests that there is not an association between noise from wind turbines and measures of psychological distress or mental health problems. There were two smaller, weaker, studies: one did note an association, one did not. Therefore, we conclude the weight of the evidence suggests no association between noise from wind turbines and measures of psychological distress or mental health problems.

None of the limited epidemiological evidence reviewed suggests an association between noise from wind turbines and pain and stiffness, diabetes, high blood pressure, tinnitus, hearing impairment, cardiovascular disease, and headache/migraine."

In relation to shadow flicker, the expert panel found the following:

"Scientific evidence suggests that shadow flicker does not pose a risk for eliciting seizures as a result of photic stimulation.

There is limited scientific evidence of an association between annoyance from prolonged shadow flicker (exceeding 30 minutes per day) and potential transitory cognitive and physical health effects."

6. *Wind Turbines and Health, A Critical Review of the Scientific Literature, Massachusetts Institute of Technology (Journal of Occupational and Environmental Medicine Vol. 56, Number 11, November 2014)*

This review assessed the peer-reviewed literature regarding evaluations of potential health effects among people living in the vicinity of wind turbines. The review posed a number of questions around the effect of turbines on human health, with the aim of determining if stress, annoyance or sleep disturbance occur as a result of living in proximity to wind turbines, and whether specific aspects of wind turbine noise have unique potential health effects. The review concluded the following, with regard to the above questions:

- Measurements of low-frequency sound, infrasound, tonal sound emission, and amplitude-modulated sound show that infrasound is emitted by wind turbines. The levels of infrasound at customary distances to homes are typically well below audibility thresholds.
- No cohort or case–control studies were located in this updated review of the peer-reviewed literature. Nevertheless, among the cross-sectional studies of better quality, no clear or consistent association is seen between wind turbine noise and any reported disease or other indicator of harm to human health.
- Components of wind turbine sound, including infrasound and low frequency sound, have not been shown to present unique health risks to people living near wind turbines.
- Annoyance associated with living near wind turbines is a complex phenomenon related to personal factors. Noise from turbines plays a minor role in comparison with other factors in leading people to report annoyance in the context of wind turbines.

A further 25 reviews of the scientific evidence that universally conclude that exposure to wind farms and the sound emanating from wind farms does not trigger adverse health effects, were compiled in September 2015 by Professor Simon Chapman, of the School of Public Health and Sydney University Medical School, Australia, and is included as Appendix 5.1 of this EIAR. Another recent publication by Chapman and Crichton (2017) entitled 'Wind turbine syndrome; A communicated disease' critically discusses why certain health impacts might often be incorrectly attributed to wind turbines.

7. *Position Paper on Wind Turbines and Public Health: HSE Public Health Medicine Environment and Health Group, February 2017*

The Health Service Executive (HSE) position paper on wind turbines and public health was published in February 2017 to address the rise in wind farm development and concerns regarding potential impacts on public health. The paper discusses previous observations and case studies which describe a broad range of health effects that are associated with wind turbine noise, shadow flicker and electromagnetic radiation.

A number of comprehensive reviews conducted in recent years to examine whether these health effects are proven has highlighted the lack of published and high-quality scientific evidence to support adverse effects of wind turbines on health.

The HSE position paper determines that current scientific evidence on adverse impacts of wind farms on health is weak or absent. Further research and investigative processes are required at a larger scale in order to be more informative for identifying potential health effects of exposure to wind turbine effects. They advise developers on making use of the Draft Wind Energy Development Guidelines (2006), as a means of setting noise limits and set back distances from the nearest dwellings.

8. ***Environmental Noise Guidelines for the European Region: World Health Organisation Regional Office for Europe, 2018.***

The WHO Environmental Noise Guidelines provide recommendations for protecting human health from exposure to environmental noise originating from various sources such as transportation noise, wind turbine noise and leisure noise. The Guideline Development Group (GDG) defined priority health outcomes and from this were able to produce guideline exposure levels for noise exposure.

For average noise exposure, the GDG conditionally recommends reducing noise levels produced by wind turbines below 45 dB Lden. The GDG recognise the potential for increased risk of annoyance at levels below this value but cannot determine whether this increase risk can impact health. Wind turbine noise above this level is associated with adverse health effects.

The GDG points out that evidence on health effects from wind turbine noise (apart from annoyance) is either absent or rated low/very low quality and effects related to attitudes towards wind turbines are hard to differentiate from those related to noise and may be partly responsible for the associations. The GDG also recognises that the percentage of people exposed to noise from wind turbines is far lower than other sources such as road traffic and state that any benefit from specifically reducing population exposure to wind turbine noise in all situations remains unclear.

That being said, the GDG recommends renewable energy policies include provisions to ensure noise levels from wind farm developments do not rise above the guideline values for average noise exposure. The GDG also provides a conditional recommendation for the implementation of suitable measures to reduce noise exposure.

5.5.2 Turbine Safety

Turbines pose no threat to the health and safety of the general public. The Department of the Environment, Heritage and Local Government (DoEHLG)'s 'Wind Energy Development Guidelines for Planning Authorities 2006' and the 'Draft Revised Wind Energy Development Guidelines' (Department of Housing, Planning and Local Government (DoHPLG), December 2019) (currently out for public consultation), iterate that there are no specific safety considerations in relation to the operation of wind turbines. Fencing or other restrictions are not necessary for safety considerations and should be kept to a minimum. People or animals can safely walk up to the base of the turbines.

The adopted 2006 Guidelines and the Draft 2019 Guidelines state that there is a very remote possibility of injury to people from flying fragments of ice or from a damaged blade. However, most blades are composite structures with no bolts or separate components and the danger is therefore minimised. The build-up of ice on turbines is unlikely to present problems. The wind turbines will be fitted with anti-vibration sensors, which will detect any imbalance caused by icing of the blades. The sensors will cause the turbine to wait until the blades have been de-iced prior to resuming operation.

Turbine blades are manufactured from glass reinforced plastic, which will prevent any likelihood of an increase in lightning strikes within the site of the proposed development or the local area. Lightning protection conduits will be integral to the construction of the turbines. Lightning conduction cables, encased in protection conduits, will follow the electrical cable run, from the nacelle to the base of the turbine. The conduction cables will be earthed adjacent to the turbine base. The earthing system will be installed during the construction of the turbine foundations.

5.5.3 Electromagnetic Interference

The provision of underground electric cables of the capacity proposed is common practice throughout the country and installation to the required specification does not give rise to any specific health concerns.

The extremely low frequency (ELF) electric and magnetic fields (EMF) associated with the operation of the proposed cables fully comply with the international guidelines for ELF-EMF set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP), a formal advisory agency to the World Health Organisation, as well as the EU guidelines for human exposure to EMF. Accordingly, there will be no operational impact on properties (residential or other uses) as the ICNIRP guidelines will not be exceeded at any distances even directly above the cables.

The ESB document 'EMF & You' (ESB, 2017) provides further practical information on EMF (https://esb.ie/docs/default-source/default-document-library/emf-public-information_booklet_v9.pdf?sfvrsn=0) A copy of this document is included as Appendix 5-2 of this EIAR.

Further details on the potential impacts of electromagnetic interference to telecommunications and aviation are presented in Chapter 14: Material Assets.

5.5.4 Assessment of Effects on Human Health

As set out in the Department of Housing, Planning, Community and Local Government 'Key Issues Consultation Paper on the Transposition of the EIA Directive 2017' and the guidance listed in Section 1.2.2 of Chapter 1: Introduction, the consideration of the effects on populations and on human health should focus on health issues and environmental hazards arising from the other environmental factors, for example water contamination, air pollution, noise, accidents, disasters.

A wind farm is not a recognised source of pollution. It is not an activity that falls within any thresholds requiring Environmental Protection Agency licensing under the Environmental Protection Agency Licensing Act 1992, as amended. As such, a wind farm is not considered to have ongoing significant emissions to environmental media and the subsequent potential for human health effects.

Chapter 8: Land, Soils and Geology, Chapter 9: Hydrology and Hydrogeology, Chapter 10: Air and Climate, Chapter 11: Noise and Vibration and Chapter 14: Material Assets (Traffic and Transport) provide an assessment of the effects of the proposed development on these areas of consideration. There is the potential for negative effects on human health during the wind farm construction phase related to potential emissions to air of dust, potential emissions to land and water of hydrocarbons, release of potentially silt-laden runoff into watercourses and noise emissions. The assessments however show that the residual impacts are not significant and will not lead to significant effects on any environmental media with the potential to lead to health effects for humans. On this basis, the potential for negative health effects associated with the proposed development is imperceptible.

The proposed site design and mitigation measures outlined in Chapter 8 and Chapter 9 ensures that the potential for impacts on the water environment are not significant. No impacts on local water supplies are anticipated.

Potential health effects are associated with negative impacts on public and private water sup. As set out in Chapter 9 of this EIAR, there are no mapped public or group groundwater scheme protection zones in the area of the proposed wind farm site.

The proposed development is the construction of a renewable energy project, a wind farm, capable of offsetting carbon emissions associated with the burning of fossil fuels. During the operational stage, the wind farm will have a long term, slight, positive effect on air quality as set out in Chapter 10 which will contribute to positive effects on human health.

5.5.5 Vulnerability of the Project to Natural Disasters and Major Accidents

As outlined in Section 5.5.4 above a wind farm is not a recognised source of pollution. Should a major accident or natural disaster occur the potential sources of pollution onsite during both the construction, operational and decommissioning phases are limited. Sources of pollution with the potential to cause significant environmental pollution and associated negative effects on health such as bulk storage of hydrocarbons or chemicals, storage of wastes etc. are limited.

There is limited potential for significant natural disasters to occur at the proposed Ballynagare Wind Farm site. Ireland is a geologically stable country with a mild temperate climate. The potential natural disasters that may occur are therefore limited to flooding and fire. The risk of flooding is addressed in Chapter 9: Hydrology and Hydrogeology. It is considered that the risk of significant fire occurring, affecting the wind farm and causing the wind farm to have significant environmental effects is limited and therefore a significant effect on human health is similarly limited. As described earlier, there are no significant sources of pollution in the wind farm with the potential to cause environmental or health effects. Also, the spacing of the turbines and distance of turbines from any properties limits the potential for impacts on human health. The issue of turbine safety is addressed in Section 5.5.2.

Major industrial accidents involving dangerous substances pose a significant threat to humans and the environment; such accidents can give rise to serious injury to people or serious damage to the environment, both on and off the site of the accident. The wind farm site is not required to be regulated and is not connected to or close to any site regulated under the Control of Major Accident Hazards Involving Dangerous Substances Regulations i.e. SEVESO sites and so there are no potential effects from this source.

5.6 Property Values

In the absence of any Irish studies on the effect of wind farms on property values, this section provides a summary of the largest and most recent studies from the United States and Scotland.

The largest study of the impact of wind farms on property values has been carried out in the United States. 'The Impact of Wind Power Projects on Residential Property Values in the United States: A multi-Site Hedonic Analysis', December 2009, was carried out by the Lawrence Berkley National Laboratory (LBNL) for the U.S Department of Energy. This study collected data on almost 7,500 sales of single-family homes situated within ten miles of 24 existing wind farms in nine different American states over a period of approximately ten years. The conclusions of the study are drawn from eight different pricing models including repeat sales and volume sales models. Each of the homes included in the study was visited to demonstrate the degree to which the wind facility was visible at the time of the sale, and the conclusions of the report state that "The result is the most comprehensive and data rich analysis to date on the potential impacts of wind energy projects on nearby property values."

The main conclusion of this study is as follows:

> *"Based on the data and analysis presented in this report, no evidence is found that home prices surrounding wind facilities are consistently, measurably, and significantly affected by either the view of wind facilities or the distance of the home to those facilities. Although the analysis cannot dismiss the possibility that individual or small numbers of homes have been or could be negatively impacted, if these impacts do exist, they are either too small and/or too infrequent to result in any widespread and consistent statistically observable impact."*

This study has been recently updated by LBNL who published a further paper entitled "A Spatial Hedonic Analysis of the Effects of Wind Energy Facilities on Surrounding Property Values in the United States", in August 2013. This study analysed more than 50,000 home sales near 67 wind farms in 27 counties across nine U.S. states, yet was unable to uncover any impacts to nearby home property values. The homes were all within 10 miles of the wind energy facilities - about 1,100 homes were within 1 mile, with 331 within half a mile. The report is therefore based on a very large sample and represents an extremely robust assessment of the impacts of wind farm development on property prices. It concludes that:

> *"Across all model Specifications, we find no statistical evidence that home prices near wind turbines were affected in either the post-construction or post announcement/pre-construction periods."*

Both LBNL studies note that their results do not mean that there will never be a case of an individual home whose value goes down due to its proximity to a wind farm – however if these situations do exist, they are considered to be statistically insignificant. Therefore, although there have been claims of significant property value impacts near operating wind turbines that regularly surface in the press or in local communities, strong evidence to support those claims has failed to materialise in all the major U.S. studies conducted thus far.

A further study was commissioned by RenewableUK and carried out by the Centre for Economics and Business Research (Cebr) in March 2014. Its main conclusions are:

- Overall, the analysis found that the county-wide property market drives local house prices, not the presence or absence of wind farms.
- The econometric analysis established that construction of wind farms at the five sites examined across England and Wales has not had a detectable negative impact on house price growth within a five-kilometre radius of the sites.

A relatively new study issued in October 2016 'Impact of wind Turbines on House Prices in Scotland' (2016) was published by Climate Exchange. Climate Exchange is Scotland's independent centre of expertise on climate change which exists to support the Scottish Governments policy development on climate and the transition to a low carbon economy. A copy of the report is included as Appendix 5.3 of this EIAR.

The report presents the main findings of a research project estimating the impact on house prices from wind farm developments. It is based on analysis of over 500,000 property sales in Scotland between 1990 and 2014. The key findings from the study are:

- No evidence of a consistent negative effect on house prices: Across a very wide range of analyses, including results that replicate and improve on the approach used by Gibbons (2014), we do not find a consistent negative effect of wind turbines or wind farms when averaging across the entire sample of Scottish wind turbines and their surrounding houses. Most results either show no significant effect on the change in the price of properties within 2km or 3km or find the effect to be positive.
- Results vary across areas: The results vary across different regions of Scotland. Our data does not provide sufficient information to enable us to rigorously measure and test the underlying causes of these differences, which may be interconnected and complex.

Although there have been no empirical studies carried out in Ireland on the impacts of wind farms on property prices, the literature described above demonstrates that at an international level, wind farms have not impacted property values in the local areas. It is a reasonable assumption based on the available international literature, that the provision of a wind farm at the proposed location would not impact on the property values in the area.

5.7 Shadow Flicker

5.7.1 Background

Shadow flicker is an effect that occurs when rotating wind turbine blades cast shadows over a window in a nearby property. Shadow flicker is an indoor phenomenon, which may be experienced by an occupant sitting in an enclosed room when sunlight reaching the window is momentarily interrupted by a shadow of a wind turbine's blade. Outside in the open, light reaches a viewer (person) from a much less focused source than it would through a window of an enclosed room, and therefore shadow flicker assessments are typically undertaken for the nearby adjacent properties around a proposed wind farm site.

The frequency of occurrence and the strength of any potential shadow flicker impact depends on several factors, each of which is outlined below.

1. ***Whether the sunlight is direct and unobstructed or diffused by clouds:***

If the sun is not shining, shadow flicker cannot occur. Reduced visibility conditions such as clouds, haze, and fog greatly reduce the chance of shadow flicker occurring.

Cloud amounts are reported as the number of eights (okta) of the sky covered. Irish skies are completely covered by cloud for over 50% of the time. The mean cloud amount for each hour is between five and six okta. This is due to Ireland's geographical position in northwest Europe, close to the path of Atlantic low-pressure systems which tend to keep the country in humid, cloudy airflows for much of the time. A study based on data from 12 weather monitoring stations, over a 25-year period, showed that the mean cloud amount was at a minimum in April and maximum in July. Cloud amounts were less at night than during the day, with the mean minimum occurring roughly between 2100 and 0100 GMT and the mean maximum occurring between 1000 and 1500 GMT at most stations. (Source: Met Éireann, www.met.ie)

2. ***The presence of intervening obstructions between the turbine and the observer:***

For shadow flicker to occur, the windows of a potentially affected property must have direct visibility of a wind turbine, with no physical obstructions such as buildings, trees and hedgerows, hills or other structures located on the intervening land between the window and the turbine.

Any obstacles such as trees or buildings located between a property and the wind turbine will reduce or eliminate the occurrence and/or intensity of the shadow flicker.

3. ***How high the sun is in the sky at a given time:***

At distances of greater than approximately 500m between a turbine and a receptor, shadow flicker generally occurs only at sunrise or sunset, when the shadow cast by the turbine is longer. The current adopted 'Wind Energy Development Guidelines for Planning Authorities' published by the Department of the Environment, Heritage and Local Government (DoEHLG) in 2006, states that at distances greater than ten times the turbine rotor diameter from a wind turbine base, the potential for shadow flicker is very low.

Figure 5.4 illustrates the shadow cast by a turbine at various times during the day; the red shading represents the area where shadow flicker may occur. When the sun is high in the sky, the length of the shadow cast by the turbine is significantly shorter.

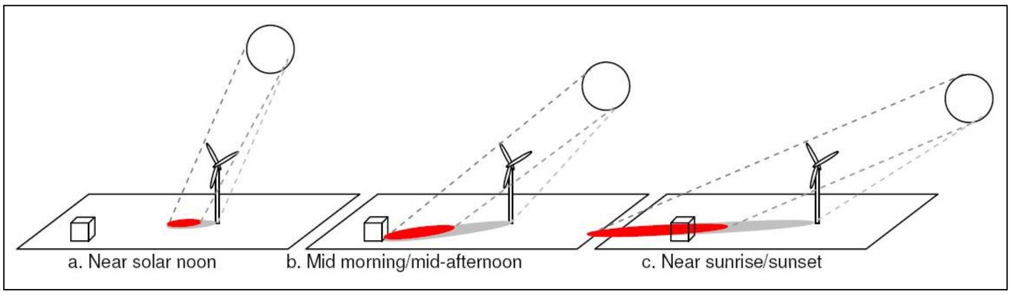

Figure 5.4 Shadow-Prone Area as Function of Time of Day (Source: Shadow Flicker Report, Helimax Energy, Dec 2008)

4. Distance and bearing, i.e., property location relative to a turbine and the sun:

The further a property is from the turbine the less pronounced the impact will be. There are several reasons for this: there are fewer times when the sun is low enough to cast a long shadow; when the sun is low it is more likely to be obscured by either cloud on the horizon or intervening buildings and vegetation; and the centre of the rotor's shadow passes more quickly over the land reducing the duration of the impact.

At a distance, the turbine blades do not cover the sun but only partly mask it, substantially weakening the shadow. This impact occurs first with the shadow from the blade tip, the tips being thinner in section than the rest of the blade. The shadows from the tips extend the furthest and so only a very weak impact is observed at distance from the turbines. (Source: Update of Shadow Flicker Evidence Base, UK Department of Energy and Climate Change, 2010).

5. Property usage and occupancy:

Where shadow flicker is predicted to occur at a specific location, this does not imply that it will be witnessed. Potential occupants of a property may be sleeping or occupying a room on another side of the property that is not subject to shadow flicker, or completely absent from the location during the time of shadow flicker events. As shadow flicker usually occurs only when the sun is at a low angle in the sky, i.e., very early in the morning after sunrise or late in the evening before sunset, even if there is a bedroom on the side of the property affected, the shadow flicker may not be witnessed if curtains or blinds in the bedroom are closed.

6. Wind direction, i.e., position of the turbine blades:

The direction of wind turbine blades changes according to wind direction, as the turbine rotor turns to face the wind. To cast a shadow, the turbine blades must be facing directly toward or away from the sun, so they are moving across the source of the light relative to the observer. This is illustrated in Figure 5.5 Turbine Blade Position and Shadow Flicker Impact (Source: Wind Fact Sheet: Shadow Flicker, Noise Environment Power LLC).

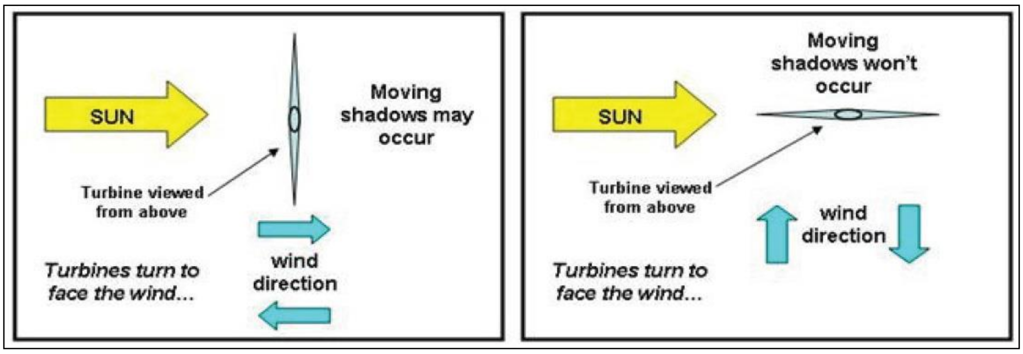

Figure 5.5 Turbine Blade Position and Shadow Flicker Impact (Source: Wind Fact Sheet: Shadow Flicker, Noise Environment Power LLC)

7. ***Rotation of turbine blades:***

Shadow flicker occurs only if there is sufficient wind for the turbine blades to be continually rotating. Wind turbines begin operating at a specific wind speed referred to as the 'cut-in speed', i.e., the speed at which the turbine produces a net power output, and they cease operating at a specific 'cut-out speed'. Therefore, even during the sunlight hours when shadow flicker has been predicted to occur, if the turbine blades are not turning due to insufficient wind speed, no shadow flicker will occur.

5.7.2 Guidance

The current, adopted guidance for shadow flicker in Ireland is derived from the '*Wind Energy Development Guidelines for Planning Authorities 2006'* (DoEHLG), and the '*Best Practice Guidelines for the Irish Wind Energy Industry'* (Irish Wind Energy Association, 2012). The 2006 DoEHLG Guidelines state that at distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low.

The DoEHLG 2006 wind energy guidelines recommend that shadow flicker at dwellings within 500 metres of a proposed turbine location should not exceed a total of 30 hours per year or 30 minutes per day. The closest occupied residential property is located approximately 677 metres from the nearest turbine location. Refer to Section 5.2.

The DoEHLG guidelines state that shadow flicker lasts only for a short period of time and occurs only during certain specific combined circumstances, as follows:

- the sun is shining and is at a low angle in the sky, i.e. just after dawn and before sunset, **and**
- the turbine is located directly between the sun and the affected property, **and**
- there is enough wind energy to ensure that the turbine blades are moving, **and**
- the turbine blades are positioned so as to cast a shadow on the receptor.

Although the DoEHLG thresholds apply to properties located within 500 metres of a proposed turbine location, for the purposes of this assessment, the guideline thresholds of 30 hours per year or 30 minutes per day have been applied to all properties located within ten rotor diameters (i.e. assumed at 1.5 kilometres as a worst-case scenario) of the proposed turbines within the Proposed Development (as per IWEA guidelines, 2012). The DoEHLG Guidelines state that at distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low.

The adopted 2006 DoEHLG guidelines are currently under review. The Department of Housing, Local Government and Heritage (DoHLGH) released the '*Draft Revised Wind Energy Development Guidelines*' in December 2019 for public consultation. The Draft 2019 Guidelines recommend local planning authorities and/or An Bord Pleanála (ABP) impose conditions to ensure that:

> *"no existing dwelling or other affected property will experience shadow flicker as a result of the wind energy development subject of the planning application and the wind energy development shall be installed and operated in accordance with the shadow flicker study submitted to accompany the planning application, including any mitigation measures required."*

The Draft 2019 Guidelines are based on the recommendations as set out in the '*Proposed Revisions to Wind Energy Development Guidelines 2006 – Targeted Review*' (Department of Environment Community and Local Government [DoECLG], December 2013) and the subsequent '*Review of the Wind Energy Development Guidelines 2006 – Preferred Draft Approach*' (Department of Housing, Planning, Community and Local Government [DoHPCLG], June 2017).

The applicant is aware that the Department of the Environment, Heritage and Local Government (DoEHLG) Wind Energy Development Planning Guidelines (2006) are currently being revised. The assessment herein is based on compliance with the DoEHLG Guidelines limit (30 hours per year or 30 minutes per day), however Ballynagare Wind Farm Ltd. is committing to zero shadow flicker at occupied residential receptors within 10 rotor diameters of the proposed turbines.

5.7.3 Scoping

Chapter 2 of this EIAR describes the scoping and consultation exercise undertaken for the proposed Ballynagare Wind Farm. The HSE issued a scoping response on the Proposed Development in 14th January 2021. With respect to Shadow Flicker, the HSE recommended that a shadow flicker assessment be undertaken to identify all dwellings and sensitive receptors which may be impacted by shadow flicker. The assessment should also include all proposed mitigation measures.. MKO's scoping document stated that shadow flicker would be assessed using a specialist computer software programme specifically designed for the wind energy industry. This assessment is included in the following sections of the EIAR.

5.7.4 Shadow Flicker Prediction Methodology

Shadow flicker occurs only under certain, combined circumstances, as detailed above. Where shadow flicker does occur, it is generally short-lived. The DoHPCLG guidelines state that careful site selection, design and planning, and good use of relevant software can help avoid the possibility of shadow flicker, all of which have been employed at the site of the proposed development. Proper siting of wind turbines is key in eliminating shadow flicker.

The occurrence of shadow flicker can be precisely predicted using specialist computer software programmes specifically developed for the wind energy industry, such as WindFarm (ReSoft), WindPRO (EMD), WindFarmer (DNV.GL) or AWS OpenWind. The computer modelling of the occurrence and magnitude of shadow flicker is made possible by the fact that the sun rises and sets in the same position in the sky on every day each year.

Any potential impact can be precisely modelled to give the start and end time (accurate to the second) of any incidence of shadow flicker, at any location, on any day or all days of the year when it might occur. Where a shadow flicker impact is predicted to occur, the total maximum daily and annual durations can be predicted, along with the total number of days. Any incidence of predicted shadow flicker can be attributed to a particular turbine or group of turbines to allow effective mitigation strategies to be planned and proposed as detailed further below.

For the purposes of this shadow flicker assessment, the software package ReSoft WindFarm Version 5.0.1.2 (WindFarm)has been used to predict the level of shadow flicker associated with the proposed wind farm development. WindFarm is a commercially available software tool that enables developers to analyse, design and optimise proposed wind farms. It allows proposed turbine layouts to be optimised for maximum energy yield whilst taking account of environmental, planning and engineering constraints.

5.7.5 Shadow Flicker Assessment Criteria

5.7.5.1 Turbine Dimensions

Planning permission is being sought for a turbine size envelope with a tip height of between 169.5 and170 metres above the top of foundation, and a rotor diameter of between 149 and 150 metres. For the purposes of this assessment, a turbine with a rotor diameter of 150m and a hub height of 95m was modelled in order to assess a worst-case scenario. Given the very small difference in tip height and rotor diameter within the proposed turbine size envelope the difference in projected shadow flicker between the maximum and minimum values would be minimal and not significant given the proposed mitigation measures set out in Section 5.9.3.7. While these dimensions have been used for the purposes of this assessment, the actual turbine to be installed on the site will be the subject of a competitive tender process and could include turbines of a different rotor diameter and hub height configuration (within the 169.5-170-metre tip height envelope) than considered as part of this assessment.

Regardless of the make or model of the turbine eventually selected for installation on site, it will have a minimum tip height of 169.5 metres and maximum tip height of up to 170 metres, and a minimum rotor diameter of 149 metres and maximum rotor diameter of 150m. Regardless of the make or model installed (within the size envelope described above) the potential shadow flicker impact it will give rise to will be largely the same as that predicted in this assessment. This assessment includes for all properties located with 10 rotor diameters i.e. 1.5km. This is considered the worst case scenario as it brings the maximum number of properties within the assessment and therefore subject to the SCADA mitigation system which is described further below. Irrespective of the turbine procured the residual impact will not change for any of the properties located within 10 rotor diameters of the turbines. With the benefit of the mitigation measures outlined in section 5.9.3.7, all turbines installed onsite will comply with the current adopted 2006 DoEHLG guidelines thresholds of 30 minutes per day or 30 hours per year, or with any revised guidelines if required, through the use of turbine control software.

5.7.5.2 Study Area

At the outset of the project, during the constraints mapping process detailed in Section 3.3.5.1 of this EIAR, all sensitive receptors within 2km of the development site boundary were identified and mapped. This included all occupied and unoccupied dwellings. In addition, a planning history search to identify properties that may have been granted planning permission, but not yet been constructed, was carried out. These properties were also added to the sensitive receptors' dataset.

The study area for the shadow flicker assessment is ten times rotor diameter from each turbine as set out in the Wind Energy Development Guidelines for Planning Authorities', DoEHLG, 2006. All residential properties located within ten rotor diameters which is no greater than 1.5 kilometres have been included in the assessment.

There is a total of 80 No. dwellings located within 10 rotor diameters (assumed at 1.5km) of the proposed turbine locations. There are no third party dwellings located closer than 680 metres (4 times tip height) from the nearest proposed turbine location. The shadow flicker study area and sensitive receptor locations are shown in Figure 5.6.

Map Legend

- EIAR Study Area
- Shadow Flicker Study Area (1500m Turbine Buffer)
- Proposed Turbine Locations
- Dwellings

Microsoft product screen shots reprinted with permission from Microsoft Corporation

Drawing Title	Shadow Flicker Study Area
Project Title	Ballynagare Wind Farm
Drawn By: TB	Checked By: MW
Project No.: 200512	Drawing No.: Figure 5.6
Scale: 1:25000	Date: 13.10.2021

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5.7.5.3 Assumptions and Limitations

Due to the latitude of Ireland and the UK, shadow flicker impacts are only possible at properties 130 degrees either side of north as turbines do not cast shadows on their southern side (ODPM Annual Report and Accounts 2004: Housing, Planning, Local Government and the Regions Committee; Planning Policy Statement 22; Draft Revised Wind Energy Development Guidelines 2019). As such properties located outside of this potential shadow flicker zone will not be impacted. However, in this assessment, all 80 no. properties within 360 degrees of the Proposed Development within the study area (1.5km from turbines) were assessed for shadow flicker impact.

At each property, shadow flicker calculations were carried out based on 4 no. notional windows facing north, east, south and west, labelled Windows 1, 2, 3 and 4 respectively. The degrees from north value for each window is:

- Window 1: 0 degrees from North
- Window 2: 90 degrees from North
- Window 3: 180 degrees from North
- Window 4: 270 degrees from North

Each window measures one-metre-high by one-metre-wide, and tilt angle is assumed to be zero. The centre height of each window is assumed to be two metres above ground level and no screening due to trees or other buildings or vegetation is assumed. It was not considered necessary or practical to measure the dimensions of every window on every property in the study area. While the actual size of a window will marginally influence the incidence and duration of any potential shadow flicker impact, with larger windows resulting in slightly longer shadow flicker durations, any incidences or durations or shadow flicker can be countered by the measures outlined in Section 5.9.3.7 below.

The use of computer models to predict the amount of shadow flicker that will occur is known to produce an over-estimate of possible impact, referred to as the 'worst-case impact', due to the following limitations:

- The sun is assumed to be shining during all daylight hours such that a noticeable shadow is cast. This will not occur in reality.
- The wind is always assumed to be within the operating range of the turbines such that the turbine rotor is turning at all times, thus enabling a periodic shadow flicker. Wind turbines only begin operating at a specific 'cut-in speed', and cease operating at a specific 'cut-out speed'. In periods where the wind is blowing at medium to high speeds, the probability of there being clear or partially clear skies where the sun is shining and could cast a shadow, is low.
- The wind turbines are assumed to be available to operate, i.e. turned on at all times. In reality, turbines may be switched off during maintenance or for other technical or environmental reasons.
- Each turbine rotor is modelled perpendicular to each individual sensitivity receptor, to maximise the turbines aspect at each window and consequentially the potential instance for shadow flicker. In reality, the wind direction and relative position of the turbine rotor would result in a changing aspect being presented by the turbine. The rotor will actually present as ellipses of varying sizes to observers from different directions. The time taken for the sun to pass across the sky behind a highly elliptical rotor aspect will be shorter than the modelled maximum aspect.
- The topographical information used in the model is limited to elevation changes and does not factor in the potential cover provided by vegetation and man-made structures.

The total annual shadow flicker calculated for each property assumes 100% sunshine during daytime hours, as referred to above. However, weather data for this region shows that the sun shines on average for 29.5% of the daylight hours per year. This percentage is based on Met Éireann weather data for this region, recorded at Valentia, Co. Kerry over the 30-year period from 1981 to 2010. The mean regional daily sunshine duration over this 30 year period ranges from 1.3 to 5.9 hours, depending on the month. The greatest recorded regional daily sunshine duration, meanwhile, ranges from 6.5 to 15.9 hours, again depending on monthly variability(www.met.ie). The actual sunshine hours at the Proposed Development and therefore the percentage of time shadow flicker could actually occur is 29.5% of daylight hours. Table 5.7 therefore lists the annual shadow flicker calculated for each property when corrected for the regional average of 29.5% sunshine, to give a more accurate annual average shadow flicker prediction.

Table 5-9 outlines whether a shadow flicker mitigation strategy is required for any property within the study area which may be impacted by shadow flicker.

5.7.6 Shadow Flicker Assessment Results

5.7.6.1 Daily and Annual Shadow Flicker

The WindFarm computer software was used to model the predicted daily and annual shadow flicker levels in significant detail, identifying the predicted daily start and end times, maximum daily duration and the individual turbines predicted to give rise to shadow flicker.

The model results for maximum shadow hours per day, and maximum shadow hours per year assume worst-case conditions, including

- 100% sunshine during all daylight hours throughout the year,
- An absence of any screening (vegetation or other buildings),
- That the sun is behind the turbine blades,
- That there is a window facing each turbine,
- That the turbine blades are facing the property, and
- That the turbine blades are moving.

The maximum daily shadow flicker model assumes that daylight hours consist of 100% sunshine. This is a conservative assumption which represents a worst-case scenario. Following the detail provided above on sunshine hours, a sunshine factor of 29.5% has been applied to the annual shadow flicker results. Taking this information into consideration, the predicted shadow flicker which is estimated to occur at nearby dwellings is presented in Table 5-9.

The predicted maximum daily and annual shadow flicker levels are then considered in the context of the DoEHLG's guideline daily threshold of 30 minutes per day and annual threshold of 30 hours per year. If there is a predicted exceedance of the threshold limits at any property, the turbines that contribute to the exceedance are also identified.

The DoEHLG Wind Energy Guidelines recommend that shadow flicker at dwellings within 500 metres of a proposed turbine location should not exceed a total of 30 minutes per day or 30 hours per year. As detailed in Section 5.2.1 there are no sensitive receptors less than 500 metres of the proposed turbine locations. There is one property located 677 metres to the southeast of turbine no. 7. The owner of this property is an involved party in the Proposed Development. However, for the purposes of this assessment, the predicted shadow flicker levels have been modelled for all receptors within 1,500 metres of the proposed turbine locations.

A total of 80 No. receptors have been modelled as part of the shadow flicker assessment, the results of which are presented in Table 5-7. Former residential dwellings termed as "derelict" within this assessment are defined as properties that are currently in an uninhabitable condition.

Table 5.7 Maximum Potential Daily & Annual Shadow Flicker – Proposed Ballynagare Wind Farm, Co. Kerry
** Involved properties*

House ID	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Proposed Turbine No.	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine (hrs:min:sec)	Proposed Turbine(s) Giving Rise to Daly Shadow Flicker Exceedance	Mitigation Strategy Required (Daily)	Mitigation Strategy Required (Annual)
1*	489338.0863	630966.8013	Involved	677	T7	00:55:48	90:18:00	26:05:12	7	Yes	Yes
2*	489404.4721	630990.8957	Involved	732	T7	00:51:00	62:36:00	18:05:04	7	Yes	Yes
3*	489441.834	630984.067	Involved	769	T7	00:48:36	54:00:00	15:36:00	7	Yes	Yes
4	490123.2101	631513.4292	N/A	824	T4	00:36:00	35:30:00	10:15:20	6	Yes	Yes
5	487930.9092	630918.2295	N/A	827	T7	00:45:36	75:42:00	21:52:08	7	Yes	Yes
6	490140.9663	631518.3681	N/A	832	T4	00:35:24	34:12:00	9:52:48	6	Yes	Yes
7	488100.2911	630626.8913	N/A	839	T7	00:00:00	0:00:00	0:00:00	N/A	No	No
8	490158.5225	631518.7079	N/A	843	T4	00:35:24	33:00:00	9:32:00	6	Yes	Yes
9	487847.1082	631085.8538	N/A	867	T7	00:42:36	55:36:00	16:03:44	7	Yes	Yes
10	487954.1833	630759.2536	N/A	875	T7	00:45:00	53:24:00	15:25:36	7	Yes	Yes
11*	489569.9365	631005.3917	Involved	877	T6	00:42:00	34:30:00	9:58:00	7	Yes	Yes

12	490052.9846	631396.8147	N/A	879	T4	00:38:24	46:06:00	13:19:04	6	Yes	Yes
13	490426.1417	632458.092	Derelict	885	T4	00:41:24	101:54:00	29:26:16	2, 4	Yes	Yes
14	488199.4088	630451.9685	N/A	910	T7	00:00:00	0:00:00	0:00:00	N/A	No	No
15	487810.9657	631027.2366	N/A	913	T7	00:40:48	54:42:00	15:48:08	7	Yes	Yes
16	487858.9044	630855.7333	N/A	917	T7	00:42:00	47:06:00	13:36:24	7	Yes	Yes
17	487776.4237	631137.3731	N/A	932	T7	00:39:36	43:36:00	12:35:44	7	Yes	Yes
18	488248.5977	630349.3403	N/A	973	T7	00:00:00	0:00:00	0:00:00	N/A	No	No
19	487732.7343	631360.0253	N/A	985	T7	00:37:12	70:42:00	20:25:28	5,7	Yes	Yes
20	487720.2364	631247.2497	N/A	986	T7	00:37:12	49:18:00	14:14:32	7	Yes	Yes
21	487706.1302	631381.1409	N/A	1014	T7	00:36:36	74:18:00	21:27:52	5,7	Yes	Yes
22	488292.8578	630280.305	N/A	1015	T7	00:00:00	0:00:00	0:00:00	N/A	No	No
23	487681.455	631292.9601	N/A	1028	T7	00:35:24	48:30:00	14:00:40	5,7	Yes	Yes
24	487998.8752	632861.3503	N/A	1029	T3	00:36:00	57:24:00	16:34:56	1,3	Yes	Yes
25	487982.8084	632816.97	N/A	1032	T3	00:36:00	64:24:00	18:36:16	1,3,5	Yes	Yes
26	488241.2589	630282.1648	N/A	1036	T7	00:00:00	0:00:00	0:00:00	N/A	No	No
27	487967.4816	632793.0452	N/A	1040	T3	00:35:24	68:18:00	19:43:52	1,3,5	Yes	Yes
28	487944.0654	632772.6728	Derelict	1058	T3	00:34:48	71:24:00	20:37:36	3,5	Yes	Yes
29	487710.3853	632485.8928	N/A	1058	T5	00:36:00	38:06:00	11:00:24	5	Yes	Yes
30	487656.001	631377.8819	N/A	1063	T7	00:35:24	61:30:00	17:46:00	5,7	Yes	Yes

31	489993.346	631131.8622	N/A	1075	T6	00:34:48	40:06:00	11:35:04	6	Yes	Yes
32	488274.7913	630218.5484	N/A	1079	T7	00:00:00	0:00:00	0:00:00	N/A	No	No
33	487655.0871	632457.5792	N/A	1093	T5	00:34:12	34:18:00	9:54:32	5	Yes	Yes
34	487640.7901	632443.8823	N/A	1100	T5	00:34:12	33:30:00	9:40:40	5	Yes	Yes
35	487816.0438	632706.9146	N/A	1105	T5	00:34:48	69:42:00	20:08:08	3,5	Yes	Yes
36	487986.0889	633032.5635	N/A	1107	T3	00:34:12	38:06:00	11:00:24	1,3	Yes	Yes
37	487609.0112	631398.9176	N/A	1113	T7	00:34:12	60:36:00	17:30:24	5,7	Yes	Yes
38	487901.896	632848.6036	N/A	1118	T3	00:33:00	59:24:00	17:09:36	3,5	Yes	Yes
39	487752.5759	630604.3881	N/A	1128	T7	00:35:24	37:54:00	10:56:56	7	Yes	Yes
40	487999.9663	633112.9761	N/A	1134	T3	00:33:36	38:42:00	11:10:48	1,3	Yes	Yes
41	487581.1173	631411.605	N/A	1143	T7	00:33:36	57:12:00	16:31:28	5,7	Yes	Yes
42	488008.8049	633199.7074	N/A	1164	T1	00:33:00	39:30:00	11:24:40	1,3	Yes	Yes
43	487539.0465	631427.2319	N/A	1187	T7	00:32:24	45:30:00	13:08:40	5,7	Yes	Yes
44	487619.2655	632585.9018	N/A	1188	T5	00:32:24	32:18:00	9:19:52	5	Yes	Yes
45	488384.5695	634214.7466	N/A	1209	T1	00:29:24	25:48:00	7:27:12	N/A	No	No
46	488310.4853	634192.2218	N/A	1242	T1	00:30:36	30:54:00	8:55:36	1	Yes	Yes
47	488390.3852	630005.1137	N/A	1243	T7	00:00:00	0:00:00	0:00:00	N/A	No	No
48*	490044.0539	630925.1864	Involved	1244	T6	00:27:36	13:30:00	3:54:00	N/A	No	No
49	488404.9854	634277.423	N/A	1245	T1	00:27:36	17:48:00	5:08:32	N/A	No	No

50	490339.2711	631072.873	N/A	1307	T4	00:28:48	30:48:00	8:53:52	N/A	No	No
51	488348.0979	634314.7552	N/A	1310	T1	00:27:00	17:18:00	4:59:52	N/A	No	No
52	490246.8907	631004.1883	N/A	1316	T4	00:30:00	28:12:00	8:08:48	N/A	No	No
53	488477.8659	629909.8338	N/A	1318	T7	00:00:00	0:00:00	0:00:00	N/A	No	No
54	488457.4448	634404.4053	N/A	1319	T1	00:00:00	0:00:00	0:00:00	N/A	No	No
55	488224.8408	629977.4706	N/A	1321	T7	00:00:00	0:00:00	0:00:00	N/A	No	No
56*	490282.483	631012.8862	Involved	1326	T4	00:29:24	30:30:00	8:48:40	N/A	No	No
57	487928.8053	633775.1138	N/A	1330	T1	00:28:12	13:18:00	3:50:32	N/A	No	No
58	488360.1655	634351.4073	N/A	1331	T1	00:25:12	13:00:00	3:45:20	N/A	No	No
59	490458.1458	631128.2904	N/A	1335	T4	00:27:00	17:06:00	4:56:24	N/A	No	No
60	487348.0226	632344.6153	N/A	1336	T5	00:28:12	12:42:00	3:40:08	N/A	No	No
61	490543.7278	631204.6435	N/A	1336	T4	00:00:00	0:00:00	0:00:00	N/A	No	No
62	488181.93	629976.521	N/A	1338	T7	00:00:00	0:00:00	0:00:00	N/A	No	No
63	488469.3924	634436.9582	N/A	1340	T1	00:00:00	0:00:00	0:00:00	N/A	No	No
64*	490936.648	632086.8512	Involved	1341	T4	00:28:12	12:42:00	3:40:08	N/A	No	No
65	490503.5762	631151.8251	N/A	1347	T4	00:00:00	0:00:00	0:00:00	N/A	No	No
66	488483.2896	634462.7526	N/A	1355	T1	00:00:00	0:00:00	0:00:00	N/A	No	No
67	490530.2305	631165.452	N/A	1355	T4	00:00:00	0:00:00	0:00:00	N/A	No	No
68	487320.1086	632345.7052	N/A	1363	T5	00:27:36	12:12:00	3:31:28	N/A	No	No

69	488131.7307	629950.8268	N/A	1382	T7	00:00:00	0:00:00	0:00:00	N/A	No	No
70	487286.7657	632314.772	N/A	1386	T5	00:27:00	11:42:00	3:22:48	N/A	No	No
71	489924.3276	630530.6821	N/A	1394	T7	00:28:48	31:00:00	8:57:20	N/A	No	No
72	489905.9613	630494.6999	N/A	1396	T7	00:28:48	32:24:00	9:21:36	N/A	No	No
73	489979.5662	630620.2825	N/A	1403	T7	00:28:12	19:12:00	5:32:48	N/A	No	No
74	489909.6904	630473.9644	N/A	1410	T7	00:28:48	31:36:00	9:07:44	N/A	No	No
75	488086.7503	629935.5004	N/A	1415	T7	00:00:00	0:00:00	0:00:00	N/A	No	No
76	489910.5702	630461.5571	N/A	1417	T7	00:28:48	31:00:00	8:57:20	N/A	No	No
77	491013.5911	632031.3427	N/A	1421	T4	00:26:24	11:24:00	3:17:36	N/A	No	No
78	490942.9395	632614.1875	N/A	1424	T4	00:26:24	23:12:00	6:42:08	N/A	No	No
79	487244.4154	632419.1498	N/A	1457	T5	00:26:24	10:42:00	3:05:28	N/A	No	No
80	488049.7579	629874.6537	N/A	1486	T7	00:00:00	0:00:00	0:00:00	N/A	No	No

Of the 80 No. properties modelled; it is predicted that 39 properties may experience daily shadow flicker levels in excess of the DoEHLG guideline threshold of 30 minutes per day. This prediction is assuming worst-case conditions (i.e. 100% sunshine on all days where the shadow of the turbines passes over a house, wind blowing in the correct direction, no screening present, etc.) and in the absence of any turbine control measures.

Of these 39 No. properties:

- 37 No. properties are inhabitable dwellings (including 4 Involved Properties); and
- 2 No. properties are derelict properties

Of the 80 no. properties modelled, when the regional sunshine average (i.e. the mean number of sunshine hours throughout the year) of 29.5% is taken into account, the DoEHLG guideline limit of 30 hours per year is predicted to not be exceeded at any of the inhabitable or derelict properties.

Additionally, it is worth reiterating that the predicted shadow flicker listed in Table 5-9 is considered conservative and in reality, the occurrence and/or duration of shadow flicker at these properties is likely to be eliminated or significantly reduced as the following items are not considered by the model:

- Receivers may be screened by topography, cloud cover and/or vegetation/built form i.e. adjacent buildings, farm buildings, garages or barns;
- Each receiver will not have windows facing in all directions onto the wind farm.
- At distances, greater than 500-1000m '*the rotor blade of a wind turbine will not appear to be chopping the light but the turbine will be regarded as an object with the sun behind it. Therefore, it is generally not necessary to consider shadow casting at such distances'* (Danish Wind Industry Association, accessed 2010).

Section 5.9.3.4 below outlines the mitigation strategies which may be employed at the potentially affected properties to ensure EMPower's commitment to zero shadow flicker at occupied residential receptors within 10 rotor diameters of the Proposed Development.

5.7.6.2 Cumulative Shadow Flicker

For the assessment of cumulative shadow flicker, any other existing, permitted or proposed wind farm would be considered where it was located within three kilometres of the proposed turbines and where the dwellings included in the shadow flicker assessment were within 10 rotor diameters of both the proposed turbines and the other existing, permitted or proposed wind farms. There are no other existing and permitted wind turbines located within three kilometres of the proposed wind turbines. The closest existing or permitted windfarm is the Pallas Wind Farm which is located approximately 8.3 kilometres south-east of the Proposed Development. The Pallas Wind Farm has operating turbines with a rotor diameter of 140 metres. There are no residential properties within 10 rotor diameters of both the Proposed Development and the Pallas Wind Farm. Therefore, cumulative effects will not arise. The closest proposed wind farm is Ballyhorgan Wind Farm which is located approximately 3.8 kilometres south-east of the Proposed Development. The proposed Ballyhorgan Wind Farm has a rotor diameter of up to 117 metres, there are no residential properties within 10 rotor diameters of both the Proposed Development and the proposed Ballyhorgan Wind Farm.

5.8 Residential Amenity

Residential amenity relates to the human experience of one's home, derived from the general environment and atmosphere associated with the residence. The quality of residential amenity is influenced by a combination of factors, including site setting and local character, land-use activities in the area and the relative degree of peace and tranquillity experienced in the residence.

The wind farm site is located on a site mainly consisting of partially cutover raised bog and agricultural land. As such, the amount of people accessing the site relates mainly to those cutting peat, recreating, and engaged in agricultural activities. Per the detailed layout description in Chapter 1 of this EIAR there will be no third-party dwellings within 680 metres (4 times tip height).

When considering the amenity of residents in the context of a proposed wind farm, there are three main potential impacts of relevance: 1) Shadow Flicker, 2) Noise, and 3) Visual Amenity. Shadow flicker and noise are quantifiable aspects of residential amenity while visual amenity is more subjective. Detailed shadow flicker and noise modelling have been completed as part of this EIAR (Section 5.7 above refers to shadow flicker modelling, Chapter 11 addresses noise). A comprehensive landscape and visual impact assessment has also been carried out, as presented in Chapter 13 of this EIAR. Impacts on human beings during the construction, operational and decommissioning phases of the proposed development is assessed in relation to each of these key issues and other environmental factors such as noise, traffic and dust; see Impacts in Section 5.9 below. The impact on residential amenity is then derived from an overall judgement of the combination of impacts due to shadow flicker, changes to land-use and visual amenity, noise, traffic, dust and general disturbance.

5.9 Likely Significant Impacts and Associated Mitigation Measures

5.9.1 'Do-Nothing' Scenario

If the proposed development were not to proceed, the existing uses of the site for agriculture and turbary would continue. These land-uses will also continue if the proposed development does proceed. The environmental impact of this is considered neutral in the context of the EIAR.

If the proposed development were not to proceed, the opportunity to capture an even greater part of County Kerry's valuable renewable energy resource would be lost, as would the opportunity to further contribute to meeting Government and EU targets for the production and consumption of electricity from renewable resources and the reduction of greenhouse gas emissions. The opportunity to generate local employment and investment and to diversify the local economy would also be lost.

5.9.2 Construction Phase

5.9.2.1 Health and Safety

Pre-Mitigation Impacts

Construction of the proposed development will necessitate the presence of a construction site. Construction sites and the machinery used on them pose a potential health and safety hazard to construction workers if site rules are not properly implemented. This will have a short-term potential significant negative impact.

Proposed Mitigation Measures

The proposed development will be constructed, operated and decommissioned in accordance with all relevant Health and Safety Legislation, including:

- Safety, Health and Welfare at Work Act 2005 (No. 10 of 2005);
- Safety, Health and Welfare at Work (General Application) Regulations 2007 (S.I. No. 299 of 2007), as amended;
- Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. 291 of 2013), as amended; and

A Health and Safety Plan covering all aspects of the construction process will address the Health and Safety requirements in detail. This will be prepared on a preliminary basis at the procurement stage and developed further at construction stage.

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 under the construction contract and current health and safety legislation to adequately provide for all hazards and risks associated with the construction phase of the project. Safepass registration cards are required for all construction, delivery and security staff. Construction operatives will hold a valid Construction Skills Certificate Scheme card where required. The developer is required to ensure a competent contractor is appointed to carry out the construction works. The contractor will be responsible for the implementation of procedures outlined in the Safety and Health Plan. Public safety will be addressed by restricting site access during construction. Fencing will be erected in areas of the site where uncontrolled access is not permitted. Appropriate warning signs will be posted, directing all visitors to the site manager. Appropriate warning measures including 'goalposts' will be used as appropriate to prevent contact with any overheads lines that traverse the site.

The scale and scope of the project requires that a Project Supervisor Design Process (PSDP) and Project Supervisor Construction Stage (PSCS) are required to be appointed in accordance with the provisions of the Health & Safety Authority's '*Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2013 (Updated)'*.

The PSDP appointed for the construction stage shall be required to perform his/her duties as prescribed in the Safety, Health and Welfare at Work (Construction) Regulations 2013, as amended. These duties include (but are not limited to):

- Identify hazards arising from the design or from the technical, organisational, planning or time related aspects of the project;
- Where possible, eliminate the hazards or reduce the risks;
- Communicate necessary control measures, design assumptions or remaining risks to the PSCS so they can be dealt with in the Safety and Health Plan;
- Ensure that the work of designers is coordinated to ensure safety;
- Organise co-operation between designers;
- Prepare a written Safety and Health Plan;
- Prepare a safety file for the completed structure and give it to the client; and
- Notify the Authority and the client of non-compliance with any written directions issued.

The PSCS appointed for the construction stage shall be required to perform his/her duties as prescribed in the Safety, Health and Welfare at Work (Construction) Regulations. These duties include (but are not limited to):

- Development of the Safety and Health Plan for the construction stage with updating where required as work progresses;
- Compile and develop safety file information
- Reporting of accidents / incidents;
- Weekly site meeting with PSDP;
- Coordinate arrangements for checking the implementation of safe working procedures. Ensure that the following are being carried out:
- Induction of all site staff including any new staff enlisted for the project from time to time;
- Toolbox talks as necessary;
- Maintenance of a file which lists personnel on site, their name, nationality, current Safe Pass number, current Construction Skills Certification Scheme (CSCS) card (where relevant) and induction date;
- Report on site activities to include but not limited to information on accidents and incidents, disciplinary action taken and PPE compliance;
- Monitor the compliance of contractors and others and take corrective action where necessary; and
- Notify the Authority and the client of non-compliance with any written directions issued.

Residual Impact

With the implementation of the above, there will be a short-term potential slight negative residual impact on health and safety during the construction phase of the proposed development.

Significance of Effects

Based on the assessment above there will be no significant direct and indirect effects on health and safety during the construction phase of the proposed development.

5.9.2.2 Employment and Investment

The design, construction and operation of the wind farm will provide employment for technical consultants, contractors, and maintenance staff. Approximately, 71 jobs could be created during the construction, operation, and maintenance phases of the proposed development. This estimate of jobs created during the construction phase is based on the modelling set out in 'A Macroeconomic Analysis of Onshore Wind Deployment to 2020' (SEAI 2015). The construction phase of the wind farm will last between approximately 18 months. The majority of construction workers and materials will be sourced locally, thereby helping to sustain employment in the construction trade. This will have a short-term significant positive impact.

The injection of money in the form of salaries and wages to those employed during the construction phase of the project has the potential to result in an increase in household spending and demand for goods and services in the local area. This would result in local retailers and businesses experiencing a short-term positive impact on their cash flow. This will have a short-term slight positive indirect impact.

The proposed development will result in an influx of skilled people into the area, bringing specialist skills for both the construction and operational phases that could result in the transfer of these skills into the local workforce, thereby having a long-term positive impact on the local skills base. Up-skilling and training of local staff in the particular requirements of the wind energy industry is likely to lead to additional opportunities for those staff as additional wind farms are constructed in Ireland. This will have a long-term moderate positive indirect impact. As discussed above, the wind sector currently supports 5,130 jobs (not including employment in grid development) with a 'with a strong foothold in rural Ireland.

Rates payments for the wind farm will contribute significant funds to Kerry County Council, which will be redirected to the provision of public services within Co. Kerry. These services include provisions such as road upkeep, fire services, environmental protection, street lighting, footpath maintenance etc. along with other community and cultural support initiatives.

Proposed Community Benefit Scheme

In addition to employment during the construction and operational phases of the proposed development and annual rates that will be paid to the local authority by the developer, a range of other benefits associated with the proposed development will be provided to the local community through the annual Community Fund.

The community fund will set aside approximately €200,000 per annum for the benefit of the local community. The value of the fund for the Community Fund be in the region of €3.1 million over the first 15 years of the lifetime of the project.

5.9.2.3 Population

Those working on the construction phase of the proposed development will travel daily to the site from the wider area. The construction phase will have no impact on the population of the area in terms of changes to population trends or density, household size or age structure.

5.9.2.4 Land-use

The existing land-uses of agriculture, roads, and turbary will continue on the site of the proposed development. The proposed development will have no impact on existing land-uses as it has been designed to co-exist with these land-uses.

The existing land-use of road networks will continue on the proposed grid connection route options. There will be no change to existing land-uses in the wider area as a result of the proposed grid connection.

5.9.2.5 Tourism and Amenity

Given that there are currently no tourism attractions specifically pertaining to the site there are no impacts associated with the construction phase of the development. With regard to tourist attractions and amenity use around the site, described in Section 5.3.2, traffic management safety measures will be in place. Please see Traffic Impacts below for further details on proposed mitigation measures.

5.9.2.6 Noise

Pre-Mitigation Impacts

There will be an increase in noise levels in the vicinity of the proposed development site during the construction phase, as a result of heavy machinery and construction work which has the potential to cause a nuisance to sensitive receptors located closest the proposed development site. These impacts will be short-term in duration. The noisiest construction activities associated with wind farm development are excavation, winning rock from the borrow pit, and pouring of the turbine bases. Excavation of a base can typically be completed in one to two days however, and the main concrete pours are usually conducted in one continuous pour, which is done within a matter of hours.

Construction noise at any given noise sensitive location will be variable throughout the construction project, depending on the activities underway and the distance from the main construction activities to the receiving properties. The potential noise impacts that will occur during the construction phase of the proposed development are further described in Chapter 11: Noise and Vibration.

Proposed Mitigation Measures

Best practice measures for noise control will be adhered to onsite during the construction phase of the proposed development in order to mitigate the slight short-term negative impact associated with this phase of the development. These measures will include:

- No plant used on site will be permitted to cause an on-going public nuisance due to noise.
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract.
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers.
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.
- Any plant, such as generators or pumps, which is required to operate outside of general construction hours will be surrounded by an acoustic enclosure or portable screen.
- During the course of the construction programme, supervision of the works will include ensuring compliance with the limits detailed in Section 11.3.2 using methods outlined in British Standard BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise.
- The hours of construction activity will comply with any conditions attached to the planning permission and be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 7:00hrs and 19:00hrs

Monday to Saturday. However, to ensure that optimal use is made of good weather periods or at critical periods within the programme (i.e. concrete pours, rotor/tower deliveries) it will be necessary on occasion to work outside of these hours.

Residual Impact

Following the implementation of the above mitigation measures, there will be a short-term, slight, negative residual effect due to an increase in noise levels during the construction phase of the proposed development.

Significance of Effects

Based on the assessment above there will be no significant direct or indirect effects.

5.9.2.7 Dust

Pre-Mitigation Impacts

Potential dust emission sources during the construction phase of the proposed development include upgrading of existing access tracks and construction of new access roads, turbine foundations and substation. An increase in dust emissions has the potential to cause a nuisance to sensitive receptors in the immediate vicinity of the site. The entry and exit of construction vehicles from the site may result in the transfer of mud to the public road, particularly if the weather is wet. This may cause nuisance to residents and other road users. These impacts will not be significant and will be relatively short-term in duration. The potential dust impacts that may occur during the construction phase of the proposed development are further described in Chapter 10: Air and Climate.

Proposed Mitigation Measures

Aggregate material for the construction of roads and turbine bases will be sourced from the on-site borrow pit and vehicles will be inspected upon leaving the borrow pit area. A road sweeper will be available if any section of the public roads were to be dirtied by trucks associated with the proposed development. All plant and materials vehicles shall be stored in the compound area or other dedicated areas. Areas of excavation will be kept to a minimum, and stockpiling will be minimised by coordinating excavation, spreading and compaction. Construction traffic will be restricted to defined routes and a speed limit will be implemented.

In periods of extended dry weather, dust suppression may be necessary along haul roads to ensure dust does not cause a nuisance. If necessary, water will be taken from the site's drainage system, and will be pumped into a bowser or water spreader to dampen down haul roads and the temporary site compound to prevent the generation of dust. Silty or oily water will not be used for dust suppression, because this would transfer the pollutants to the haul roads and generate polluted runoff or more dust. Water bowser movements will be carefully monitored, as the application of too much water may lead to increased runoff.

Residual Impact

Following the implementation of the above mitigation measures, there will be short-term slight negative impact due to dust emissions from the construction of the proposed development.

Significance of Effects

Based on the assessment above there will be no significant direct or indirect effects.

5.9.2.8 Traffic

Pre-Mitigation Impacts

The construction phase of the proposed development will last approximately 18 months. Construction materials and turbines will be delivered to the site of the proposed development from Foynes, via the N21 National Primary Road and the N69 National Secondary Road around Tralee. The site will be accessed via a local road from the R557 to the south of the site.

Construction traffic will be comprised of Heavy Goods Vehicle (HGV) and Light Goods Vehicle (LGV) movements involved in the delivery of wind turbines and construction materials to the site and the export of excess construction materials and plant from the site. A complete Traffic and Transportation Assessment (TTA) of the proposed development has been carried out by Alan Lipscombe Traffic and Transport Consultants. The full results of the TTA are presented in Chapter 14 of this EIAR.

The types of vehicles that will be required to negotiate the local network represent abnormal loads and a detailed assessment of the geometry of the proposed route was therefore undertaken. It was established that short-term remedial measures may be required at some locations on the route and that further analysis and dry delivery runs will be required at these locations prior to construction

Proposed Mitigation Measures

A traffic management plan will be developed and implemented to ensure any impact is short term in duration and slight in significance during the construction of the proposed development. Prior to commencement of any works, the occupants of dwellings in the vicinity of the proposed works will be contacted and the scheduling of works will be made clear. Local access to properties will also be maintained throughout any construction works and local residents will also be supplied with the number of the works supervisor in order to ensure that disruption will be kept to a minimum. In relation to the cable laying works, the works area in any one day will be approximately 300m in length and so the potential for significant disruption is limited. Aggregate materials for the construction of any additional site tracks will be obtained from a borrow pit on the site of the proposed development. This will significantly reduce the number of delivery vehicles required to access the site.

Residual Impact

Once a traffic management plan is implemented for the construction phase of the proposed development, there will be a short-term imperceptible negative residual impact on local road users.

Significance of Effects

Based on the assessment above there will be no significant direct or indirect effects.

5.9.2.9 Shadow Flicker

Shadow flicker, which occurs during certain conditions due to the movement of wind turbine blades, as described in Section 5.7 of this chapter, occurs only during the operational phase of a wind energy development. There are therefore no shadow flicker impacts associated with the construction phase of the proposed development.

5.9.3 Operational Phase

The effects set out below relate to the operational phase of the proposed wind farm.

5.9.3.1 Health and Safety

Pre-Mitigation Impact

It is not anticipated that the operation of the wind farm will present a danger to the public and livestock. Rigorous safety checks are conducted on the turbines during design, construction, commissioning and operation to ensure the risks posed to staff, landowners and general public are negligible.

Proposed Mitigation Measures

Notwithstanding the above, the following mitigation measures will be implemented during the operation of the proposed development to ensure that ensure the risks posed to staff, landowners and general public remain negligible throughout the operational life of the wind farm.

Access to the turbines is through a door at the base of the structure, which will be locked at all times outside maintenance visits.

Signs will be erected at suitable locations such as, amenity access points and carparks, setting out the conditions of public access under the relevant legislation and providing normal hours (and out of hours) contact details. Staff associated with the project will conduct frequent visits, which will include inspections to establish whether any signs have been defaced, removed or are becoming hidden by vegetation or foliage, with prompt action taken as necessary.

Signs will also be erected at suitable locations across the site as required for the ease and safety of operation of the wind farm. These signs include:

- Buried cable route markers at 50m (maximum) intervals and change of cable route direction;
- Directions to relevant turbines at junctions;
- “No access to Unauthorised Personnel” at appropriate locations;
- Speed limits signs at site entrance and junctions;
- “Warning these Premises are alarmed” at appropriate locations;
- “Danger HV” at appropriate locations;
- “Warning – Keep clear of structures during electrical storms, high winds or ice conditions” at site entrance;
- “No unauthorised vehicles beyond this point” at specific site entrances; and
- Other operational signage required as per site-specific hazards.

An operational phase Health and Safety Plan will be developed to fully address identified Health and Safety issues associated with the operation of the site and providing for access for emergency services at all times.

The components of a wind turbine are designed to last up to 30 years and are equipped with a number of safety devices to ensure safe operation during their lifetime. During the operation of the wind farm regular maintenance of the turbines will be carried out by the turbine manufacturer or appointed service company. A project or task specific Health and Safety Plan will be developed for these works in accordance with the site’s health and safety requirements.

Residual Impact

With the implementation of the above mitigation measures, there will be a long-term, imperceptible residual impact on health and safety during the operational life of the proposed development.

Significance of Effects

Based on the assessment above there will be no significant direct or indirect effects.

5.9.3.2 Employment and Investment

The operational phase will present an opportunity for mechanical-electrical contractors and craftspeople to become involved with the maintenance and operation of the wind farm. On a long-term scale, the proposed development will create approximately 17 jobs during the operational phase relating to the maintenance and control of the wind farm, having a long-term slight positive effect. This estimate of jobs created during the operational phase is based on the modelling set out in 'A Macroeconomic Analysis of Onshore Wind Deployment to 2020' (SEAI 2015).

Proposed Community Benefit Scheme

Two important areas of Government policy development are nearing completion which will have a bearing on the establishment of future community benefit funds, the draft updated Wind Energy Guidelines and the Renewable Energy Support Scheme (RESS), the terms and conditions for which were published in February 2020. Both sets of policy are expected to provide the Government requirements on future community benefit funds for renewable energy projects. We will fully take into account these two important policies when finalised as we present the approach to community benefit.

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

If this project is constructed as currently designed, we estimate that a total of approximately 3.1 million euro will be available in the local area for community funding over the lifetime of the project. The above figure is indicative only and will be dependent on the generation capacity of the wind farm which is influenced by a number of factors including:

1. *Number of wind turbines.*
2. *Capacity and availability of energy production of those turbines.*
3. *Quantity of wind.*

The Community Benefit Fund belongs to the local community. The premise of the fund is that it should be used to bring about significant, positive change in the local area. To make this happen, our first task will be to form a benefit fund development working group that clearly represents both the close neighbours to the project as well as nearby communities. This group will then work on designing the governance and structure of a community entity that would administer the Community Benefit Fund.

5.9.3.3 Population

The operational phase of the proposed development will have no impact on the population of the area with regards to changes to trends, population density, household size or age structure.

5.9.3.4 Land-use

The footprint of the proposed development site, including turbines, roads etc., will occupy only a small percentage of the total Study Area defined for the purposes of this EIAR. The main land-use of agriculture and turbary will continue to co-exist with the wind farm during the operational phase. The proposed development will have no impact on other land-uses within the wider area.

5.9.3.5 Property Values

As noted in Section 5.6 above, the conclusions from available international literature indicate that property values are not impacted by the positioning of wind farms near houses. It is on this basis that it can be reasonably concluded that there would be a long-term imperceptible impact from the proposed development.

5.9.3.6 Tourism and Amenity

Pre-Mitigation Impacts

The Department of the Environment, Heritage and Local Government's Wind Energy Development Guidelines for Planning Authorities 2006 state that "the results of survey work indicate that tourism and wind energy can co-exist happily". It is not considered that the proposed development would have an adverse impact on tourism infrastructure in the vicinity. Wind farms are an existing feature in the surrounding landscape, which will assist in the assimilation of the proposed development into this environment.

Proposed Mitigation Impacts

None required.

Residual Impact

The proposed development will have a long-term neutral effect on tourism.

Significance of Effects

Based on the assessment above there will be no significant direct or indirect effects on tourism.

5.9.3.7 Shadow Flicker

Pre-Mitigation Impacts

Assuming worst-case conditions, a total of 39 residential properties may experience daily shadow flicker in excess of the current DoEHLG guideline threshold of 30 minutes per day. The DoEHLG total annual guideline limit of 30 hours is not exceeded at any occupied property.

Proposed Mitigation Measures

Prior to the commissioning of the wind farm, shadow flicker modelling will be conducted in order to identify where daily or annual shadow flicker exceedances are predicted at any occupied receptor or 3rd party property. A site visit will be undertaken firstly to determine the existing screening and window orientation. This will determine if the receptor has an actual line of sight to any turbine. Once this is completed and all of the potential receptors identified, the following measures will be employed,

Screening Measures

In the event of an occurrence of shadow flicker exceeding guideline threshold values of 30 minutes per day at residential receptor locations, mitigation options will be discussed with the affected homeowner, including:

- Installation of appropriate window blinds in the affected rooms of the residence;
- Planting of screening vegetation;
- Other site-specific measures which might be agreeable to the affected party and may lead to the desired mitigation.

If agreement can be reached with the homeowner, then it would be arranged for the required mitigation to be implemented in cooperation with the affected party as soon as practically possible and for the full costs to be borne by the wind farm operator.

Wind Turbine Control Measures

If it is not possible to mitigate any identified shadow flicker limit exceedance locally using the measures detailed above, wind turbine control measures will be implemented.

Wind turbines can be fitted with shadow flicker control units to allow the turbines to be controlled to prevent the occurrence of shadow flicker at properties surrounding the wind farm. The shadow flicker control units will be added to any required turbines.

A shadow flicker control unit allows a wind turbine to be programmed and controlled using the wind farm's SCADA control system to change a particular turbine's operating mode during certain conditions or times, or even turn the turbine off if necessary.

All predicted incidents of shadow flicker can be pre-programmed into the wind farm's control software. The wind farm's SCADA control system can be programmed to shut down any particular turbine at any particular time on any given day to ensure that shadow flickers occurrences at properties which are not naturally screened or cannot be screened with measures outlined above. Where such wind turbine control measures are to be utilised, they need only be implemented when the specific combined circumstances occur that are necessary to give rise to the shadow flicker effect in the first instance. Therefore, if the sun is not shining on a particular day that shadow flicker was predicted to occur at a nearby property, there would be no need to shut down the relevant turbines that would have given rise to the shadow flicker at the property. Similarly, if the wind speed was below the cut-in speed that caused the turbine rotor to rotate and give rise to a shadow flicker effect at a nearby property, there would be no need to shut down the relevant turbines that otherwise would have caused shadow flicker.

The atmospheric variables that determine whether shadow flicker will occur or not, are continuously monitored at the wind farm site and the data fed into the wind farm's SCADA control system. The strength of direct sunlight is measured by way of photocells, and if the sunlight is of sufficient strength to cast a shadow, the shadow flicker control mechanisms come into effect. Wind speed and direction are measured by anemometers and wind vanes on each turbine and on the wind farm's met mast, and similarly, and if wind speed and direction is such that a shadow will be cast, the shadow flicker control mechanisms come into effect. The moving blades of the turbine will require a short period of time to cease rotating and as such there may be a very short period (less than 3 to 5 minutes) during which the blades are slowed to a complete halt. The turbines giving rise to shadow flicker may be turned off on different days to prevent excessive wear and tear on any single turbine.

In order to ensure that the model and SCADA system is accurate and working well a site visit will be carried out to verify the system. The shadow flicker prediction data will be used to select dates on which a shadow flicker event could be observed at one or multiple affected properties and the following process will be adhered to.

1. *Recording the weather conditions at the time of the site visit, including wind speeds and direction (i.e. blue sky, intermittent clouds, overcast, moderate breeze, light breeze, still etc.).*
2. *Recording the house number, time and duration of site visit and the observation point GPS coordinates.*
3. *Recording the nature of the sensitive receptor, its orientation, windows, landscaping in the vicinity, any elements of the built environment in the vicinity, vegetation.*
4. *In the event of shadow flicker being noted as occurring the details of the duration (times) of the occurrence will be recorded*
5. *The data will then be sent to the wind farm operational team to confirm that the model and SCADA system are working.*
6. *Following 12 months of full operation of the Proposed Development a report can be prepared for the Local Authority describing the shadow flicker mitigation measures used at the wind farm and confirming the implementation and successful operation of the system.*

This method of shadow flicker mitigation has been technically well-proven at wind farms in Ireland and also in areas outside Ireland that experience significantly longer periods of direct sunlight.

Residual Impact

Shadow flicker could potentially have a long-term slight negative impact. However, as the applicant has committed to exceeding the existing daily and annual guideline requirement and committed to zero shadow flicker at occupied residential receptors, there will be no impact from shadow flicker on human beings.

Significance of Effects

Based on the assessment above and the mitigation measures proposed there will be no significant effects related to shadow flicker.

5.9.3.8 Residential Amenity

Pre-Mitigation Impacts

Potential impacts on residential amenity during the operational phase of the proposed wind farm could arise primarily due to noise, shadow flicker, changes to visual amenity or interference with telecommunications. Detailed noise and shadow flicker modelling have been carried out as part of this EIAR, which shows that the proposed development will be capable of meeting all required guidelines in relation to noise thresholds and the shadow flicker thresholds set out in the 2006 DoEHLG Wind Energy Guidelines and the Draft Revised Wind Energy Development Guidelines 2019.

The visual impact of the proposed development is addressed comprehensively in Chapter 13: Landscape and Visual. The proposed development was designed to be meet the setback recommendations in the 2019 Draft Wind Energy Development Guidelines (WEGS). There will be no turbines within 680 metres (4 times tip height) of any third-party dwellings. Based on a minimum setback distance of 680 metres from third-party residences there will be no significant effect on the visual amenity of those residences according to the 2019 Draft WEGS.

An assessment of roadside screening was carried out for roads within 5km of the proposed turbine locations, with both the methodology and findings of this described in Section 13.4.4. Many of these roads have intermittent screening, and therefore intermittent views rather than full visibility of the site.

Given the separation distance of the residential properties from the proposed turbines, and the level of existing screening in the area, the proposed development will have no significant impact on existing visual amenity at dwellings.

Proposed Mitigation Measures

There will be no turbines within 680 metres (4 times tip height) of any third-party dwellings. All mitigation as outlined under noise and vibration, dust, traffic, visual amenity and shadow flicker in this EIAR will be implemented in order to reduce insofar as possible impacts on residential amenity at properties located in the vicinity of the proposed development works, including along the proposed turbine and construction materials haul route.

Residual Impact

With the implementation of the mitigation measures outlined in relation to noise and vibration, dust, traffic, shadow flicker and visual amenity, the proposed development will have an imperceptible impact on residential amenity.

Significance of Effects

Based on the assessment above there will be no significant direct or indirect effects on residential amenity.

5.9.3.9 Noise

A baseline assessment of the existing background noise conditions was carried out, the results of which are presented in Chapter 11 of the EIAR. A noise assessment of the operational phase of the proposed development has also been carried out through modelling of the development using noise prediction software. The predicted noise levels for the proposed development have been compared with the existing background noise levels and the best practice guidance levels for noise emissions from wind farms. There are no existing or proposed wind farms within 2km of the the proposed development. The proposed Ballyhorgan Wind farm is approximately 3.8km from the proposed development and has been considered as part of the cumulative noise impact assessment.

Details of the noise assessment carried out by AWN Consulting are presented in Chapter 11 of the EIAR. The noise assessment determined that the predicted operational noise effect at the closest noise sensitive receptors to the site is of a moderate, negative, long-term nature. It is noted that this effect considers the periods of greatest potential effect prior to mitigation, i.e. the worst-case scenario. For the majority of locations assessed, operation of the proposed turbines will have a slight, negative, long-term effect. The noise assessment notes that these effects should be considered in terms that the effect is variable, and that this assessment considers periods of the greatest potential effect.

As stated in the noise assessment in Chapter 11, it has been demonstrated that the relevant national guidance in relation to noise associated with proposed wind turbines can be satisfied, therefore the predicted impact associated with the operational turbines is long term and not significant.

5.9.3.10 Traffic

Two to three service technicians may have to attend to the site of the proposed wind farm on a weekly basis during the operational phase of the project. A Traffic and Transportation Assessment (TTA) of the proposed development has been completed by Alan Lipscombe Traffic and Transport Consultants, the results of which are presented in Section 14.1 of this EIAR. The TTA found that there will be a long-term imperceptible impact on traffic created during the operational phase of the proposed wind farm.

5.9.4 Decommissioning Phase

The wind turbines proposed as part of the proposed development are expected to have a lifespan of approximately 30 years. Following the end of their useful life, the wind turbines may be replaced with a new set of turbines, subject to planning permission being obtained, or the site may be decommissioned fully. The substation will remain in place as it will be under the ownership of the ESB.

The works required during the decommissioning phase are described in Section 4.11 in Chapter 4: Description of the Proposed Development. Any impact and consequential effect that occurs during the decommissioning phase will be similar to that which occurs during the construction phase, however to a lesser extent.

5.9.5 Cumulative Effects

For the assessment of cumulative impacts, any other existing, permitted or proposed developments (wind energy or otherwise) have been considered. Further information on projects considered as part of the cumulative assessment are given in Chapter 2: Background to the Proposed Development. The impacts with the potential to have cumulative effects on human beings are discussed below and in more detail in the relevant chapters: noise (Chapter 11), visual impacts (Chapter 12) and traffic (Chapter 14).

5.9.5.1 Health and Safety

The proposed wind farm will have no cumulative impacts in terms of health and safety. There is no credible scientific evidence to link wind turbines with adverse health impacts

5.9.5.2 Employment and Economic Activity

Of the nearby wind energy developments listed in Section 2.5.2 of this EIAR, Tullahennel, Tylagh, Ballincollig Hill, Stacks Mountain, Knocknagoum/Maghanknockane, Beennageeha, Pallas/Clahane, Beale Hill, Cahercullanagh, Muingnaminane, Knocknacaheragh, Beennanaspuck, Kilathomoy-Toberatooreen, Curraghderrig, Cloghaneniskirt, Tursillagh I, II, Leanamore, Tobaratorreen, Cloghboola, and Breevha are operational, Moyvane, Dromadda Beg, and Ballylongford are permitted.. The permitted projects along with the proposed development will contribute to short term employment during construction stages. All wind farms including the proposed development, will provide the potential for long-term employment resulting from maintenance operations. This results in a long-term, moderate positive impact.

Agricultural activities on the site of the proposed development can continue while the proposed development is under construction and operating, resulting in a long-term moderate positive cumulative impact.

5.9.5.3 Tourism and Amenity

There are no key identified tourist attractions pertaining specifically to the site of the proposed development itself.

It is not considered that the proposed development together with other projects in the area will cumulatively affect any tourism infrastructure in the wider area. As mentioned previously, wind farms are an existing feature in the surrounding landscape, which will assist in the assimilation of the proposed development into this environment.

5.9.5.4 Property Values

As noted in Section 5.6 above, the conclusions from available international literature indicate that property values are not impacted by the positioning of wind farms near houses. It is on this basis that it can be concluded that there would be a long-term, imperceptible, neutral cumulative impact from the proposed development and other wind farm developments in the area.

5.9.5.5 Shadow Flicker

As outlined in Section 5.7.6.2 no dwellings will impacted by shadow flicker from the proposed Ballynagare Wind Farm in combination with other permitted wind farms. Therefore, there are no cumulative shadow flicker effects associated with the proposed development and other permitted wind farms.

5.9.5.6 Residential Amenity

Pre-Mitigation Impacts

In the unlikely event of permitted and proposed projects as described in the cumulative assessment in Chapter 2 being constructed at the same time, there is the potential for a resulting short term, slight, cumulative, negative impact to occur on residential amenity, in relation to noise and vibration, dust, traffic, and telecommunications.

Proposed Mitigation Measures

There will be no turbines as part of the proposed development that will be located within 680 metres of any third-party dwellings. No turbines associated with any other existing, planned, or permitted windfarms are located within 1.5 kilometers (10 rotor diameters) of any dwellings located within 1.5 kilometres of the proposed development. All mitigation as outlined under noise and vibration, dust, traffic, visual amenity and telecommunications in this EIAR will be implemented in order to reduce insofar as possible impacts on residential amenity at properties located in the vicinity of the proposed development works, including along the proposed turbine and construction materials haul route. It is assumed also that all mitigation measures in relation to the other cumulative projects will also be implemented.

Residual Impact

The proposed development will have a short-term, slight negative effect on residential amenity during construction works. During the operational phase, noise and shadow flicker from the proposed and permitted projects will be limited to below guideline levels or as committed to by the developer.

Significance of Effects

Based on the assessment above there will be no significant direct or indirect effects.

6. BIODIVERSITY

6.1 Introduction

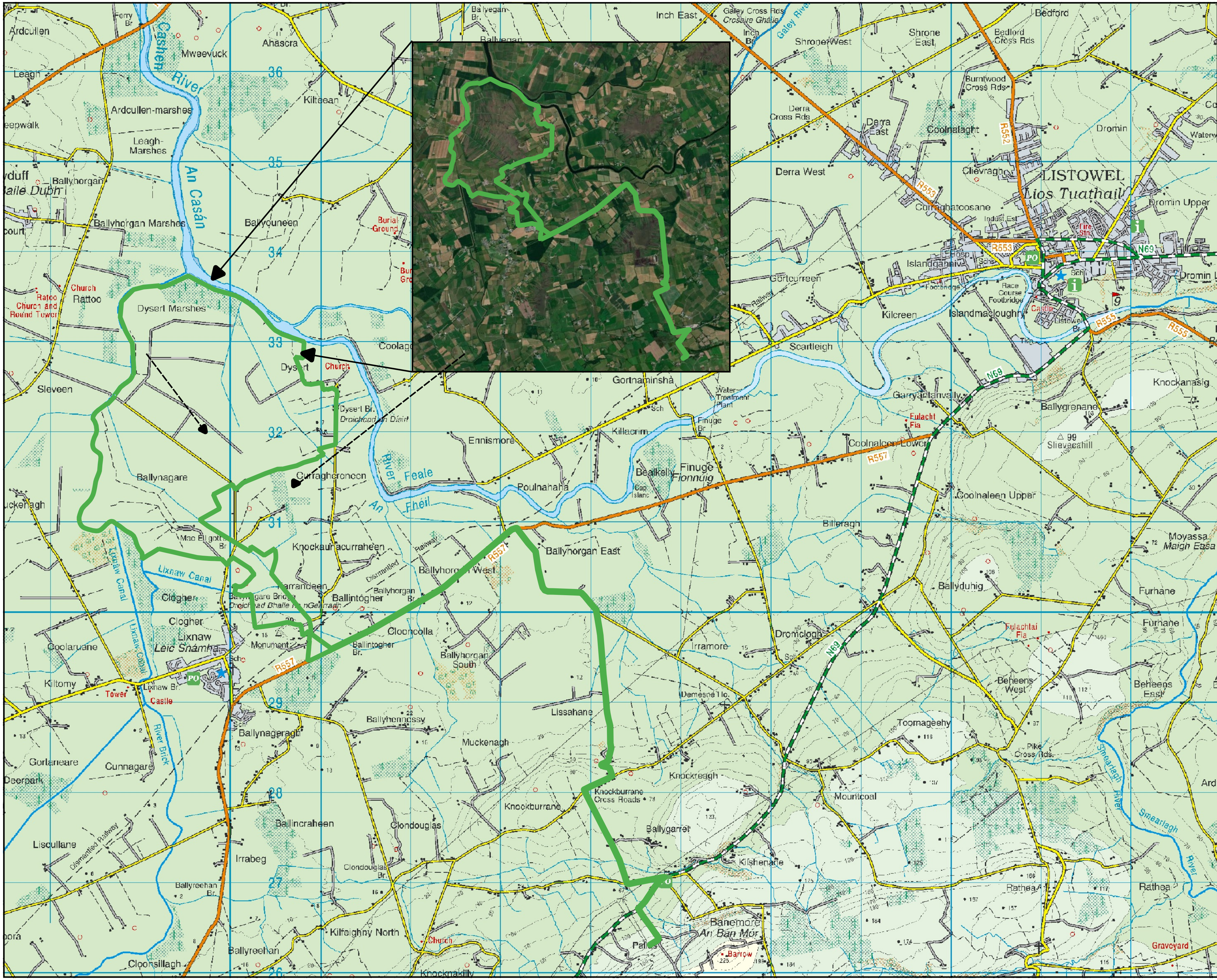
This chapter assesses the likely significant effects (both alone and cumulatively with other projects) that the proposed development may have on Biodiversity, Flora and Fauna and sets out the mitigation measures proposed to avoid, reduce or offset any potential significant effects that are identified. The residual impacts on biodiversity are then assessed. Particular attention has been paid to species and habitats of ecological importance. These include species and habitats with national and international protection under the Wildlife Acts 1976-2019, EU Habitats Directive 92/43/EEC. The full description of the proposed development is provided in Chapter 4 of this EIAR. Impacts on avian receptors are considered in Chapter 7 of this EIAR.

The chapter is structured as follows:

- The Introduction provides a description of the legislation, guidance and policy context applicable to Biodiversity, Flora and Fauna.
- This is followed by a comprehensive description of the ecological survey and impact assessment methodologies that were followed to inform the robust assessment of likely significant effects on ecological receptors.
- A description of the Baseline Ecological Conditions and Receptor Evaluation is then provided.
- This is followed by an Assessment of Effects which are described with regard to each phase of the development: construction phase, operational phase and decommissioning phase. Potential Cumulative effects in combination with other projects are fully assessed.
- Proposed mitigation and best practice measures to avoid, reduce or offset the identified effects are described and discussed. This is followed by an assessment of residual effects taking into consideration the effect of the proposed mitigation and best practice measures.
- The conclusion provides a summary statement on the overall significance of predicted effects on Biodiversity, Flora and Fauna.

The following defines terms utilised in this chapter:

- For the purposes of this EIAR, the entire project is referred to as 'the Proposed Development' or the 'Proposed Development site', where relevant and shown in Figure 6-1.
- Where the term EIAR site boundary is used in this document or in figures this refers to the 'Proposed Development site'.
- The infrastructural layout of the Proposed Development is referred to as the 'Development Footprint',
- "Key Ecological Receptor" (KER) is defined as a species or habitat occurring within the zone of influence of the development upon which likely significant effects are anticipated.
- "Zones of Influence" (ZOI) for individual ecological receptors refers to the zone within which potential effects are anticipated. ZOIs differ depending on the sensitivities of particular habitats and species and were assigned in accordance with best available guidance and through adoption of a precautionary approach.



Map Legend

Ballynagare Wind Farm Study Area

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Drawing Title	
Site Location	
Project Title	
Ballynagare Wind Farm	
Drawn By: OOG	Checked By: PR
Project No.: 200512	Drawing No.: Figure 6.1
Scale: 1:54826	Date: 08.10.2021

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6.2 Requirements for Ecological Impact Assessment

National Legislation

The Wildlife Act, 1976–2019, is the principal piece of legislation governing protection of wildlife in Ireland. The Wildlife Act provides strict protection for species of conservation value. The Wildlife Act conserves wildlife (including game) and protects certain wild creatures and flora. These species are therefore considered in this report as ecological receptors. Natural Heritage Areas (NHAs) and Proposed Natural Heritage Areas (pNHAs) are heritage sites that are designated for the protection of flora, fauna, habitats and geological sites. Only NHAs are designated under the Wildlife (Amendment) Act 2017. These sites do not form part of the Natura 2000 network of European sites and the AA process, or screening for same, does not apply to NHAs or pNHAs. Proposed Natural Heritage Areas (pNHAs) were published on a non-statutory basis in 1995 but have not since been statutorily proposed or designated[1]. However, these sites are considered to be of significance for wildlife and habitats as they may form statutory designated sites in the future (NPWS, 2020).

The Flora (Protection) Order, 2015 (S.I. No. 356 of 2015) lists the species, hybrids and/or subspecies of flora protected under Section 21 of the Wildlife Acts. It provides protection to a wide variety of protected plant species in Ireland including vascular plants, mosses, liverworts, lichens and stoneworts. Under Flora Protection Order.

It illegal to cut, pick, collect, uproot or damage, injure or destroy species listed or their flowers, fruits, seeds or spores or wilfully damage, alter, destroy or interfere with their habitat (unless under licence).

National Policy

The National Biodiversity Action Plan 2017-2021 (Department of Culture, Heritage and the Gaeltacht, 2017) (the "**Plan**") demonstrates Ireland's continuing commitment to meeting and acting on its obligations to protect Ireland's biodiversity for the benefit of future generations through a series of targeted strategies and actions. The main objective of the Plan is to bring biodiversity into the mainstream of policy and decision-making. Objective 1 (*Mainstream biodiversity into decision-making across all sectors*) of the Plan identifies the following relevant measures in relation to future developments:

- "Incorporate into legislation the requirement for consideration of impacts on biodiversity to ensure that conservation and sustainable use of biodiversity are taken into account in all relevant plans and programmes and relevant new legislation;
- Public and Private Sector relevant policies will use best practice in SEA, AA and other assessment tools to ensure proper consideration of biodiversity in policies and plans;
- All Public Authorities and private sector bodies move towards no net loss of biodiversity through strategies, planning, mitigation measures, appropriate offsetting and/or investment in Blue-Green infrastructure;
- Strengthen ecological expertise in local authorities and relevant Government Departments and agencies;
- Local Authorities will review and update their Biodiversity and Heritage Action Plans;
- Local Authorities will review and update their Development Plans and policies to include policies and objectives for the protection and restoration of biodiversity;
- Develop a Green Infrastructure at local, regional and national levels and promote the use of nature-based solutions for the delivery of a coherent and integrated network;

[1] https://www.npws.ie/protected-sites/nha (accessed 23 January 2020).

- Continue to produce guidance on the protection of biodiversity in designated areas, marine and the wider countryside for Local Authorities and relevant sectors;
- Integrate Natura 2000 and Biodiversity financial expenditure tracking into Government Programmes internal paying agency management procedures including linkage to the Prioritised Action Framework and this NBAP;
- Develop a Natural Capital Asset Register and national natural capital accounts by 2020, and integrate these accounts into economic policy and decision-making;
- Initiate natural capital accounting through sectoral and small-scale pilot studies, including the integration of environmental and economic statistics using the framework of the UN System of Experimental-Ecosystem Accounting (SEEA);
- Establish a national Business and Biodiversity Platform under the CBD's Global Business Partnership;
- Ensure Origin Green produces tangible benefits for biodiversity with increased emphasis on conservation and restoration of biodiversity;
- Implement actions from Ireland's Biodiversity Climate Change Sectoral Adaptation Plan;
- Identify and take measures to minimise the impact of incentives and subsidies on biodiversity loss, and develop positive incentive measures, where necessary, to assist the conservation of biodiversity;
- Establish and implement mechanisms for the payments of ecosystem services including carbon stocks, to generate increased revenue for biodiversity conservation and restoration;
- Develop and implement a National Biodiversity Finance Plan to set out in detail how the actions and targets of this NBAP will be delivered from 2017 and beyond; and
- Monitor the implementation of the Plan"

Such policies have informed the evaluation of ecological features recorded within the Wind Farm study area and the ecological assessment process.

European Legislation

The EU Habitats Directive (92/43/EEC) (together with the Birds Directive (79/409/EEC), as subsequently codified by Council Directive 2009/147/EC on the conservation of wild birds) forms the cornerstone of Europe's nature conservation within the EU. It is built around two pillars: the Natura 2000 network of protected sites and the strict system of species protection. The Habitats Directive protects over 1,000 animal and plant species and over 200 "habitat types" (e.g. special types of forests, meadows, wetlands, etc.), which are of European importance. The Habitats Directive and Birds Directive, which were transposed into Irish law through Part XAB of the Planning and Development Acts 2000-2019 (from a land use planning perspective) recognise the significance of protecting rare and endangered species of flora and fauna, and more importantly, their habitats.

Annex I of the Habitats Directive lists habitat types whose conservation requires the designation of Special Areas of Conservation (SAC). Priority habitats, such as Turloughs, which are in danger of disappearing within the EU territory are also listed in Annex I. Annex II of the Directive lists animal and plant species (e.g. marsh fritillary *(Euphydryas aurinia)*, Atlantic salmon *(Salmo salar)*, and Killarney *fern (Trichomanes speciosum)* whose conservation also requires the designation of SAC. Annex IV lists animal and plant species in need of strict protection such as lesser horseshoe bat and otter, and Annex V lists animal and plant species whose taking in the wild and exploitation may be subject to management measures. In Ireland, species listed under Annex V include Irish hare *(Lepus timidus hibernicus)*, common frog *(Rana temporaria)* and pine marten *(Martes martes).* Species can be listed in more than one Annex, as is the case with otter *(Lutra lutra)* and lesser horseshoe bat *(Rhinolophus hipposideros*) which are listed on both Annex II and Annex IV. The disturbance of species under Article 12 of the Habitats Directive (and in particular avoidance of deliberate disturbance of Annex IV species, particularly during the period of breeding, rearing, hibernation and migration and avoidance of deterioration or destruction of breeding sites or resting places) has been specifically assessed in this EIAR.

In summary, the species and habitats provided National and International protection under these legislative and policy documents have been considered in this Ecological Impact Assessment. A detailed assessment of the likelihood of the proposed development having either a significant effect or an adverse impact on any relevant European Sites (i.e. SACs, cSACs) has been carried out in the Appropriate Assessment Screening Report and Natura Impact Statement. A separate assessment has not been carried out in this chapter, to avoid duplication of assessments. However, the relevant conclusions have been cross-referenced and incorporated.

6.3 Scoping/Review of Relevant Guidance and Sources of Consultation

The assessment methodology is based primarily upon the National Road Authority (NRA)'s Guidelines for Assessment of Ecological Impacts of National Road Schemes Rev 2 (NRA, 2009) (referred to hereafter as the NRA Ecological Impact Assessment Guidelines), and the survey methodology is based on the NRA Guidelines on Ecological Surveying Techniques for Protected Flora and Fauna on National Road Schemes (NRA, 2009). Although these survey methodologies relate to road schemes, these standard guidelines are recognised survey methodologies that ensure good practice regardless of the development type.

In addition, the following guidelines were consulted in the preparation of this document to provide the scope, structure and content of the assessment:

- Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater and Coastal (CIEEM, 2018).

This assessment has been carried out in accordance with the Environmental Impact Assessment guidance as outlined in Chapter 1 of the EIAR.

In addition to the above, the following legislation applies with respect to habitats, fauna and water quality in Ireland and has been considered in the preparation of this report:

- The International Convention on Wetlands of International Importance especially Waterfowl Habitat (Concluded at Ramsar, Iran on 2 February 1971)
- S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 and S.I. No. 722 of 2003 European Communities (Water Policy) Regulations 2003 which give further effect to EU Water Framework Directive (2000/60/EC).
- Planning and Development Acts 2000 – 2019.

The following legislation applies with respect to non-native species:

- Regulation 49 and 50 of European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477 of 2011).

This assessment has been prepared with respect to the various planning policies and strategy guidance documents listed below:

- Kerry County Development Plan 2015 – 2021.

The Development Plan is currently under review. The Issues Paper have been out on public consultation and this consultation has now ended. The draft Kerry County Development Plan 2022-2028 is scheduled to be published for consultation in Q4 2021.

6.3.1 Statement of Authority

Ecological baseline surveys, including bat surveys, were conducted by MKO ecologists; John Hynes (B.Sc., M.Sc MCIEEM), Olivia O' Gorman (B.Sc., M.Sc), Aoife Joyce (BSc., MSc.), Luke Dodebier (BSc.), All surveyors have relevant academic qualifications and experience in undertaking habitat and ecological assessments.

Bat survey data was compiled and assessed by Aoife Joyce and Luke Dodebier. The final bat report was prepared by Aoife Joyce and reviewed by John Hynes (B.Sc., M.Sc., MCIEEM).

This EIAR chapter has been prepared by Olivia O' Gorman (B.Sc., M.Sc) and reviewed by John Hynes (B.Sc., M.Sc., MCIEEM). Olivia is an experienced ecologist with over 5 years professional experience. John is an experienced ecologist who has over 8 years' professional experience in environmental management and ecological assessment.

6.4 Methodology

The following sections describe the methodologies followed to establish the baseline ecological condition of the proposed development site and surrounding area. Assessing the impacts of any project and associated activities requires an understanding of the ecological baseline conditions prior to and at the time of the project proceeding. Ecological Baseline conditions are those existing in the absence of proposed activities (CIEEM, 2018).

6.4.1 Desk Study

The desk study undertaken for this assessment included a thorough review of available ecological data including the following:

- Review of online web-mappers: National Parks and Wildlife Service (NPWS), EPA (Envision), Water Framework Directive (WFD) and Inland Fisheries Ireland (IFI).
- Data on potential occurrence of protected bryophytes – as per NPWS online map viewer; Flora Protection Order Map Viewer – Bryophytes[2].
- Review of the publicly available National Biodiversity Data Centre (NBDC) web-mapper
- Inland Fisheries Ireland (IFI) Reports, where available.
- Records from the NPWS web-mapper and review of specially requested records from the NPWS Rare and Protected Species Database for the hectads in which the Proposed development is located.
- Review of existing reports and assessments in relation to the current project

6.4.2 Scoping and Consultation

MKO undertook a scoping exercise during preparation of this EIAR, as described in Chapter 2, Section 2.6 of this EIAR.

Copies of all scoping responses are included in Appendix 2-3 of this EIAR. The recommendations of the consultees have informed the EIAR preparation process and the contents of this chapter. Table 2.3

[2] NPWS, 2019, Online map viewer; Flora Protection Order Map Viewer – Bryophytes. Online, Available at: http://dahg.maps.arcgis.com/apps/webappviewer/index.html?id=71f8df33693f48edbb70369d7fb26b7e, Accessed: 26/06/2019.

in Chapter 2 of this EIAR describes where the comments raised in the scoping responses received have been addressed in this assessment.

6.4.3 Field Surveys

A comprehensive survey of the biodiversity of the entire site was undertaken on May, July and September 2020 and April, June, September and October 2021. The following sections fully describe the ecological surveys that have been undertaken and provide details of the methodologies, dates of survey and guidance followed.

6.4.3.1 Multi-disciplinary Walkover Surveys (as per NRA Guidelines, 2009)

Prior to the commencement of multidisciplinary walkover surveys of the Proposed Development the habitats within the site were mapped using aerial photographs.

Multidisciplinary walkover surveys were undertaken 11th May, 26th May, 02nd July, 16th July, 09th September, 11th September and 24th September 2020 and on 1st April, 18th June, 21st June, 1st September and 8th October 2021. The Proposed Development site was systematically and thoroughly walked in a ground-truthing exercise with the habitats on the Proposed Development assessed, classified and sketched onto field maps. The grid connection route options were surveyed on the 18th June, 21st of June, 1st September and 8th October 2021.

Survey timings fall within the recognised optimum period for vegetation surveys/habitat mapping, i.e. April to September (Smith *et al.*, 2011). Comprehensive walkover surveys of the Proposed Development were completed.

The walkover surveys were also designed to detect the presence, or likely presence, of a range of protected species. The survey included a search for badger setts and areas of suitable habitat, potential features likely to be of significance to bats and additional habitat features for the full range of other protected species that are likely to occur in the vicinity of the proposed development (e.g. otter etc.). In addition, an inventory of other species of local biodiversity interest was compiled including invertebrates (butterflies, dragonflies, damselflies, beetles), plants, fungi etc.

The multi-disciplinary walkover surveys comprehensively covered the entire Wind Farm Study Area and based on the survey findings, further detailed targeted surveys were carried out for features and locations of ecological significance. These surveys were carried out in accordance with NRA *Guidelines on Ecological Surveying Techniques for Protected Flora and Fauna* on National Road Schemes (NRA, 2009).

During the multidisciplinary surveys, a search for Invasive Alien Species (IAS) listed under the Third Schedule of the European Communities Regulations 2011 (S.I. 477 of 2015) was conducted.

Other targeted survey methodologies undertaken at the Proposed Development site are described in the following subsections.

6.4.3.2 Dedicated Habitat and Vegetation Composition Surveys

The walkover surveys were undertaken in order to ground truth the habitats within the proposed development site. Detailed habitat classification and assessment was undertaken by MKO at targeted locations within the development footprint, with relevés undertaken within representative habitats at each turbine base, substation, borrow pits etc. Relevés were 2x2 metres for all habitats. The extent of each habitat within the Proposed Development site was mapped on site using aerial photography, hand-held GPS and smartphone technology. A representative photograph was also taken for each of the habitats recorded on site.

All habitats recorded on site and described in this EIAR chapter have been classified in accordance with Fossitt (2000). In addition, grassland habitats outside of the proposed infrastructure footprint but within the study area are described in detail in this chapter. Full details of all the botanical surveys and results are provided in Appendix 6.1.

These surveys provided an understanding of the baseline and informed further survey work following finalisation of the proposed infrastructure layout. The habitat assessment surveys described in this report have been undertaken with reference to the following guidelines and interpretation documents:

- Perrin, P.M, Martin, J.R., Barron, J.R., Roche & O'Hanrahan, B. (2014) *Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland.* Version 2.0. Irish Wildlife Manuals, No. 79. National Parks and Wildlife Service.
- Cross, J. & Lynn, D. (2013) *Results of a monitoring survey of bog woodland.* Irish Wildlife Manuals, No. 69. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
- Fernandez, F., Connolly K., Crowley W., Denyer J., Duff K. & Smith G. (2014) Raised Bog Monitoring and Assessment Survey 2013. Irish Wildlife Manuals, No. 81. National Parks and Wildlife Service, Department of Arts, Heritage and Gaeltacht, Dublin, Ireland.
- Commission of the European Communities (2013) Interpretation manual of European Union habitats. Eur 28. European Commission DG Environment.
- Foss, P.J. & Crushell, P. 2008, *Guidelines for a National Fen Survey of Ireland, Survey Manual.* Report for the National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Ireland.
- NPWS (2013) The Status of EU Protected Habitats and Species in Ireland. Habitat Assessments Volume 2. Version 1.1. Unpublished Report, National Parks and Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
- NPWS (2019). The Status of EU Protected Habitats and Species in Ireland. Volume 2: *Habitat Assessments*. Unpublished NPWS report. Edited by: Deirdre Lynn and Fionnuala O'Neill

Habitats considered to be of ecological significance and in particular having the potential to correspond to those listed in Annex I of the EU Habitats Directive 92/43/EEC were identified and classified as Key Ecological Receptors (KERs).

Plant nomenclature for vascular plants follows '*New Flora of the British Isles*' (Stace, 2010), while mosses and liverworts nomenclature follows '*Mosses and Liverworts of Britain and Ireland - a field guide*' (British Bryological Society, 2010).

6.4.3.3 Terrestrial Fauna Surveys

The results of the desk study, scoping replies, incidental records of protected species during ecological survey work and multidisciplinary walkover surveys were used to inform the scope of targeted ecological surveys required. Dedicated surveys for bats, otter and badger were undertaken at the times set out below with the methodologies followed also provided below. During the multidisciplinary walkover surveys, evidence of any other mammalian species including hare, pine marten and red squirrel, and occurrences of invertebrates including butterflies, damselflies, dragonflies, moths, beetles etc. were recorded and no requirement for further, more dedicated surveys for these species was identified. Given the known occurrence of the marsh fritillary butterfly in the area, this species was also focused on during the study area visits with dedicated surveys undertaken on 11th September 2020 and 1st April 2021 to determine the occurrence, distribution of the species within the study area.

6.4.3.3.1 Badger Survey

Areas identified as providing potential habitat for badger were subject to specialist targeted survey on 1st April, 18th June and 21st June 2021.

The badger surveys covered the entire development footprint and surrounding suitable habitats in the study area. The badger survey was not constrained by vegetation given the nature of the habitats within the site and the timing of the surveys (NRA 2006a).

The badger surveys were conducted in order to determine the presence or absence of badger signs within and outside (areas of identified suitable habitat) the development footprint and study area. This involved a search for all potential badger signs as per NRA (2009) (latrines, badger paths and setts). If encountered, setts would be classified as per the convention set out in NRA (2009) (i.e. main, annexe, subsidiary, outlier).

The badger survey was conducted adhering to best practice guidance (NRA, 2009) and followed the *'Guidelines for the Treatment of Badger Prior to the Construction of National Roads Schemes'* (NRA, 2006a) and CIEEM best practice competencies for species surveys (CIEEM, 2013[3]).

6.4.3.3.2 Otter Survey

Areas identified as providing potential habitat for otter, i.e., watercourses within and in close proximity to the Proposed Development site, were subject to specialist targeted survey. Potential habitat for otter was noted during the initial site survey in 2020 and a dedicated otter survey of watercourses was conducted on the 11th of September 2020, 18th June and 21st June 2021. The purpose of the visits was to survey the windfarm study area and grid connection route for any evidence of otter in proximity to the development footprint.

All otter surveys were conducted as per NRA (2009) guidelines (Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes). This involved a search for all otter signs e.g. spraints, scat, prints, slides, trails, couches and holts. The survey extended 150m upstream and downstream of the watercourse as per NRA guidelines. In addition to the width of the rivers/watercourses, a 10m riparian buffer (both banks) was considered to comprise part of the otter habitat (NPWS 2009). The dedicated otter survey also followed the guidance as set out in NRA (2008) *'Guidelines for the Treatment of Otters Prior to the Construction of National Roads Schemes'* and following CIEEM best practice competencies for species surveys (CIEEM, 2018).

There are a total of 7 EPA mapped stream crossings along the proposed grid connection route. There will be no requirement for instream works. The grid connection routes were surveyed for Otter on the 18th June, 21st June 2021, 1st September and 8th October 2021.

6.4.3.3.3 Marsh Fritillary Surveys

Following the identification of suitable habitat for marsh fritillary within the site during habitat surveys, targeted surveys for the species were undertaken by MKO on the 11th September 2020 and 1st April 2021. The survey methodology followed that described in the NRA (2009) best practice guidance document. This involved walked surveys to identify suitable areas of marsh fritillary habitat within or adjacent to the development footprint. Where suitable habitat did occur, detailed surveys to locate larval webs were undertaken.

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[3] CIEEM, 2013, Technical Guidance Series – Competencies for Species Survey, Online, Available at: https://cieem.net/resource/competencies-for-species-survey-css/ Accessed: 20.06.2019

6.4.3.3.4 Bat Surveys

In August 2021, NatureScot (formerly Scottish Natural Heritage), published *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation* (NatureScot, 2021). The 2021 version supersedes the 2019 version of the guidance. The purpose of the guidance is to help planners, developers and ecological consultants to consider the potential effects of onshore wind energy developments on bats. The emphasis is on direct impacts such as collision mortality, but there is reference throughout to the need for a full impact assessment requiring wider consideration of other (indirect) effects. The Guidance replaces previous guidance on the subject; notably that published by Natural England and Chapter 10 of the Bat Conservation Trust publication, *Bat Surveys: Good Practice Guidelines (2nd edition),* (Hundt, 2012) and tailors the generic EUROBATS guidance on assessing the impact of wind turbines on European bats (Rodrigues *et al.* (2014)). The document guides the user through the key elements of survey, impact assessment and mitigation.

The NIEA (NED) recently published *Guidance on Bat Surveys, Assessment and Mitigation for Onshore Wind Turbine Developments in Northern Ireland*. This new guidance follows and builds upon the recently updated NatureScot 2021 guidance. The latter guidance has set the industry standard since its publication in 2019. The NED guidance does not aim to replace the NatureScot guidance, but it does provide additional clarifications and recommendations regarding survey requirements and impact assessment in an Irish context.

The survey scope and assessment provided in this report are in accordance with NatureScot 2021 Guidance. The mitigation outlined in this report is in accordance with NIEA, 2021.

Bat Habitat Suitability Appraisal

Bat walkover surveys were carried out throughout 2020. During these surveys, habitats within the site were assessed for their suitability to support roosting, foraging and commuting bats. Connectivity with the wider landscape was also considered. Suitability was assessed according to Collins (2016) which provides a grading protocol for roosting habitats and for commuting and foraging areas. Suitability categories are divided into *High, Moderate, Low* and *Negligible* are described fully in **Appendix 1** of the Bat Report, provided as **Appendix 6-2**.

Roost Surveys

A search for roosts was undertaken within 200m plus the rotor radius (i.e. 75m) of the boundary of the Proposed Development footprint (NatureScot, 2021). The aim was to determine the presence of roosting bats and the need for further survey work or mitigation. The site was visited in May, July and September 2020. A walkover was carried out and all structures and trees were assessed for their potential to support roosting bats (see **Appendix 1** for criteria in assessing roosting habitats).

Any potential roost sites were subject to a roost assessment. This comprised a detailed inspection of the exterior and interior (if accessible) to look for evidence of bat use, including live and dead specimens, droppings, feeding remains, urine splashes, fur oil staining and noises.

Any potential tree roosts were examined for the presence of rot holes, hazard beams, cracks and splits, partially detached bark, knot holes, gaps between overlapping branches and any other potential roost features (i.e. PRFs) identified by Andrews (2018).

No structures or trees with PRFs were identified within 275m of the Proposed Development footprint.

One structure was identified within the wider site (Grid Ref: Q 90463 32419) and was subject to a roost assessment on 11th May and 2nd July 2020. A dusk emergence survey was carried out on the night of the 11th May 2020. Two surveyors were equipped with Bat Logger M bat detectors (Elekon AG, Lucerne, Switzerland). Conditions were suitable for bat surveys; dry, warm (13˚C), calm (Beaufort

Force 1). The emergence survey commenced half an hour before sunset and lasted for 1.5 hours. The purpose was to identify any bat species, numbers, access points and roosting locations within the structure.

Manual Transects

Manual activity surveys comprised walked transects at dusk. A series of representative transect routes were selected throughout the Proposed Development Site. The aim of these surveys was to identify bat species using the site and gather any information on bat behaviour and important features used by bats. Transect routes were prepared with reference to the proposed layout, desktop and walkover survey results as well as any health and safety considerations and access limitations. As such, transect routes generally followed existing roads and tracks. Transect routes are presented in **Appendix 6-2**.

Transects were walked by two surveyors, recording bats in real time. Dusk surveys commenced 30 minutes before sunset and were completed for 3 hours after sunset. Surveyors were equipped with active full spectrum bat detectors, the Batlogger M bat detector (Elekon AG, Lucerne, Switzerland), and all bat activity was recorded for subsequent analysis to confirm species identifications. Transects surveys were undertaken in Spring, Summer and Autumn 2020. Table 3-1 of the Bat Report (**Appendix 6.2**) summarises survey effort in relation to walked transects.

Ground-level Static Surveys

Where developments have more than 10 turbines, NatureScot requires 1 detector per turbine up to 10 plus a third of additional turbines. Given that 7 turbines were proposed 7 detectors were deployed to ensure compliance with NatureScot guidance. Detectors were numbered utilising an initial indicative layout that included 9 turbines. The extent of the Proposed Development changed through the design process, and the number of turbines reduced by 2. The final layout includes 7 turbines. The detector locations achieved a good spatial spread in relation to the proposed turbines and sampled the range of available habitats.

Automated bat detectors were deployed at 7 no. locations for at least 10 nights in 2020 in each of spring (April-May), summer (June-mid August) and autumn (mid-August-October) (NatureScot, 2021). Detector locations were based on indicative turbine locations and differ slightly to the final proposed layout. Detector locations achieved a representative spatial spread in relation to proposed turbines and sampled the range of available habitats. Table 3-2 in **Appendix 6-2** describes the locations of static detectors and Figure 3-4 (**Appendix 6-2**) presents static detector locations in relation to the final proposed layout.

Full spectrum bat detectors, Song Meter SM4BAT (Wildlife Acoustics, Maynard, MA, USA), were employed using settings recommended for bats, with minor adjustments in gain settings and band pass filters to reduce background noise when recording. Detectors were set to record from 30 minutes before sunset until 30 minutes after sunrise. The Song Meter automatically adjusts sunset and sunrise times using the Solar Calculation Method when provided with GPS coordinates.

Onsite weather monitoring was undertaken concurrently with static detector deployments. One Vantage Pro 2 (Davis Instruments, CA, UCS) was deployed each season and night-time hourly data was tracked remotely to ensure a sufficient number of nights (i.e., minimum 10 no.) with appropriate weather conditions were captured (i.e., dusk temperatures above 8°, wind speeds less than 5m/s and no or only very light rainfall). Table 3-3 of the bat report (**Appendix 6-2**) summarises survey effort achieved in 2020 for each of the 7 no. detector locations.

6.4.3.4 Aquatic surveys

Habitat suitability surveys for protected aquatic species of conservation interest which are known or suspected to occur within the wind farm study area (e.g. fish species, otter etc.) were conducted.

Neither the Proposed Development site nor the Grid Connection route are not located within a freshwater pearl mussel catchment as mapped and neither the highly managed silty watercourses within the proposed development site nor the Cashen Estuary provided suitable habitat for Freshwater Pearl mussel and as such no further assessment was required. Aquatic habitats and species were assessed during the multi-disciplinary walkover surveys. Watercourses within and adjacent to the Proposed Development site were assessed during the multi-disciplinary walkover survey.

6.4.3.5 Invasive species survey

During the multi-disciplinary walkover surveys, a search for non-native invasive species was undertaken. The survey focused on the identification of invasive species listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (As Amended) (S.I. 477 of 2015).

6.4.4 Methodology for Assessment of Impacts and Effects

6.4.4.1 Identification of Target Receptors and Key Ecological Receptors

The methodology for assessment followed a precautionary screening approach with regard to the identification of Key Ecological Receptors (KERs). Following a comprehensive desk study, initial site visits (main ecological surveys of the Proposed Development site undertaken 21st June 2018, 28th September 2018, 21st and 22nd August 2019, 1st October 2019 and 5th December 2019, not including bat surveys) and stakeholder consultation; "Target receptors" likely to occur in the zone of influence of the development were identified. The target receptors included habitats and species that were protected under the following legislation:

- Annexes of the EU Habitats Directive
- Qualifying Interests (QI) of Special Areas of Conservation (SAC) within the likely zone of impact.
- Species protected under the Wildlife Acts 1976-2019
- Species protected under the Flora Protection Order 2015

6.4.4.2 Determining Importance of Ecological Receptors

The importance of the ecological features identified within the wind farm study area was determined with reference to a defined geographical context. This was undertaken following a methodology that is set out in Chapter 3 of the 'Guidelines for Assessment of Ecological Impacts of National Roads Schemes' (NRA, 2009). These guidelines set out the context for the determination of value on a geographic basis with a hierarchy assigned in relation to the importance of any particular receptor. The guidelines provide a basis for determination of whether any particular receptor is of importance on the following scales:

- International
- National
- County
- Local Importance (Higher Value)
- Local Importance (Lower Value)

The Guidelines clearly set out the criteria by which each geographic level of importance can be assigned. Locally Important (lower value) receptors contain habitats and species that are widespread and of low ecological significance and of any importance only in the local area. Internationally Important sites are either designated for conservation as part of the Natura 2000 Network (SAC or SPA) or provide the best examples of habitats or internationally important populations of protected flora and fauna. Specific criteria for assigning each of the other levels of importance are set out in the guidelines and have been followed in this assessment. Where appropriate, the geographic frame of reference set out above was adapted to suit local circumstances. In addition, and where appropriate, the conservation status of habitats and species is considered when determining the significance of ecological receptors.

Any ecological receptors that are determined to be of National or International, County or Local importance (Higher Value) following the criteria set out in NRA (2009) are considered to be Key Ecological Receptors (KERs) for the purposes of ecological impact assessment if there is a pathway for effects thereon. Any receptors that are determined to be of Local Importance (Lower Value) are not considered to be Key Ecological Receptors.

6.4.4.3 Characterisation of Impacts and Effects

The proposed development will result in a number of direct and indirect impacts. The ecological effects of these impacts are characterised as per the CIEEM 'Guidelines for Ecological Impact Assessment in the UK and Ireland' (2018). These guidelines are the industry standard for the completion of Ecological Impact Assessment in the UK and Ireland. This chapter has also been prepared in accordance with the corresponding EPA guidance (EPA 2017). The headings under which the impacts are characterised follow those listed in the guidance document and are applied where relevant. A summary of the impact characteristics considered in the assessment is provided below:

- **Positive or Negative.** Assessment of whether the proposed development results in a positive or negative impact on the ecological receptor.
- **Extent.** Description of the spatial area over which the impact has the potential to occur.
- **Magnitude** Refers to size, amount, intensity and volume. It should be quantified if possible and expressed in absolute or relative terms e.g. the amount of habitat lost, percentage change to habitat area, percentage decline in a species population.
- **Duration** is defined in relation to ecological characteristics (such as the lifecycle of a species) as well as human timeframes. For example, five years, which might seem short-term in the human context or that of other long-lived species, would span at least five generations of some invertebrate species.
- **Frequency and Timing.** This relates to the number of times that an impact occurs and its frequency. A small-scale impact can have a significant effect if it is repeated on numerous occasions over a long period.
- **Reversibility.** This is a consideration of whether an effect is reversible within a 'reasonable' timescale. What is considered to be a reasonable timescale can vary between receptors and is justified where appropriate in the impact assessment section of this report.

6.4.4.4 Determining the Significance of Effects

The ecological significance of the effects of the proposed development are determined following the precautionary principle and in accordance with the methodology set out in Section 5 of CIEEM (2018).

For the purpose of Ecological Impact Assessment (EcIA), 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features' or for biodiversity in general. Conservation objectives may be specific (e.g. for a designated site) or broad (e.g. national/local nature conservation policy) or more wide-ranging (enhancement of biodiversity). Effects can be considered significant at a wide range of scales from international to local (CIEEM, 2018).

When determining significance, consideration is given to whether:

- Any processes or key characteristics of key ecological receptors will be removed or changed
- There will be an effect on the nature, extent, structure and function of important ecological features
- There is an effect on the average population size and viability of ecologically important species.
- There is an effect on the conservation status of important ecological habitats and species.

The EPA draft Guidelines on information to be included in Environmental Impact Assessment Reports (EPA, 2017) and the *Guidelines for assessment of Ecological Impacts of National Road Schemes*, (NRA, 2009) were also considered when determining significance and the assessment is in accordance with those guidelines.

The terminology used in the determination of significance follows the suggested language set out in the Draft EPA Guidelines (2017) as shown in 6.1.

Table 6- 1 Criteria for determining significance of effect, based on (EPA, 2017) guidelines

Effect Magnitude	Definition
No change	No discernible change in the ecology of the affected feature.
Imperceptible effect	An effect capable of measurement but without noticeable consequences.
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight effect	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate effect	An effect that alters the character of the environment that is consistent with existing and emerging trends.
Significant effect	An effect which, by its character, its magnitude, duration or intensity alters a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
Profound effect	An effect which obliterates sensitive characteristics.

As per TII (NRA, 2009) and CIEEM (2018) best practice guidelines, the following key elements should also be examined when determining the significance of effects:

- The likely effects on 'integrity' should be used as a measure to determine whether an impact on a site is likely to be significant (NRA, 2009).
- A 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives (CIEEM, 2018).

Integrity

In the context of EcIA, 'integrity' refers to the coherence of the ecological structure and function, across the entirety of a site, that enables it to sustain all of the ecological resources for which it has been valued (NRA, 2009). Impacts resulting in adverse changes to the nature, extent, structure and function of component habitats and effects on the average population size and viability of component species, would affect the integrity of a site, if it changes the condition of the ecosystem to unfavourable.

Conservation status

An impact on the conservation status of a habitat or species is considered to be significant if it will result in a change in conservation status. According to CIEEM (2018) guidelines the definition for conservation status in relation to habitats and species are as follows:

- Habitats – conservation status is determined by the sum of the influences acting on the habitat that may affect its extent, structure and functions as well as its distribution and its typical species within a given geographical area
- Species – conservation status is determined by the sum of influences acting on the species concerned that may affect its abundance and distribution within a given geographical area.

As defined in the EU Habitats Directive 92/43/EEC, the conservation of a habitat is favourable when:

- Its natural range, and areas it covers within that range, are stable or increasing
- The specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future
- The conservation status of its typical species is favourable.

The conservation of a species is favourable when:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats
- The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future
- There is and will probably continue to be, a sufficiently large habitat to maintain its population on a long-term basis.

According to the NRA/CIEEM methodology, if it is determined that the integrity and/or conservation status of an ecological feature will be impacted on, then the level of significance of that effect is related to the geographical scale at which the impact will occur (i.e. local, county, national, international).

6.4.4.5 Incorporation of Mitigation

Section 6.5 of this EIAR assesses the potential effects of the proposed development to ensure that all effects on sensitive ecological receptors are adequately addressed. Where significant effects on sensitive ecological receptors are predicted, mitigation is incorporated into the project design or layout to address such impacts. The implemented mitigation measures avoid or reduce or offset potential significant residual effects, post mitigation.

6.4.4.6 Limitations

The information provided in this assessment accurately and comprehensively describes the baseline ecological environment following surveys on numerous dates during all seasons, provides an accurate prediction of the likely ecological effects of the proposed development; prescribes best practice and mitigation as necessary; and describes the residual ecological impacts. The specialist studies, analysis and reporting have been undertaken in accordance with the appropriate guidelines. The habitats and species on the site were readily identifiable and comprehensive assessments were made during the field visit. No significant limitations in the scope, scale or context of the assessment have been identified.

6.5 Establishing the Ecological Baseline

6.5.1 Desk Study

The following sections describe the results of a survey of published material that was consulted as part of the desk study for the purposes of the ecological assessment. It provides a baseline of the ecology known to occur in the existing environment. Material reviewed includes the Site Synopses for designated sites within the zone of influence, as compiled by the National Parks and Wildlife Service (NPWS) of the Department of Culture, Heritage and the Gaeltacht, bird and plant distribution atlases and other research publications.

6.5.1.1 Designated Sites

6.5.1.1.1 *Identification of the Designated Sites within the Likely Zone of Influence of the Proposed Development*

The potential for the proposed development to impact on sites that are designated for nature conservation was considered in this Ecological Impact Assessment.

Special Areas of Conservation (SACs) are designated under the EU Habitats Directive. The Special Protection Areas for Birds (SPAs) are considered in Chapter 7 (Ornithology). The potential for adverse impacts resulting in significant effects on the integrity of European Sites is fully assessed in the AA Screening Report and Natura Impact Statement that accompanies this application. As per EPA draft Guidance 2017, *"a biodiversity section of an EIAR, should not repeat the detailed assessment of potential effects on European sites contained in a Natura Impact Statement"* but should *"incorporate their key findings as available and appropriate"*. Section 6.6.2 of this EIAR provides a summary of the key assessment findings with regard to European Designated Sites.

Natural Heritage Areas (NHAs) are designated under Section 18 the Wildlife (Amendment) Act 2000 and their management and protection is provided for by this legislation and planning policy. The potential for effects on these designated sites is fully considered in this EcIA.

Proposed Natural Heritage Areas (pNHAs) were designated on a non-statutory basis in 1995 but have not since been statutorily proposed or designated. However, the potential for effects on these designated sites is fully considered in this EcIA.

The following methodology was used to establish which sites that are designated for nature conservation have the potential to be impacted by the proposed development:

- Initially the most up to date GIS spatial datasets for European and Nationally designated sites and water catchments were downloaded from the NPWS website (www.npws.ie) and the EPA website (www.epa.ie) on the 10/03/2021. The datasets were utilised to identify Designated Sites which could feasibly be affected by the proposed development.
- All designated sites within a distance of 15km surrounding the development site were identified. In addition, the potential for connectivity with European or Nationally designated sites at distances of greater than 15km from the proposed development was also considered in this initial assessment.
- A map of all the European Sites within 15km is provided in Figure 6.2 with all Nationally designated sites shown in Figure 6.3.
- Table 6.2 provides details of all relevant Nationally designated sites as identified in the preceding steps and assesses which are within the likely Zone of Impact. Table 6.3 provided details of all relevant European Designated Sites. These sites are also

are fully described and assessed in the Screening for Appropriate Assessment and Natura Impact Statement reports submitted as part of this planning application.

- The designation features of these sites, as per the NPWS website (www.npws.ie), were consulted and reviewed at the time of preparing this report 25/05/2021.

Table 6- 2 Identification of Nationally designated sites within the Likely Zone of Impact

Designated Site	Distance from Proposed Development (km)
There are no Natural Heritage Areas (NHA) within the likely zone of impact	
Proposed Natural Heritage Area (pNHA)	
Cashen River Estuary pNHA [001340]	0 km from wind farm site and 2.7km from both grid connection route.
Moanveanlagh Bog pNHA [000374]	12.3 km from wind farm site and 10.1km from grid connection route..
Akeragh, Banna And Barrow Harbour pNHA [000332]	13 km from wind farm site and 14.9km from both grid connection route.
Beal Point pNHA [001335]	14.8 km from wind farm site and 17.7km from grid connection route.
Ballylongford Bay pNHA [001332]	14.9 km from wind farm site and 15.5km from grid connection route.
Dooneen Wood pNHA [001349]	20.6 km from wind farm site and 14.5km from grid connection route.

Moanveanlagh Bog pNHA [000374], Akeragh, Banna and Barrow Harbour pNHA [000332], Beal Point pNHA [001335], Ballylongford Bay pNHA [001332] and Dooneen Wood pNHA [001349] are either designated for terrestrial habitats or there is no connectivity between the proposed development site and the pNHA given this location and separation distance from the proposed development site.

The Cashen River Estuary pNHA [001340] is located immediately adjacent to the proposed development with hydrological connectivity via Monument, Dysert Marshes and Ballyoween watercourses. On a precautionary basis, this site is considered to be within the likely impact zone of the proposed development. There is no pathway for connectivity between the proposed development and any other pNHAs.

Map Legend

- Ballynagare Wind Farm Study Area
- 15km Buffer Zone
- Proposed National Heritage Area (pNHA)
- Hydrological Catchments

Drawing Title: National sites within 15km Buffer Zone	
Project Title: Ballynagare Wind Farm	
Drawn By: OOG	Checked By: PR
Project No.: 200512	Drawing No.: Figure 6-3
Scale: 1:195000	Date: 08.10.2020

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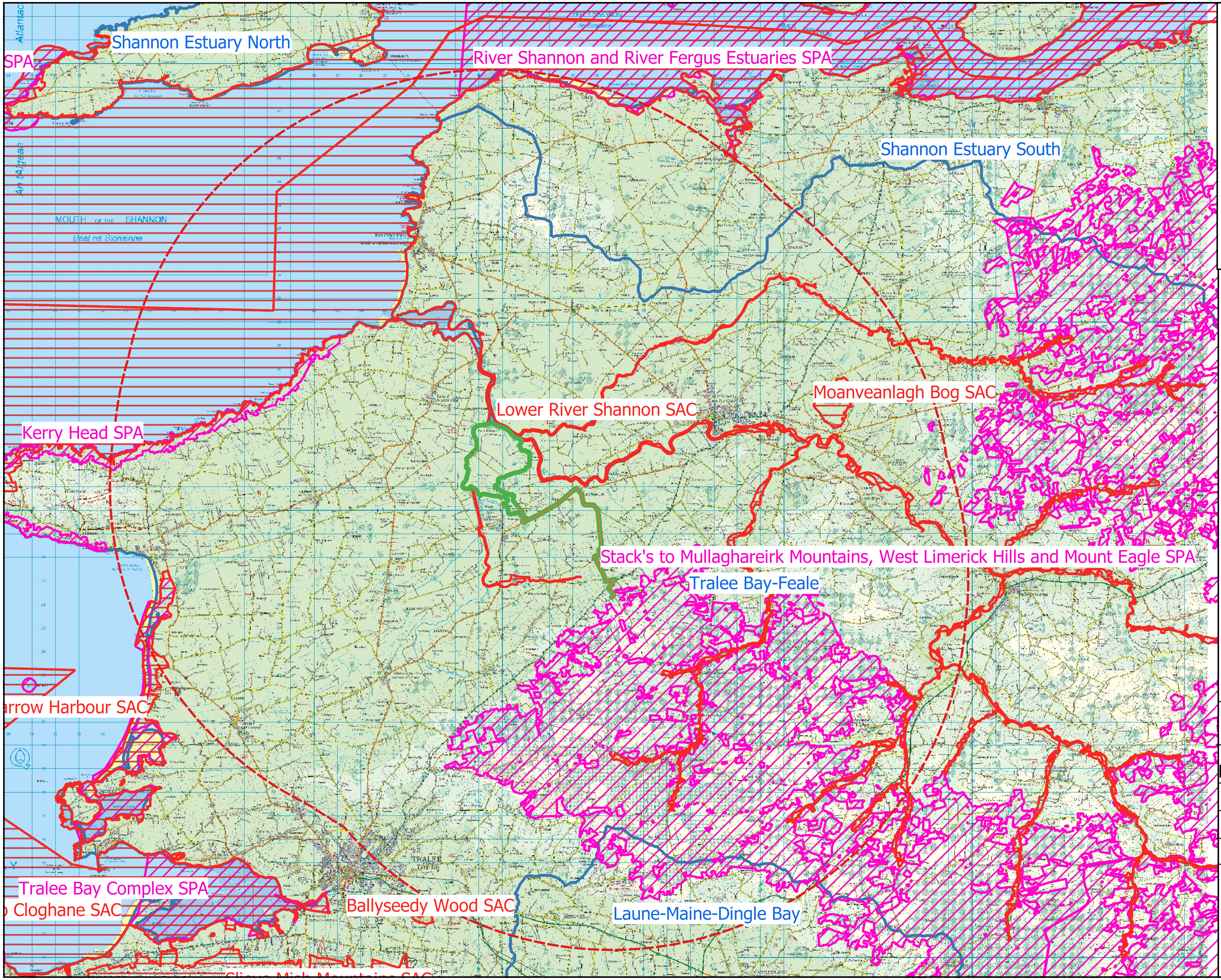

Map Legend

- Ballynagare Wind Farm Study Area
- 15km Buffer Zone
- Grid Connection Route
- Hydrological Catchments
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)

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Drawing Title	European Designated sites within 15km Buffer Zone
Project Title	Ballynagare Wind Farm
Drawn By: OOG	Checked By: PR
Project No.: 200512	Drawing No.: Figure 6-2
Scale: 1:210000	Date: 08.10.2021

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Table 6- 3 Identification of European designated sites within the Likely Zone of Impact

<table>
<tr><th>European Sites and distance from proposed development</th><th>Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 19/06/2021</th><th>Conservation Objectives</th><th>Likely Zone of Impact Determination</th></tr>
<tr><td colspan="4">Special Areas of Conservation (SAC)</td></tr>
<tr><td>Lower River Shannon SAC [002165]

Distance: 0m from windfarm site.</td><td>› Sandbanks which are slightly covered by sea water all the time [1110]
› Estuaries [1130]
› Mudflats and sandflats not covered by seawater at low tide [1140]
› Coastal lagoons* [1150]
› Large shallow inlets and bays [1160]
› Reefs [1170]
› Perennial vegetation of stony banks [1220]
› Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]
› Salicornia and other annuals colonizing mud and sand [1310]
› Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330]
› Mediterranean salt meadows (Juncetalia maritimi) [1410]
› Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion Vegetation [3260]
› Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) [6410]
› Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)*[91EO]</td><td>Detailed conservation objectives for this site, (Version 1.0, August 2012), were reviewed as part of the assessment and are available at www.npws.ie</td><td>The European site is located directly adjacent to the proposed windfarm site

No pathway for impact exists in relation to the following terrestrial and coastal QIs of the European site, which are not recorded in the vicinity of the proposed development.

› Sandbanks which are slightly covered by sea water all the time [1110]
› Mudflats and sandflats not covered by seawater at low tide [1140]
› Coastal lagoons* [1150]
› Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) [6410]
› Perennial vegetation of stony banks [1220]
› Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]
› Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330]
› Mediterranean salt meadows (Juncetalia maritimi) [1410]
› Salicornia and other annuals colonizing mud and sand [1310]

The Freshwater Pearl Mussel [1029] population for which the SAC is designated is located in the Cloon River in County Clare (See Map 15 of the NPWS Conservation Objective Document). Given that the proposed development is located within a separate hydrological sub-catchment to the SAC designed population (EPA, 2020), there is no hydrological connectivity between the development site and the SAC population. Therefore, no potential pathway for impact exists.</td></tr>
</table>

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 19/06/2021	Conservation Objectives	Likely Zone of Impact Determination
	- Bottlenose Dolphin *(Tursiops truncates)* [1349] - Freshwater Pearl Mussel *(Margaritifera margaritifera)* [1029] - Sea Lamprey *(Petromyzon marinus)* [1095] - Brook Lamprey *(Lampetra planeri)* [1096] - River Lamprey *(Lampetra fluviatilis)* [1099] - Atlantic Salmon *(Salmo salar)* (only in fresh water) [1106] - Otter *(Lutra lutra)* [1355]		There is hydrological connectivity between the proposed development and this European site via the onsite watercourses – Ballyouneen [EPA code: 23B32), Dysert Marshes [EPA code: 23D19] and Monument [EPA code: 23M41]. Therefore, a potential pathway for indirect effect has been identified via deterioration of water quality in relation to the following QI's; - Reefs [1170] - Estuaries [1130] - Sandbanks which are slightly covered by sea water all the time [1110] - Large shallow inlets and bays [1160] - Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* Vegetation [3260] - Alluvial forests with *Alnus glutinosa* and Fraxinus excelsior (*Alno-Padion, Alnion incanae, Salicion albae*)*[91EO] - Bottlenose Dolphin (*Tursiops truncates*) [1349] - Sea Lamprey (*Petromyzon marinus*) [1095] - Brook Lamprey (*Lampetra planeri*) [1096] - River Lamprey (*Lampetra fluviatilis*) [1099] - Atlantic Salmon (*Salmo salar*) (only in fresh water) [1106] - Otter (*Lutra lutra)* [1355] The windfarm site is located immediately adjacent to the SAC. Therefore, taking precautionary approach the potential for disturbance to Otter requires further assessment. **This site is within the Likely Zone of Impact and further assessment will be provided in the Natura Impact Statement.**

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 19/06/2021	Conservation Objectives	Likely Zone of Impact Determination
Moanveanlagh Bog SAC [0022351] **Distance:** 12.2 km	- Active raised bogs [7110] - Degraded raised bogs still capable of natural regeneration [7120] - Depressions on peat substrates of the *Rhynchosporion* [7150]	Detailed conservation objectives for this site, (Version 1, Dec 2015), were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct impacts on the QI's of this European site as the proposed development site is located 12.2 km from the SAC. This site is designated for terrestrial peatland habitats. The development site and the SAC are in separate River Sub-basins (EPA 2020) and there is no hydrological connectivity. Therefore, there is no potential for indirect impacts which would result in the deterioration of water quality. **This site is not within the Likely Zone of Impact and does not require further assessment.**
Akeragh, Banna and Barrow Harbour SAC [000332] **Distance:** 13.0 km	- Annual vegetation of drift lines [1210] - Salicornia and other annuals colonising mud and sand [1310] - Atlantic salt meadows *(Glauco-Puccinellietalia maritimae)* [1330] - Mediterranean salt meadows *(Juncetalia maritimi)* [1410] - Embryonic shifting dunes [2110] - Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120] - Fixed coastal dunes with herbaceous vegetation (grey dunes)* [2130] - Humid dune slacks [2190] - European dry heaths [4030]	Detailed conservation objectives for this site, (Version 1, Jan 2017), were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct impacts on the QI's of this European site as the proposed development is located entirely outside and 8.8km from the SAC. This site is designated for coastal, shoreline habitats. The development site and the SAC are in separate River Sub-basins (EPA 2020) and there is no hydrological connectivity. Therefore, there is no potential for indirect impacts which would result in the deterioration of water quality. **This site is not within the Likely Zone of Impact and does not require further assessment.**
Ballyseedy Wood SAC [002351]	- Alluvial forests with *Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)** [91E0]	Generic conservation objectives for this site, (Version 8, March 2021),	There will be no direct impacts on the QIs of this European site as the proposed development is located 17.0 km from the SAC.

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 19/06/2021	Conservation Objectives	Likely Zone of Impact Determination
Distance: 17.0 km		were reviewed as part of the assessment and are available at www.npws.ie	This site is designated for terrestrial alluvial woodland habitat. The development site and the SAC are in separate River Sub-basins (EPA 2020) and there is no hydrological connectivity. Therefore, there is no potential for indirect impacts which would result in the deterioration of water quality. **This site is not within the Likely Zone of Impact and does not require further assessment.**

6.5.1.2 NPWS Article 17 Reporting

A review of the Irish Reports for Article 17 of the Habitats Directive (92/42/EEC), including the Heath, Bogs and Mires, Irish Semi-Natural Grassland Survey datasets, National Survey of Native Woodlands and Ancient and Long-Established Woodland datasets were conducted prior to undertaking the multi-disciplinary walkover survey.

Available NPWS datasets were downloaded and overlain on the proposed development study area. Estuaries [1130] was identified as being immediately adjacent to the EIAR Study Area. Old Oak Woodland [91A0] was identified approximately 440 meters to the east of Grid Option 1.

A review of Article 17 reporting in relation to species was conducted. Area of mapped Marsh Fritillary habitat were identified within the proposed development study boundary. These areas of Marsh Fritillary habitat were in the vicinity of the proposed development footprint associated with T4.

6.5.1.3 Vascular plants

A search was made in the New Atlas of the British and Irish Flora (Preston *et al*, 2002) to investigate whether any rare or unusual plant species listed under Annex II of the EU Habitats Directive, The Irish Red Data Book - 1 Vascular Plants (Curtis, 1988) or the Flora (Protection) Order (1999, as amended 2015) had been recorded in the relevant 10km squares in which the study site is situated (Q83 and Q93). Each hectad contains 100 whole one kilometre squares containing terrestrial habitats. Species of conservation concern are given in Table 6.3. No species listed in Annex II of the Habitats Directive or the Flora (Protection) Order are shown in the atlas for squares Q83 and Q93.

Table 6- 4 Species listed designated under the Flora Protection Order or the Irish Red Data Book within Hectad Q83 & Q93

Common Name	Scientific Name	Hectad	Status
Triangular Club-rush	*Schoenoplectus triqueter*	Q83	NT
Darnel Ryegrass	*Lolium temulentum*	Q93	EN
Least Bur-reed	*Sparganium natans*	Q83	NT
Dwarf spike-rush	*Eleocharis parvula*	Q83, Q93	CR
Fragrant Agrimony	*Agrimonia procera*	Q83, Q93	NT
Marsh Mallow	*Althaea officinalis*	Q83	NT
Yellow bartsia	*Parentucellia viscosa*	Q83	NT
Green Field-speedwell	*Veronica agrestis*	Q93	NT

Near Threatened (NT), Vulnerable (VU), Critically Endangered (CR), Regionally Extinct (RE)

6.5.1.4 Bryophytes

A search of the NPWS online data map for bryophytes (NPWS, 2018) was also undertaken with one protected bryophytes, *Pallavicinia lyellii,* recorded approximately 12.7km north-east of the proposed development site.

6.5.1.5 National Biodiversity Data Centre (NBDC) Records

A search of the National Biodiversity Data Centre (NBDC) website was conducted on the 11/06/2021. This helped to inform survey effort and provide a baseline of likely species composition in the area. Records of protected fauna recorded from hectads Q83 and Q93 are provided in Table 6.4.

Table 6- 5 NBDC records for species of conservation interest in hectads Q83 and Q93

Common name	Scientific name	Designation	Hectad
Marsh fritillary	*Euphydryas aurinia*	HD Annex II	Q83, Q93,
Common frog	*Rana temporaria*	HD Annex V, WA	Q83, Q93,
Common lizard	*Zootoca vivipara*	WA	Q83
Lesser noctule	*Nyctalus leisleri*	HD Annex IV, WA	Q83, Q93,
Brown long-eared bat	*Plecotus auritus*	HD Annex IV, WA	Q93,
Daubenton's bat	*Myotis daubentonii*	HD Annex IV, WA	Q83, Q93,
Natterer's bat	*Myotis nattereri*	HD Annex IV, WA	Q93
Common pipistrelle	*Pipistrelle (Pipistrellus pipistrellus sensu lato)*	HD Annex IV, WA	Q83, Q93,
Soprano pipistrelle	*Pipistrellus pygmaeus*	HD Annex IV, WA	Q93,
Otter	*Lutra lutra*	HD Annex II, IV, WA	Q83, Q93,
Freshwater pearl mussel	*Margaritifera margaritifera*	HD Annex II, V, WA	Q93
Smooth newt	*Lissotriton vulgaris*	WA	Q93,
Badger	*Meles meles*	WA	Q83, Q93,
Eurasian Red squirrel	*Scuirus vulgaris*	WA	Q93,
Eurasian pygmy shrew	*Sorex minutus*	WA	Q93
European hedgehog	*Erinaceus europaeus*	WA	Q83, Q93

HD = EU Habitats Directive; WA = Wildlife Acts (Ireland).

6.5.1.6 NPWS

National Parks and Wildlife Service (NPWS) online records were searched to see if any rare or protected species of flora or fauna have been recorded from hectads Q83 and Q93. An information request was also sent to the NPWS scientific data unit requesting records from the Rare and Protected Species Database on the 19^{6h} June 2021. A response was received on the 28th June 2021. Table 6.6 lists rare and protected species records obtained from NPWS.

Table 6- 6 NPWS records for rare and protected species

Common name	Scientific name	Designation	Hectad
Otter	*Lutra Lutra*	HD Annex II, IV, WA	Q83, Q93
Sea Lamprey	*Petromyzon marinus*	HD Annex II	Q93
Freshwater Pearl Mussel	*Margaritifera margaritifera*	HD Annex II, V, WA	Q93
Common frog	*Rana temporaria*	HD Annex V, WA	Q93
Marsh Fritillary	*Euphydryas aurinia*	HD Annex II	Q83, Q93
Pygmy Shrew	*Sorex minutus*	WA	Q93
Badger	*Meles meles*	WA	Q83, Q93
Hedgehog	*Erinaceus europaeus*	WA	Q93
Dwarf Spike-rush	*Eleocharis parvula*	RL	Q83, Q93
Triangular Club-rush	*Schoenoplectus triqueter*	RL	Q83, Q93
Darnel	*Lolium temulentum*	EN	Q93
Corncockle	*Agrostemma githago*	-	Q83

FPO = Flora Protection Order; RL = Red List, VU = Vulnerable, WA = Wildlife Act

6.5.1.7 Freshwater Pearl Mussel (*Margaritifera margaritifera)*

The NPWS *Margaritifera* Sensitive Area map (Version 8, 2017) was consulted during the desk study. The proposed development is located approximately 12.6 km downstream of a '*catchment of other extant populations'*.

There are 5 watercourse crossings associated with the grid connection however, no instream works are required at any of the watercourse crossing locations along the grid connection route.

6.5.1.8 Inland Fisheries Ireland Data

The proposed development site drains northward into the Feale River. The Feale River flows to the Lower River Shannon SAC. A search of the Inland Fisheries Ireland (IFI) online database was carried out to determine the species richness of the Feale River. The results are presented in Table 6.7.

The Feale watercourse is located within the Tralee Bay-Feale water catchment and is hydrologically connected to the proposed development. The Upper Feale Estuary provides suitable habitat for a variety of aquatic species including European eel (*Anguilla anguilla*), brown trout (*Salmo trutta*), sea trout *(Salmo trutta trutta),* salmon, flounder, three-spined stickleback and minnow (The Central and Regional Fisheries Board, 2008).

The River Feale is listed in the first schedule of the '*European Communities (Quality of Salmonid Waters) Regulations, 1988* (S.I. No. 293) as a 'salmonid water' and therefore, is an important river for Atlantic Salmon (*Salmo salar*) and also Sea Trout (*Salmo trutta* morpha *trutta*).

Brook and River Lamprey have been recorded within the main Feale Catchment around Listowel and Fingue (O' Connor, 2006). Sea Lamprey (*Petromyzon marinus*) were also recorded within the River

Feale between Listowel and the open sea. O' Connor (2006) recorded a total of 97 juvenile sea lampreys and 280 river/brook juveniles within a total fished area of 165 m^2 with the highest densities of lamprey species occurring in the lower reaches of the river between Duagh and Listowel. It is noted that some gravel and cobble were removed upstream of the Duagh Bridge during this period and that the river was displaying enrichment with substantial growth of filamentous algae in the vicinity of Listowel.

O' Connor (2006) state that the River Brick and Lixnaw canal were subject to preliminary assessment and that no suitable lamprey habitat / electrical fishing sites were found due to poor access and therefore were not further assessed.

All three species of lamprey are listed in Annex II of the Habitats Directive while Atlantic Salmon is listed in Annexes II and V of the EU Habitats Directive and in the Irish Red List for reptiles, amphibians and freshwater fish (King *et al.*, 2011) as Vulnerable and European Eel is listed as Critically Endangered in the Irish Red List.

Table 6- 7 Water quality monitoring stations and associated Q values

Station Location and Name	Grid Reference	Q Status	Assessment Year
Feale [EPA Code: 23F01] - Finuge Bridge	E95135.87, N132124.31	Q-Value 3-4 - Moderate	2020
Galey [EPA Code: 23G01] - Br d/s Inch Br	E94164.38, N134362.52	Q-Value 3 - Poor	2020
Brick [EPA Code: Br W of Garrynagore	E87828.34, N125477.46	Q-Value 3-4 - Moderate	2020

6.5.1.9 Invasive Species

The NBDC database also contains records of invasive species identified within the relevant hectad. Records of 'high impact' invasive species for hectads Q83 and Q93 are provided in Table 6.8.

Table 6- 8 NBDC records for invasive species (hectads Q83 and Q93)

Common Name	Scientific Name	Hectad
Canadian waterweed	*Elodea canadensis*	Q93
Indian Balsam	*Impatiens glandulifera*	Q83, Q93
Japanese knotweed	*Fallopia japonica*	Q83, Q93
American Skunk-cabbage	*Lysichiton americanus*	Q83
Common Cord-grass	*Spartina anglica*	Q83
Three-cornered garlic	*Allium triquetrum*	Q93
Cherry laurel	*Prunus laurocerasus*	Q93
Harlequin ladybird	*Harmonia axyridis*	Q93
Sika deer	*Cervus nippon*	Q93,

American Mink	*Mustela vison*	Q83
Brown rat	*Rattus norvegicus*	Q93

Regulations 49 and 50 of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477 of 2011) include legislative measures to deal with the introduction, dispersal, dealing in and keeping of non-native species.

Japanese knotweed (*fallopian japonica*) and Rhododendron (*rhododendron ponticum*) are two species subject to restrictions under Regulations 49 and 50 and are included in the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011).

6.5.1.10 Baseline Hydrology

The proposed development site is located in the Tralee Bay-Feale surface water catchment (IEGBNISH) within Hydrometric Area 23 of the Shannon River Basin District. A regional hydrology map is shown in Figure 9.1, Chapter 9 of this EIAR.

The proposed development site is located in the Tralee Bay-Feale catchment (Catchement_23) and Brick sub-catchment (Brick_SC_010). The development is located within following river sub basins; Brick_030, Brick_040, Smearlagh_040, Mountcoal_010, Feale_080, Feale_090.

The Monument watercourse (EPA code: 23M41) flows northward through the western section of the proposed development site. The Monument watercourse flows to the Brick watercourse (EPA code: 23B03) which flows in a north-eastward direction the Cahen Estuary. The Cashen Estuary classified as a transitional watercourse. There are a number of watercourses classified as lowland/depositing rivers (FW2) or drainage ditches (FW4) within the proposed development site study area. These watercourses drain to the Cashen Estuary and therefore, to the Lower River Shannon SAC.

To the west of the proposed development, the Dysert Marshes [EPA code: 12D19] flows in a northward direction merging with the Ballyoween [EPA code: 23B32] which flows parallel to the Dysert Marshes watercourse. Both watercourses flow in a northward direction and drain to the Cashen Estuary and to the Lower River Shannon SAC.

6.5.1.10.1 *Water Quality*

River Basin Management Plans (RBMPs) have been published for all River Basin Districts in Ireland in accordance with the requirements of the Water Framework Directive. The online EPA Envision map viewer provides access to water quality information at individual waterbody status for all the River Basin Districts in Ireland. The EPA Envision map viewer was consulted on 17th June 2020 regarding the water quality status of the river which run within and directly adjacent to the Study Area. The Transitional Waterbody WFD Status 2013-2018 for the watercourses which flow through/adjacent to the site have been assessed in Table 6.9.

Table 6- 9 Watercourses on site with relevant water quality statuses

Name	Location	Status	Risk
Cashen	Located to the north-west of the site.	Poor	At risk
Upper Feale Estuary	Located to the south east of the site.	Poor	At risk

Status– WFD Risk Transitional Waterbody WFD Status 2013-2018, WFD Transitional Waterbodies Risk

Table 6.10 illustrates the respective Q-value status results from monitoring stations located along rivers which flow through the site or along rivers which are fed directly by watercourses which flow through or around the site.

Table 6- 10 Water quality monitoring stations and associated Q values

Watercourse Name	Sampling Station	Location	Sampling Year	Q-Value & Water Quality Status
Feale [EPA Code: 23F01]	Finue Bridge	E95135.87 N132124.31	2017	3-4 (Moderate)
	Feale_weir SW of Grenville	E96131.9 N132867	1991	3-4 (Moderate)
	0.1km d/s Racecourse Foot-bridge	E98160.87, N133598.58	2017	4 (Good)
	Feale - 2 km d/s Listowel Br (MID)	E98726, N133771	1987	3 (Poor)
Galey [EPA code: 23G01]	Br d/s Inch Br	E94164.38, N134362.52	2017	3 (Poor)
Brick [EPA code: 23B03]	Br W of Garrynagore	E87828.34, N125477.46	2017	3 (Poor)

6.5.1.11 Conclusions of the Desktop Study

The desktop study section provided information about the existing environment in Hectads Q83 & Q93, within which the proposed development is located. The proposed development is located within the Tralee Bay-Feale surface water catchment (IEGBNISH) located within Hydrometric Area 23 of the Shannon River Basin District.

The proposed development is located in the Tralee Bay-Feale catchment (Catchement_23) and the Brick sub-catchment (Brick_SC_010).). The development is located within following river sub basins; Brick_030, Brick_040, Smearlagh_040, Mountcoal_010, Feale_080, Feale_090.

There are a number of watercourses, which drain the wind farm study area to the Lower River Shannon SAC. The desktop study has provided information about the existing environment in Hectads Q83 & Q93, within which the proposed development site is located.

A number of watercourses that drain the wind farm study area and grid connection route lead to or occur within the following downstream EU Designated Sites and are further considered in the Natura Impact Statement prepared for the proposed development:

- Lower River Shannon SAC

The desk study identified that a variety of protected faunal species are known to occur within the wind farm study area, including bats, marsh fritillary, otter, badger. lamprey spp. and Atlantic salmon. The mammal species recorded during the desk study informed the survey methodologies undertaken during the site visits.

The desk study also provided useful information to inform the ecological surveys undertaken on site as well as the identification of pathways for potential impact on sensitive ecological receptors.

6.5.2 Ecological Walkover Survey Results

6.5.2.1 Description of Habitats and Flora within the Ecological Survey Area

The proposed development is located in Ballynagare, approximately 9km west of Listowel and approximately 2km north of Lixnaw County Kerry. The proposed development is located in the townlands of Ballynagare, Dysert Marshes, Dysert and Curraghcroneen. The approximate location for the centre of the proposed development is Irish Transverse Mercator (ITM) E489,500 N632,000. The proposed development covers an area of approximately 529 hectares.

The proposed development has an approximate elevation of between 2 and 5 metres above ordnance datum (m OD). The site is located close to the confluence of the River Feale and Brick River. The River Feale forms the northern boundary of the proposed development, while the Brick River forms the western boundary. The River Feale continues to flow northwest to discharge into the mouth of the Shannon estuary at Ballybunnion. The site is accessed via a number of local roads and bog tracks. From the south the site is accessed via local roads adjoining the R557 regional road which is located south of the site, which in turn adjoins the N69 National Secondary Road, south of Listowel. The south of the site can also be accessed from the west via a bridge over the Brick River.

The study area comprises 15 habitat types with the site predominately composed of cut-over bog (PB4) see Figure 6-4 (a) 'Habitat map'. Improved agricultural grassland (GA1) habitat surrounds the cut-over bog habitats with some of the agricultural areas having been reclaimed from peatland. The cut-over bog (PB4) habitat remains in use for turbary activities, and the vast majority of the habitat has been degraded by these activities. The cut-over habitat now shows variations in the vegetation which has begun to recolonise the area. Some areas of the habitat remaining relatively bare, with little vegetation. However, other areas have regenerated with Reed and large sedge swamp vegetation (FS1), peatland type vegetation including Purple-moor grass *(Molinia caerulea*), heather *(Calluna vulgaris),* Cross leaved Heath *(Erica tetralix),* Bog Myrtle *(Myrica gale)* and Bog Asphodel *(Narthecium ossifragum)* and also areas with scrub (WS1). There is a relatively small area of uncut raised bog habitat of approximately 2.9 ha, located to the west of the cut-over habitats and adjacent to the local access roadway. Although this habitat remains uncut, the drainage of the surrounding habitat has resulted in degradation of the habitat with low levels of Sphagnum present and a largely dry surface without pools and hummocks remaining.

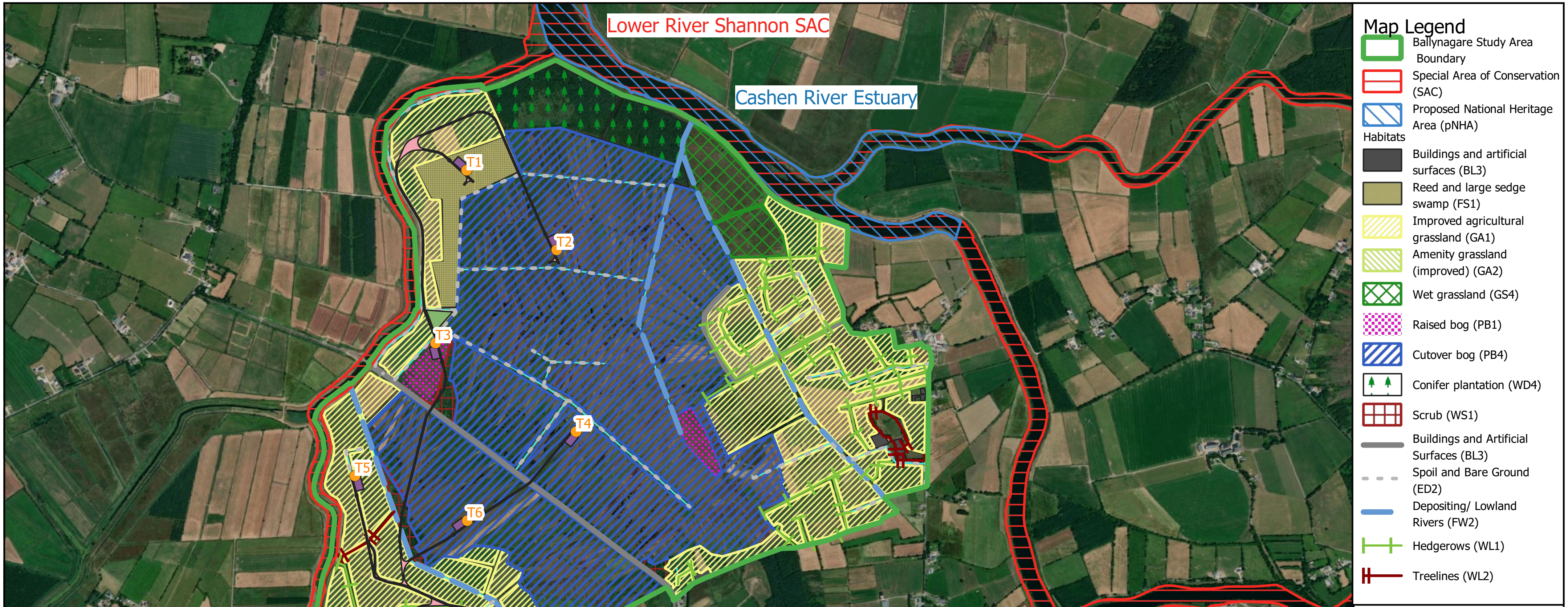
The additional habitats within the study area include conifer plantation (WD4), hedgerows (WL1), Treeline (WL2), spoil and bare ground (ED2), dry meadows and grassy verges (GS2), drainage ditches (FW4), depositing/lowland rivers (FW2) and buildings and artificial surfaces (BL3), see Figure 6-4 (a) 'Habitat map'. The Cashen Estuary (MW4) is located outside the northern boundary of the site.

The study area is drained by a number of watercourses and a network of drainage ditches that drain towards the Cashen Estuary at the northern end of the proposed development site. The site is surrounded by embankments and the drains pass through non return valves in the embankments to discharge to the estuary at low tide.

Figures 6.4 (b) the proposed development layout overlaid on the habitat mapping.

Table 6- 11 Habitats within the Study Area of the Proposed Development

Habitat	Approximate Area	Approximate % of study area
Improved agricultural grassland (GA1)	243.0	43.1
Wet Grassland (GS4)	14.1	2.5
Amenity Grassland	0.04	0.007
Cutover Bog (PB4)	236.5	41.4
Raised bog (PB1)	6.3	1.10
Reed and Large Sedge Swamp (FS1)	11.4	0.24
Conifer plantation (WD4)	20.3	3.5
Scrub (WS1)	5.2	0.9
Buildings and artificial surfaces (BL3)	3.2	0.56
Buildings and artificial surfaces (BL3) (linear)	1.8	0.32
Treelines (WL2)	1.2	0.21
Hedgerows (WL1)	10.3	1.8
Spoil and bare ground (ED2)	15.0	2.6
Depositing/lowland rivers (FW2)	3.1	0.54
Drainage ditches (FW4)	Associated with improved agricultural grassland and cut-over bog habitat	-
Dry meadows and grassy verges (GS2)	Associated with trackway and roadway verges	-



Drawing Title	
Habitat Map	
Project Title	
Ballynagare Wind Farm	
Drawn By: OOG	Checked By: PR
Project No.: 200512	Drawing No.: Figure 6.4(b)
Scale: 1:24119	Date: 08.10.2021

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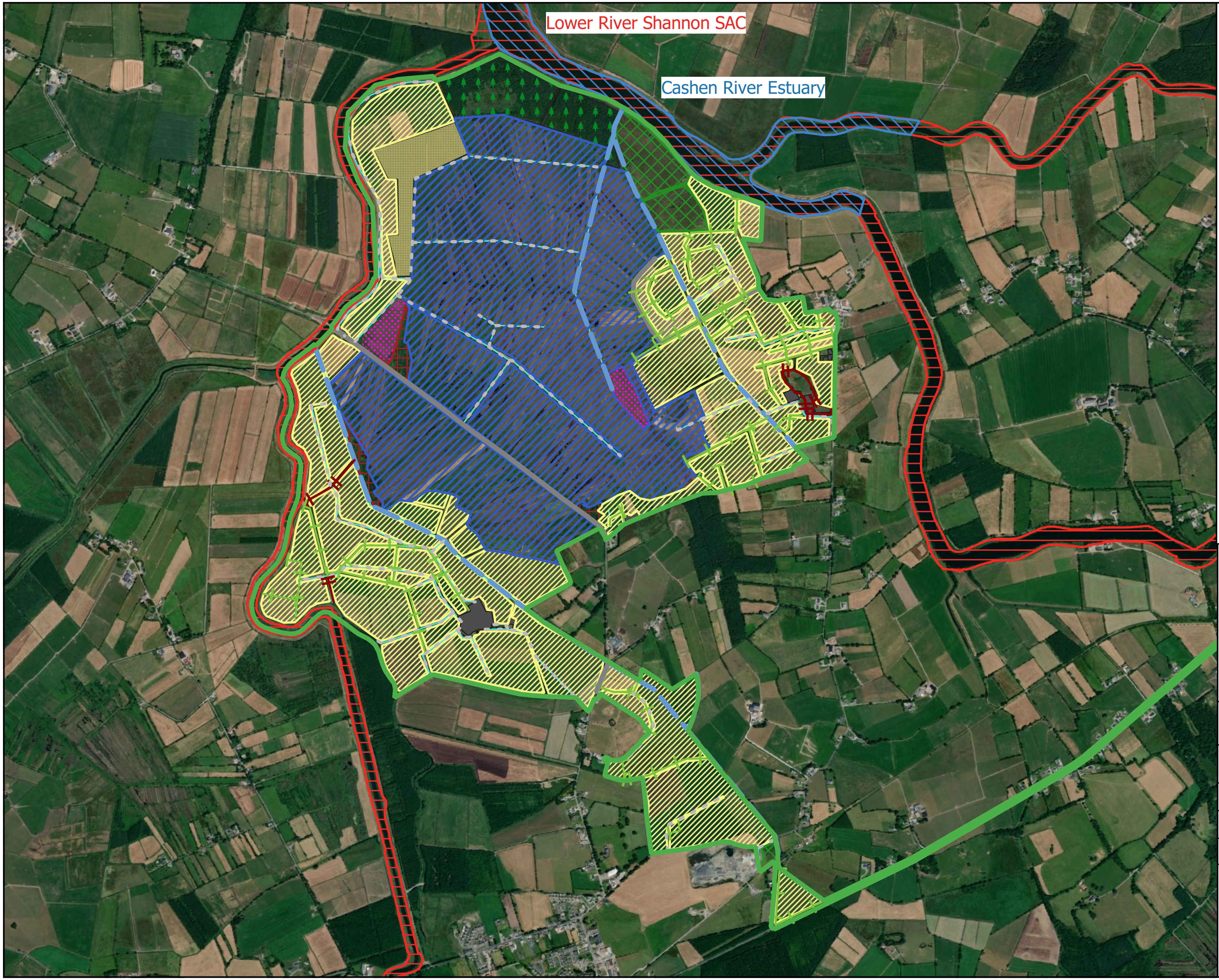

Map Legend

- Ballynagare Study Area Boundary
- Special Area of Conservation (SAC)
- Proposed National Heritage Area (pNHA)

Habitats

- Buildings and artificial surfaces (BL3)
- Reed and large sedge swamp (FS1)
- Improved agricultural grassland (GA1)
- Amenity grassland (improved) (GA2)
- Wet grassland (GS4)
- Raised bog (PB1)
- Cutover bog (PB4)
- Conifer plantation (WD4)
- Scrub (WS1)
- Buildings and Artificial Surfaces (BL3)
- Spoil and Bare Ground (ED2)
- Depositing/ Lowland Rivers (FW2)
- Hedgerows (WL1)
- Treelines (WL2)

N

Drawing Title

Habitat Map

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
OOG	PR
Project No.	**Drawing No.**
200512	Figure 6.4(a)
Scale	**Date**
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6.5.2.1.1 *Improved Agricultural Grassland (GA1)*

A large proportion of the study area is comprised of improved agricultural grassland (GA1). The majority of the grassland within the study area is under active agricultural management comprising of grazing or mowing practices including the grassland habitats associated with components of development footprint. The grassland habitats was dominated by grass species including Perennial Rye Grass (*Lolium perenne*), Yorkshire Fog (*Holcus lanatus*), Smooth meadow grass *(Poa pratensis sens lat.)* Broadleaf herbaceous species typically associated with improved agricultural grassland were recorded. These included White Clover (*Trifolium repens*), Creeping Buttercup (*Ranunculus repens*), Broadleaf dock (Rumex obtusifolius), Curled dock *(Rumex crispus spp.)* and soft rush *(Juncus effusus).*

A considerable amount of the proposed development infrastructure is located in improved agricultural grassland including two turbines (T5, T7), meteorological mast, construction compound, borrow pit and substation.

Plate 6- 1 Improved agricultural grassland (GA1) within the proposed study boundary

Plate 6- 2 Improved agricultural grassland (GA1) where the construction compound and substation will be located.

6.5.2.1.2 Wet Grassland (GS4)

Wet grassland habitat occurs in the north-east of the proposed development study site. This grassland is dominated by soft rush *(Juncus effusus)* while creeping buttercup *(Ranunculus repens),* daisy *(Bellis perennis*), and gorse *(Ulex europaeus)* were also recorded.

Plate 6- 3 Wet Grassland (GS4) within the proposed development study boundary.

6.5.2.1.3 Cutover Bog (PB4)

Large sections of the proposed development site are comprised of cutover peatland which has been used for peat extraction with areas of the proposed development site still used for turbary activities. The cutover bog has become revegetated in areas while it remains more sparsely vegetated in other sections of the site.

The cut-over bog habitat includes peatland species such as Purple moor grass *(Molinia caerulea)* and Bog Myrtle *(Myrica gale)*. Cross leaved heath *(Erica tetralix)*, Heather *(Calluna vulgaris)* and Common cotton grass *(Eriophorum angustifolium)* were frequently recorded across the cut-over peatland habitat within proposed study area. Royal Fern (*Osmunda regalis*) was abundant throughout the proposed development site. In additional orchid species including heath spotted orchid *(Dactylorhiza maculata)* and early marsh orchid *(Dactylorhiza incarnata ssp. pulchella*) were recorded within this habitat.

Within this habitat, Bracken (*Pteridium aquilinum*) and scrub including willow spp. and gorse (*Ulex europaeus*), have become established. Many areas of the older cutover habitat did not appear to have been cut for some years. However, there was still some small-scale peat extraction continuing in some parts.

It was assessed following the methodology set out in Irish Wildlife Manual 128 'The Habitats of Cutover Raised Bog' (NPWS 2020) and in no areas did it support conditions indicative of Active Raised Bog (7110)

There are 3 turbines (T2, T4, T6) located within this habitat type.

Plate 6- 4 Vegetated cutover bog (PB4).

6.5.2.1.4 Remnant Raised Bog (PB1)

There are two relatively small areas of uncut raised bog remaining within the study area. The areas are approximately 6.3 ha. One area is located adjacent to the local access road within the northwest of the Proposed Development while the other section is located to the southwest. The habitats surrounding these areas were subject to turbary activities with the wider area subject to drainage.

The vegetation is comprised of purple moor grass (*Molinia caerulea*), bog myrtle (*Myrica gale*), cross-leaved heath (*Erica tetralix*), bog asphodel *(Narthecium ossifragum),* common deergrass (*Trichophorum Sp.*), common cottongrass *(Eriophorum angustifolium),* harestail cottongrass (*Eriophorum vaginatum*) and Tormentil (*Potentilla erecta*). There were *Sphagnum* spp. occurring within the habitats however, these were not ubiquitous and were were sparse within the vegetation. Orchid species were recorded within this habitat including heath spotted orchid *(Dactylorhiza maculata)* and the O'Kelly variety of common spotted orchid *(Dactylorhiza fuchsii var. o'kellyi).*

The vegetated areas of remanent raised bog were not defined as active raised bog or classified as the Annex I habitat Degraded Raised bog still capable of natural regeneration [7120]. Only those areas with the correct combination of physical conditions (including surface shape, slope and drainage patterns) which are capable of supporting active raised bog are now considered as degraded raised bog (NPWS 2019). To be eligible for Annex I classification, the area must be capable of natural regeneration to active bog within 30 years if the hydrology is restored. Peatland habitats within and surrounding the proposed development footprint are degraded by turbary activity and reclamation and due to the extensive drainage network, small size of the remnant bog, its slope and surface shape and condition, it could not achieve the hydrological conditions necessary to support Active Raised Bog within 30 years.

The remnant intact habitat areas within the development footprint are classified as "supporting raised bog habitat" as they do not conform to active or degraded bog capable of natural regeneration. Peatland areas within the development footprint do not have the potential to revert to active peat forming systems within a 30-year timeframe (See further detail in Section 9.4.15.1 of the Hydrology Chapter).

Plate 6- 5 Raised bog (PB1) adjacent to the local access road.

6.5.2.1.5 Large reed and sedge swamp (FS1)

The cut-over bog habitat has regenerated into secondary habitat in places with a large section within the north of the site supporting swamp vegetation classified as large reed and sedge swamp (FS1). This habitat was wet underfoot and was comprised of species including Purple-moor grass *(Molinia caerulea*), Common Reed *(Phragmites australis),* Hard Rush *(Juncus inflexus),* Wild Angelica (*Angelica sylvestris),* Marsh woundwort *(Stachys palustris),* Devils bit scabious *(Succisa pratensis),* Bog Myrtle *(Myrica gale),* Star sedge *(Carex echinata),* Marsh cinquefoil *(Comarum palustre).* Pondweeds *(Potamogeton spp.)* occurred within the drainage channels which were densely vegetated.

Plate 6- 6 Area of reed and large sedge swamp (FS1)

6.5.2.1.6 Drainage Channels (FW4)

The study area has an extensive network of drains and channels that run throughout the Proposed Development. In areas within the site the drains are open and have little in channel or surrounding vegetation while in other areas the drains are surrounded by more dense vegetation with some channels supporting vegetation including common reed (*Phragmites australis*), Pondweeds (*Potamogeton spp.*) with small areas of Bulrush *(Typha latifolia).*

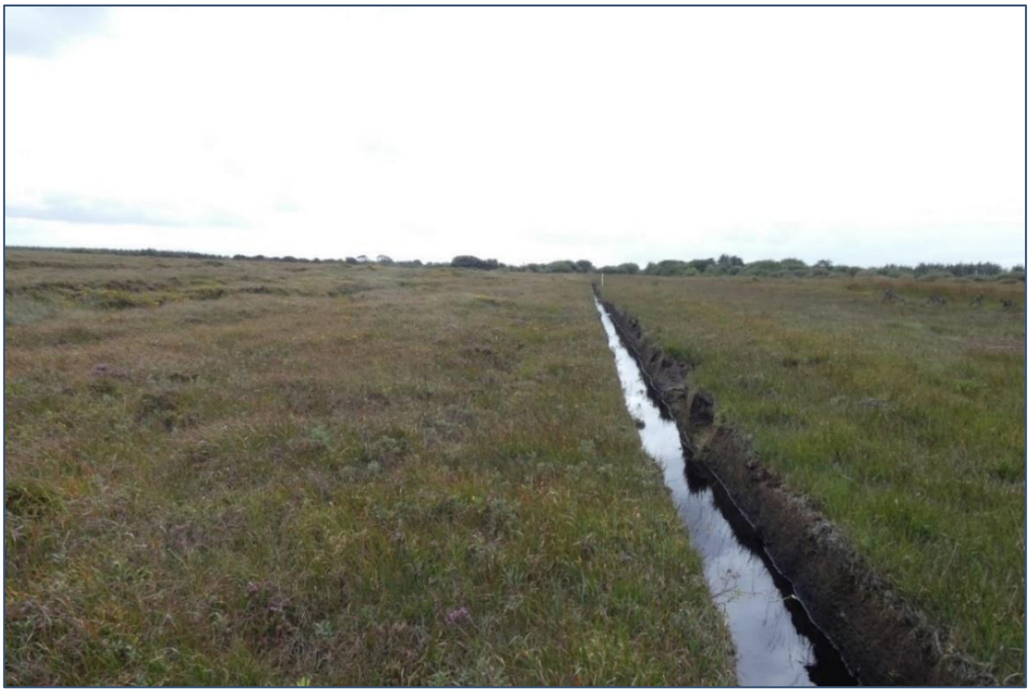


Plate 6- 7 Drainage Ditches (FW4) within the study area boundary.

6.5.2.1.7 Dry Meadows and Grassy Verges (GS2)

The network of trackways and made roadways were bordered by grassy verges classified as Dry Meadows and Grassy Verges (GS2) with a variety of grasses including Yorkshire fog (*Holcus lanatus*), cocks foot (*Dactylis glomerata*) and sweet vernal grass *(Anthoxanthum odoratum)* and broadleaf herbs such as red clover *(Trifolium pratense),* sliver weed *(Potentilla anserina),* meadow sweet *(Filipendula ulmaria),* oxeye daisy *(Leucanthemum vulgare),* broadleaf dock *(Rumex obtusifolius),* soft rush *(Juncus ffusus),* nettle (*Urtica dioica*) and bramble *(Rubus fructicosus agg.).*

Plate 6- 8 Dry meadows and grassy verges (GS2) along trackways within the study area boundary

6.5.2.1.8 Conifer Plantation (WD4)

There are two large blocks and one small block of coniferous forestry plantation within the proposed development study area. The plantation forestry is dominated by Sitka Spruce (*Picea sitchensis*). The forestry blocks were semi-mature plantation and was boarded by willow species in places.

Plate 6- 9 Coniferous Plantation within the study area boundary and surrounded by reed and large sedge swamp (FS1)

6.5.2.1.9 Scrub (WS1)

There are a number of areas of scrub within the proposed development study area which occurred within the cut-over peatland habitats and also along areas bordering this habitat and the agricultural grassland. This includes an area within the west of the Proposed Development adjacent to the Monument watercourse [EPA Code: 23M41]. The scrub habitats were typically comprised of Willow spp. including Grey Willow and Bramble (*Rubus fruticosus* agg.) with Royal Fern *(Osmunda regalis)* close to the watercourse.

Plate 6- 10 Scrub (WS1) habitat surrounded by an area of intact raised bog (BP1)

6.5.2.2 Buildings and artificial surfaces (BL3)

Local roads which have comprised of tarmacadam and any dwelling houses and agricultural buildings located within the study area are classified as Buildings and artificial surfaces (BL3).

Plate 6- 11 Made roadway within the site study boundary classified as buildings and artificial surfaces (BL3)

6.5.2.2.1 Spoil and bare ground (ED2)

The unpaved bog and agricultural tracks and roadways are classified as spoil and bare ground (ED2) and includes 14.1 km of gravelled roads and farm tracks. The trackways supported very little to no vegetation cover except for common grasses in limited areas.

Plate 6- 12 unpaved trackway within the study area boundary classified as spoil and bareground (ED2)

6.5.2.2.2 Depositing/Lowland Rivers (FW2)/Estuary (MW4)

The Proposed Development is drained by a number of watercourses. These streams are classified as depositing/lowland rivers.

The site is drained by a number of watercourses that surround the study area. The site is located in the Tralee Bay-Feale catchment (Catchement_23) and Brick sub-catchment (Brick_SC_010). The Monument watercourse (EPA code: 23M41) flows northward through the western section of the proposed development site. The Monument watercourse flows to the Brick watercourse (EPA code: 23B03) which flows in a north-eastward direction the Cashen Estuary. To the west of the proposed development study area, the Dysert Marshes [EPA code: 12D19] flows in a northward direction merging with the Ballyoween [EPA code: 23B32] which flows parallel to the Dysert Marshes watercourse.

The site is surrounded by embankments and the drains pass through non return valves in the embankments to discharge to the estuary (which is outside the site) at low tide.

Plate 6- 13 Monument watercourse [EPA code: 23M41] classified as Depositing/Lowland River (FW2)

Plate 6- 14 Cashen Estuary immediately adjacent to the study area boundary and to which the watercourse within the site drain (through non-return valves in embankments).

6.5.2.2.3 Hedgerows (WL2)

Approximately 9.4 kilometres of hedgerows was recorded along the field margins within the proposed study area many of which occur within agricultural grassland habitats. The species which occurred included Hawthorn *(Crataegus monogyna),* Rowan *(Sorbus aucuparia),* Dog Rose *(Rosa canina),* Bramble *(Rubus fruticosus agg.),* Nettle *(Urtica dioica),* Hogweed *(Heracleum sphondylium*) with occasional trees including Ash *(Fraxinus excelsior)* and Sycamore *(Acer pseudoplatanus).*

Plate 6- 15 Hedgerow (WL1) within improved agricultural grassland (GA1)

6.5.2.2.4 Treelines (WL2)

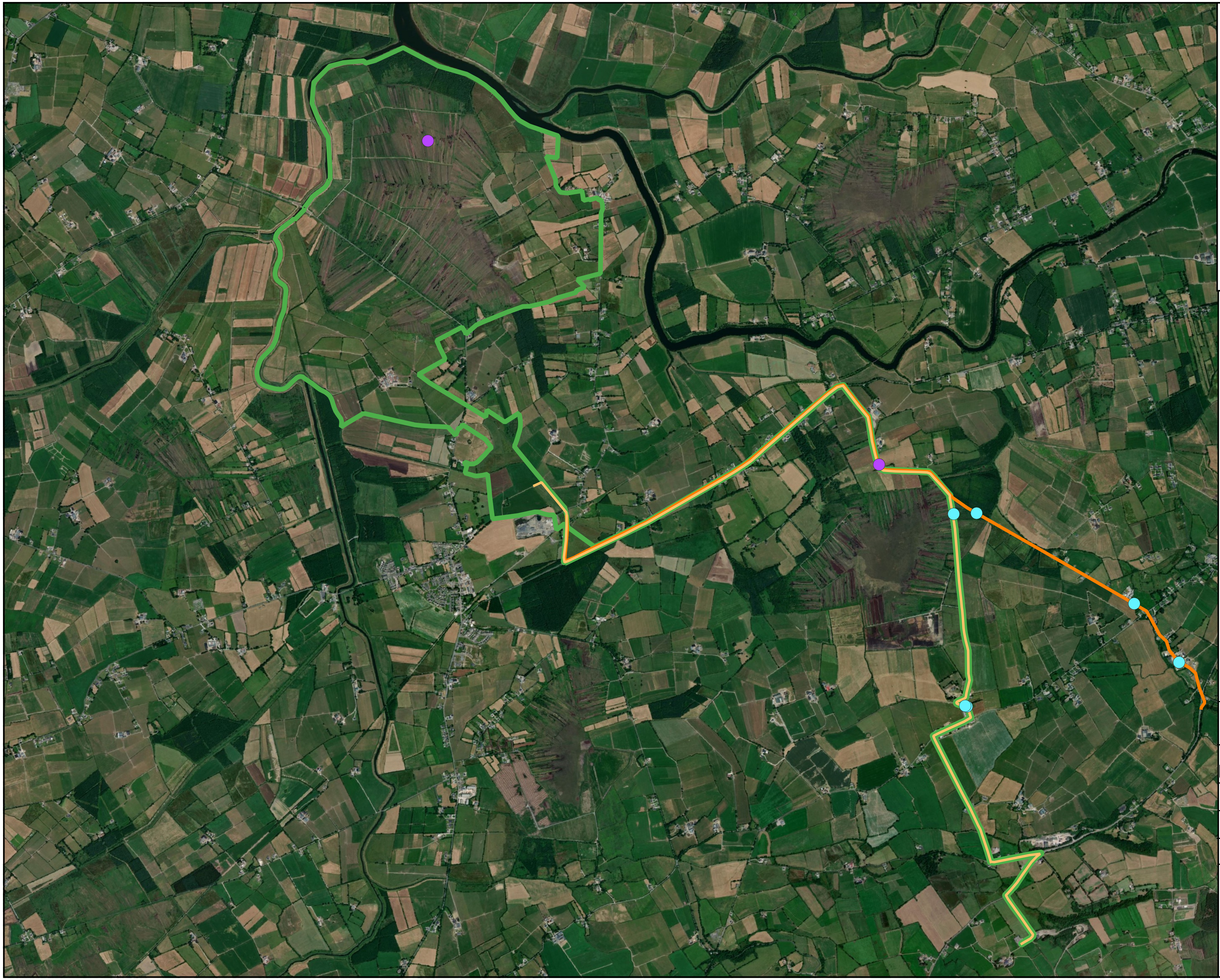
Treelines occurred within the study areas were comprised of Ash and conifer species. There was approximately 1.1 km of treeline within the study area.

6.5.2.2.5 Invasive species

Rhododendron (*Rhododendron ponticum),* a Third Schedule non-native species was recorded within the proposed development site. One individual plant was recorded within the cut-over bog habitat and this individual including a 7m buffer zone, are avoided by the proposed development footprint.

A number of infestations of Rhododendron (*Rhododendron ponticum*) and Japanese Knotweed *(Fallopia japonica)* were recorded along the proposed grid connection route options. Along grid connection route A, Japanese Knotweed was recorded adjacent to the road corridor within an agricultural grassland field. Rhododendron was recorded within hedgerow associated with dwellings while Japanese Knotweed was recorded along the grassy verges of the road corridor.

The locations of the infestations are mapped in Figure 6-5. Details of all infestations are provided in Table 6-12 below.



Map Legend

- Ballynagare Wind Farm Study Area
- Grid Connection Route
- Local Turbine Delivery Route

Invasive species

- Japanese Knotweed
- Rhododendron

N

Drawing Title	
Invasive Species	
Project Title	
Ballynagare Wind Farm	
Drawn By: OOG	Checked By: PR
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Table 6- 12 Location of invasive species

ID Ref	Species	Grid ref	Details
Proposed Development Study Site			
PD1	Rhododendron *(Rhododendron ponticum)*	489712, 633013	Located within the cut-over bog habitat.
Grid Connection Route/Turbine Delivery Route			
CG101	Japanese Knotweed *(Fallopia japonica)*	94088, 124877	Recorded adjacent to roadway.
GC102	Japanese Knotweed *(Fallopia japonica)*	94197, 128272	Recorded adjacent to roadside, Extensive stand
GC103	Japanese Knotweed *(Fallopia japonica)*	94177, 128278	Recorded adjacent to roadside, Extensive stand
T/GCR104	Rhododendron *(Rhododendron ponticum)*	93466, 130277	Recorded adjacent to roadway and existing dwelling house
T/GCR105	Japanese Knotweed *(Fallopia japonica)*	95972, 128633	Recorded adjacent to roadway.
T/GCR106	Japanese Knotweed *(Fallopia japonica)*	94300, 129866	Recorded adjacent to roadway
T/GCR107	Japanese Knotweed *(Fallopia japonica)*	95592, 129113	Recorded adjacent to roadway.
T/GCR108	Japanese Knotweed *(Fallopia japonica)*	95972, 128633	Recorded adjacent to roadway.

6.5.2.3 Habitats along the Grid Connection Route

The proposed grid connection route is approximately 13.8 km in length and will commence from the proposed Ballynagare substation and connect to the existing 110kV Clahane switching station.

The proposed grid connection route will be located within the existing road corridor, which is classified as Building and artificial surfaces (BL3) and there will be no requirement for works within habitats located outside of the existing corridor.

The existing road corridor associated with the grid connection is bordered by grass verges classified as dry meadows and grassy verges (GS2). Adjacent to the road corridor, several habitat types occur including hedgerows (WL1), treelines (WL2), earth banks (BL2), improved agricultural grassland (GA1), scrub (WS1), stone walls (BL1), drainage ditches (FW4) and dwellings houses and agricultural buildings (BL3).

The following provides a description of the proposed gird connection route starting at the most northerly point and progressing southwards.

The grid connection route is confined to the road corridor classified as buildings and artificial surfaces (BL3). The route will follow the proposed site roads to the proposed site entrance and turn south along a local road to the R557. The grid route travels east along the R557 for 2.7km where it heads south east along the tertiary road for 1.5km. It then travels south for 2km crossing under the Tralee-Tarbert 1 110kV and Tralee-Tarbert 2 110kV lines. It then turns west along the L1027 road for 0.35km where it then continues south for 1.1km. It then joins the L6074 road for 0.4km to Banemore Cross where it joins the N69. It then travels 0.45km south-west along the N69 to the entrance of the existing Clahane 110kV substation which is approx. 550m from the N69 road. All works and construction machinery will operate within the curtilage of the public road

The grid connection route is bordered by human dwellings classified as Buildings and artificial surfaces (BL3), gardens classified as amenity grassland (GA2), Hedgerows (WL1), Treelines (WL2) and Dry Grassy Verges (GS2) interspersed with one another throughout the entirety of route. The habitats adjacent to the road corridor were predominantly Improved Agricultural Grassland (GA1) with associated agricultural buildings, Wet Grassland (GS4) and areas of Conifer Plantation (WD4), Scrub (WS1) and Earth Banks (BL2) (Plate 6-17 - Plate 6-20). The treeline and hedgerows are typically composed of Ash *(Fraxinus excelsior)* and Sycamore *(Acer pseudoplatanus),* with Rowan *(Sorbus aucuparia),* Hazel *(Corylus avellana),* Hawthorn (*Crataegus monogyna*) and Willow (*Salix* spp). Scrub (WS1) habitat was comprised of bramble and willow spp. while dry meadows and grassy verges was comprised of cut-leaved crane's-bill *(Geranium dissectum),* hogweed *(Heracleum sphondylium),* ribwort plantain *(Plantago lanceolata),* cocks-foot *(Dactylis glomerata),* broadleaf dock *(Rumex obtusifolius).*

The third schedule invasive species Japanese Knotweed (*Fallopia japonica*) was also recorded along the grid connection route.

Plate 6- 16 Regional Road R557

Plate 6- 17 Local access road boarded by Treeline (WL2) and Dry meadows and Grassy Verges (GS2)

Plate 6- 18 Local access road boarded by Hedgerow (WL1)

Plate 6- 19 Entrance to Clahane 110kV substation and location of end of Grid Connection Route

6.5.2.1 Proposed Abnormal Size Load Delivery Route (Turbine Delivery Route)

The proposed transport route for the large wind turbine plant will be via the entry point at the port of Foynes, east to Limerick on the N69, south to Abbeyfeale and Castleisland via the M20 and N21, to Tralee on the N21 and finally, north on the N69 towards the site where it exits the N69 at Mountcoal.

The transport route leaves the national road network on the N69 to join the L6055, before heading northwest for approximately 4km to the priority junction with the R557. The route then heads southwest for 2.5kms before turning right into an unnamed local road towards the site at Ballynagare. The route from the N69 is discussed in detail in Section 14.1.6 and shown in Figure 14.1.2a of Chapter 14. A review of the implications on the wider national road network was also undertaken at junctions on the N21 and N69 bypassing Castleisland and Tralee with the locations and autotracks included as Appendix 14.1 of Chapter 14.

The route assessment considered comprises of;

- Location 1 - the N69 / L6055 junction at Mountcoal,
- Location 2 - the left hand bend on the L6055 at Mountcoal,
- Location 3 - the crossroads on the L6055 with the L1027,
- Locations 4, 5 and 6 – bends on the L6055,
- Location 7 - the R557 / L6055 junction,
- Location 8 – R557 Local road junction,
- Locations 9 to 12 – Access junctions A to D providing access to the site.

The locations assessed on the wider road network are list below and presented in Appendix 14.1 of Chapter 14;

- Location A - N21 / N23 roundabout at Castleisland,
- Location B - N21 / N69 roundabout at Tralee,
- Location C - N69 / L2015 roundabout at Tralee, and,
- Location D - N69 / R878 roundabout at Tralee.

6.5.2.2 Proposed Construction Traffic Haul Route

The delivery route for general HGV construction traffic may vary depending on the location of suppliers used for stone and other materials required to construct the proposed development. Based on the location of quarries in the vicinity of the Proposed Development and the fact that deliveries of stone for the grid connection comprise a large element of deliveries to and from the site, the assessment presented in this EIAR is based on all construction traffic approaching the site on the same route as specified for the abnormal loads. While this may vary in practice this assesses the worst-case scenario with all development generated traffic concentrated on one route.

6.5.3 Transport Route Assessment

The proposed transport route is detailed in Figure 14.1.2a of Chapter 14 of this EIAR. The following section details the habitats located at each point of the route in the direction that vehicles accessing the site will travel. All locations along the route referred to in this section are also highlighted in Figure 14.1.2a of Chapter 14. An assessment of habitats is detailed for the locations considered as potentially presenting issues for the abnormal loads and therefore requiring some alteration, as identified during the transport route assessment. A preliminary swept path analysis was then undertaken during the transport route assessment undertaken in Chapter 14 using Autotrack in order to establish the locations where the wind farm transporter vehicles will be accommodated, and the locations where some form of remedial measure may be required.

The locations discussed are as follows;

- Location 1 - the N69 / L6055 junction at Mountcoal,
- Location 2 - the left hand bend on the L6055 at Mountcoal,
- Location 3 - the crossroads on the L6055 with the L1027,
- Locations 4, 5 and 6 – bends on the L6055,

- Location 7 - the R557 / L6055 junction,
- Location 8 – R557 Local road junction, and,
- Locations 9 to 12 – Access junctions A to D providing access to the site.

Location 1 – N69 / L6055 junction

The swept path requirements of the wind turbine vehicles turning left from the N69 onto the L6055 are shown in Figures 14.1.6 and 14.1.7 for the blade and tower sections. There is a layby on the eastern side of the N69, which it is proposed will be used to facilitate the left turn for the large wind turbine vehicles. The assessment indicates that local temporary improvements / alterations will be required to the lay-by and the L6055 in the proximity of the N69 junction. A dry delivery run will be required at this location, and all others identified in this section, prior to the turbine delivery stage.

This layby/slip road classified as buildings and artificial surfaces (BL3) is boarded by an area of scrub comprised of willow spp. (*Salix* spp)., bramble *(Rubus fruticosus agg.)* with section of hedgerow and treeline. The treeline habitat include species such as sycamore *(Acer pseudoplatanus),* beech *(Fagus sylvatica)* and conifer spp., with the hedgerow comprised of box hedging *(Buxus sempervirens)* and Fuchsia *(Fuchsia magellanica).* Once the N69 has been crossed there is another hedgerow which is comprised of ornamental species with holly *(Ilex aquifolium)* and sycamore *(Acer pseudoplatanus).*

Plate 6- 19 Location 1 – Slip road boarded by Treeline and Scrub (WS1)

Plate 6- 20 Location 1 – Slip road boarded by Treeline and Scrub (WS1)

Location 2 – Bend on L6055

The swept path requirements for the design vehicles negotiating this bend on the L6055 are shown in Figures 14.1.8 and 14.1.9. The figures show that the existing geometry is constrained and oversail of the blade into the eastern northern property will be required. The assessment also indicates that some minor alterations will be required to the boundary in the east side of the road to accommodate the blade vehicle.

This section of the roadway classified as buildings and artificial surfaces (BL3) is boarded by earthen bank with species including meadow buttercup *(Ranunculus acris)*, creeping buttercup *(Ranunculus repens)*, dandelion *(Taraxacum officinale agg,)*, harts-tongue fern *(Asplenium scolopendrium)*, bush vetch *(Vicia sepium)* which is adjacent to a treeline with ash *(Fraxinus excelsior)*, ivy *(Hedera Hibernica)*, hawthorn *(Crataegus monogyna)*, dog-rose *(Rosa canina*) and box hedge. Dwelling houses (BL3) and gardens classified as amenity grassland (GA2) are located adjacent to the roadway.

Plate 6- 21 Location 2 – Existing roadway boarded by Earth bank and Treeline

Plate 6- 22 Location 2 – Existing roadway boarded by Earth bank and Treeline

Location 3 – Crossroads on L6055

Similar to location 2, the swept path assessment for this location, shown in Figures 14.1.10 and 14.1.11 of Chapter 14, indicates that oversail and temporary alterations will be required in order to accommodate the blade delivery vehicle at this location.

The roadway that this location is boarded by treeline, hedgerow and earthen banks. The treeline included ash and birch *(Betula spp.)* with the hedgerow comprising hawthorn. The earthen bank comprised of cocksfoot *(Dactylis glomerata),* broadleaf dock *(Rumex obtusifolius)* and bramble *(Rubus fruticosus agg.).*

Plate 6- 23 Location 3 – Existing roadway boarded by Earth bank and Treeline

Plate 6- 24 Location 2 – Existing roadway facing the cross road junction boarded by Earth bank, Treeline and Hedgerow

Plate 6- 25 Location 2 – Existing roadway across road junction boarded by Earth bank

Location 4 – Bend on L6055

The swept path assessment for this location, shown in Figures 14.1.12 and 14.1.13, indicates that oversail and temporary alterations to the boundary on the east side of the road will be required at this location in order to accommodate the blade delivery vehicle at this location.

This roadway is board by a hedgerow comprised of sycamore, hawthorn and bramble with other species including ivy, bush vetch and dog-rose. Dwelling houses (BL3) and gardens classified as amenity grassland (GA2) are located adjacent to the roadway.

Plate 6- 26 Location 4 – Existing roadway boarded by Hedgerow

Plate 6- 27 Location 4 – Existing roadway boarded by Hedgerow

Location 5 – Bend on L6055

As shown in Figures 14.1.14 and 14.1.15 significant works will be required at this location in order to accommodate the wind turbine extended artics, including land take on the northern corner of the bend and in the field to the west of the road in order to accommodate the blade delivery vehicle at this location. There is a hedgerow comprised predominantly of blackthorn with nettle *(Urtica dioica)* and ivy. Around the bend beyond the existing house, there is a treeline with beech, bramble, ivy, harts-tongue fern and hogweed *(Heracleum sphondylium)*. The opposite side of the roadway is border by conifer trees which extend around the bend of the road. Dwelling houses (BL3) and gardens classified as amenity grassland (GA2) are located adjacent to the roadway.

Plate 6- 28 Location 5 – Existing roadway boarded by Treeline and Hedgerow

Plate 6- 29 Location 5 – Existing roadway boarded by Treeline and an existing dwelling

Plate 6- 30 Location 5 – Existing roadway boarded by Treeline

Location 6 – Bend on L6055

As shown in Figures 14.1.16 and 14.1.17 oversail of the blade into the field on the eastern side of the L6055 together with local widening will be required at this location in order to accommodate the wind turbine extended artics.

At this location the roadway is bordered by earthen bank comprised of nettle, creeping buttercup, bramble with some individual willow spp. Either side of the roadway is bounded by improved agricultural grassland.

Plate 6- 31 Location 6 – Existing roadway boarded by Earth bank

Location 7 – R557 / L6055 junction

The swept path of the wind turbine extended artics negotiating this existing priority junction is shown in Figures 14.1.18 and 14.1.19. The figures indicate that a significant area of the field on the south western corner of the junction will be required for the duration of the turbine delivery stage of the project. Localised oversail will be required on the west side of the L6055 in order to minimise land take.

At this location the existing roadway is boarded by hedgerow comprised of willow spp., hawthorn, sycamore with creeping buttercup, harts-tongue fern, bush vetch and nettle. This hedgerow is immediately adjacent to an improve agricultural grassland field. A dwelling house and agricultural buildings (BL3) are located along this section of roadway.

Plate 6- 32 Location 7 – Existing roadway boarded by Hedgerow, earth bank and improved agricultural grassland

Plate 6- 33 Location 7 – Existing roadway boarded by Hedgerow and improved agricultural grassland

Location 8 – R557 / Local road junction

Similarly, the swept path of the wind turbine extended artics negotiating this existing priority junction leading to the site is shown in Figures 14.1.20 and 14.1.21. The figures indicate the extent of the field on the north-eastern corner of the junction that will be required for the duration of the turbine delivery stage of the project.

This location is comprised of agricultural grassland boarded by hedgerow and treeline. The hedgerow habitat is comprised of hawthorn with bramble, nettle, cocks-foot, red clover *(Trifolium pratense),* hogweed, ribwort plantain *(Plantago lanceolata)* and herb-robert *(Geranium robertianum).* The treeline habitat is composed of ash and sycamore which have been trimmed down.

Plate 6- 34 Location 8 –Improved agricultural grassland boarded by trimmed treeline

Plate 6- 35 Location 8 – Existing roadway boarded by Hedgerow and improved agricultural grassland

Location 9 - Site access junction A

The temporary works required to accommodate the wind farm turbine vehicles, together with the junction layouts proposed on completion, are shown for the access junction off the existing local road in Figure 14.1.22. The figure shows the proposed junction layout in accordance with TII DN-GEO-03060, and the area of land on the western side of the local road that will be required as an over-run area during the turbine delivery phase. Visibility splays (3m x 70m) that should be kept clear at all times during which the access is operational, are shown in Figure 14.1.23. The swept path analysis demonstrating that the turbine extended artic will be accommodated at this location is shown in Figures 14.1.24 and 14.1.25 of Chapter 14.

The area adjacent to the roadway comprised of wet grassland type habitat within included soft rush *(Juncus effusus)* with willowherb *(Epilobium spp.)*, bramble, hedge bindweed *(Calystegia sepium)* and nettle. There were some individual willow spp. along the road margin.

Plate 6- 36 Location 9 – Existing roadway boarded by wet grassland type grassland

Location 10 (site access B), Location 11 (site access C) and Location 12 (site access D)

Locations 10, 11 and 12 (site access junctions B, C and D) are proposed junctions where the proposed turbine and general construction traffic route crosses existing minor local roads. For all of these locations it is proposed that the existing minor roads will retain priority with stop markings and signs provided on the delivery route approaches to these junctions. The proposed junction layouts, visibility splays and swept path analyses are shown for these 3 locations in Figures 14.1.26 to 14.1.37 of Chapter 14.

6.5.3.2 Alteration of habitats along the Turbine Delivery Route

The turbine delivery route will require cutting back/trimming of treeline and hedgerow habitat to accommodate oversail as indicated in the preliminary traffic assessment as detailed in Chapter 14. Where the delivery vehicle will track outside of the existing road corridor again as indicated in the preliminary traffic assessment and associated figures as detailed in Chapter 14, there will be loss of improved agricultural grassland (GA1), earth bank (BL2) treeline (WL2) and hedgerow (WL1) habitat.

6.5.3.3 Importance of Habitats

Ecological evaluation follows a methodology that is set out in Chapter 3 of the '*Guidelines for Assessment of Ecological Impacts of National Roads Schemes'* (NRA, 2009). The habitats within and adjacent to the proposed development site were evaluated in accordance with the criteria developed by the NRA (2009b), which classifies sites in terms of their ecological importance, *i.e.,* '*international importance*', '*national importance*', '*county importance*', '*local importance (higher value)*' or '*local importance (lower value)*'.

The degraded raised bog habitats within the development footprint do not conform the active raised bog or degraded bog capable of natural regeneration. Peatland areas within the development footprint do not have the potential to revert to active peat forming systems within a 30-year timeframe (See further detail in Section 9.5.2.11 of the Hydrology Chapter). Cutover bog and degraded bog habitats within and surrounding the development footprint are assigned **Local Importance (Higher Value)**.

The Lowland depositing rivers/stream (FW2) within the site maintain ecological corridors between features of higher ecological value and these watercourses were assigned **Local Importance (higher value).** Watercourses surrounding the proposed development study area include estuaries and occur within the Lower River Shannon SAC. They are a QI habitat of **International Importance**.

Hedgerow (WL1) and Treelines (WL2) within the study area are assigned **Local Importance (higher value)** as they provide supporting semi-natural habitat with have high biodiversity and degrees of naturalness in a local context.

The remaining habitats within the site, namely Improved Agricultural Grassland (GA1), Dry meadows and grassy verges (GS1), Scrub (WS1), Conifer Plantation (WD4) Drainage Ditch (FW4), Buildings and Artificial Surfaces (BL3) and Spoil and bare ground (ED2) were common in a local and regional context and were therefore considered to be of **Local Importance (lower value).**

Many areas within the proposed development study area would be considered to be of low ecological value with areas of habitat of ecological significance within the study area. Approximately 49.6% of the study area comprised of agricultural grasslands of low diversity and sitka spruce dominated conifer plantation bog with a further 45.7% of the study area is covered by modified cutover peat.

No botanical species protected under the Flora (protection) Order (1999, as amended 2015), listed in the EU Habitats Directive (92/43/EEC), or listed in the Irish Red Data Books were recorded on the site.

6.5.3.4 Fauna

Dedicated faunal walkover surveys were undertaken at the site on dates throughout 2020 and 2021. In addition to targeted surveys, additional records of faunal signs were recorded during other surveys including habitat assessments and bat surveys.

6.5.3.4.1 *Badger*

Areas identified as providing potential habitat for badger were subject to specialist targeted surveys. The badger surveys covered the entire development footprint and surrounding suitable habitats in the study area. The badger survey was not constrained by vegetation given the nature of the habitats within the site and the timing of the surveys (NRA 2006a).

Evidence of badger activity including feeding signs i.e., snuffle marks, and a badger sett was recorded during the dedicated surveys. Badger sett is located in a bank adjacent to access track with a single entrance evident. This appeared to be regularly used with fresh bedding recorded within the sett. See Figure 6-6 in Confidential Appendix 6-3 for details and location of the badger evidence recorded.

6.5.3.4.2 Otter

Areas identified as providing potential habitat for otter, i.e., watercourses within and in close proximity to the site, were subject to specialist targeted survey. The otter survey of watercourses was conducted on the 9th September 2020, 18th of June 2021 and 21st June.

Approximately 3.0 kilometres of the main streams draining the study area were surveyed in relation to Otter. Evidence of otter was recorded during the target survey and also during other surveys of the proposed development site. Otter was sighted outside of the proposed development site boundary within the Cashen Estuary and evidence of otter i.e., spraint was recorded within the proposed development site boundary. See Figure 6-7details and location of the otter evidence recorded

There is a total of 5 EPA mapped watercourse crossings along the proposed grid connection route. The construction methodology has been designed to eliminate the requirement for in-stream works at watercourse crossing locations. An Otter survey was conducted at each of the watercourses on the grid route on the 18th June, 21th of June, 1st September and 8th October 2021. Table 6-13 details the result of the grid connection otter survey.

Table 6-13 Grid Connection Route

ID Ref	Grid Ref.	Description of Watercourse	Results
		Grid Connection Route	
01	*491277, 629725*	Watercourse: Monument [EPA Code: 23M41] Watercourse has a slow flow with vegetated banksides which is culverted under the roadway. Riparian vegetation includes ash, willow spp. hawthorn, bramble, ivy, nettle.	There was no evidence of otter. Watercourse provides sub-optimal habitat for the species.
02	*492113, 630181*	Watercourse: Ballyhennessy_23 [EPA Code: 23B12] Watercourse slow flow, slightly turbid and unpleasant smell. The channel and banksides were overgrown. Riparian vegetation includes ash, hawthorn, hazel, willow spp., ivy, hogweed.	There was no evidence of otter. Watercourse provides sub-optimal habitat for the species.
03	*494103, 629493*	Watercourse: Lissahane_23 [EPA Code: 23L09] Watercourse is crossed by a concrete bridge structure with a slow flow and turbid water.	There was no evidence of otter. Watercourse provides suitable habitat of the species.

		The banksides are overgrown. Riparian vegetation includes individual conifer, willow spp., blackthorn, bramble. ragwort, nettle, cocks-foot and hogweed.	
04	*494303, 627269*	Watercourse: Knockburrane [EPA Code: 23K73] Watercourse bridge is constructed of a stonewall face which is overgrown with ivy. The watercourse has slow flow, with slight turbid water flowing on bedrock. The channel is overgrown on the xx side. Riparian vegetation includes Ash, willow spp., hawthorn, ivy, bramble	There was no evidence of otter. Watercourse provides sub-optimal habitat for the species.
05	*494558.,6268140*	Watercourse: Pallas [EPA Code: 23P07] This section of the watercourse was not accessible with a slow flow. The channel was overgrown with vegetation. Riparian vegetation includes blackthorn, sycamore, bramble	There was no evidence of otter. Watercourse provides sub-optimal habitat for otter.

Plate 6- 37 Monument watercourse

Plate 6- 38 Overgrown channel of the Monument watercourse

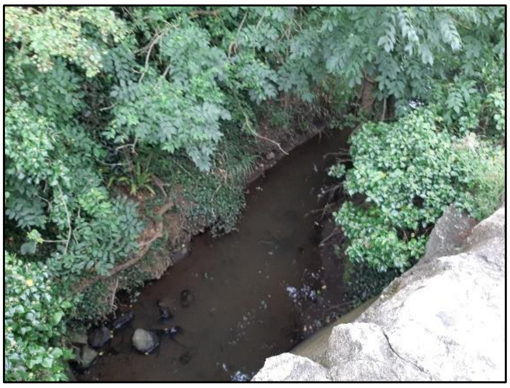


Plate 6- 39 Ballyhennessy_23 watercourse

Plate 6- 40 Overgrown channel of Ballyhennessy_23 of watercourse

Plate 6- 41 Overgrown channel of Lissahane_23 watercourse

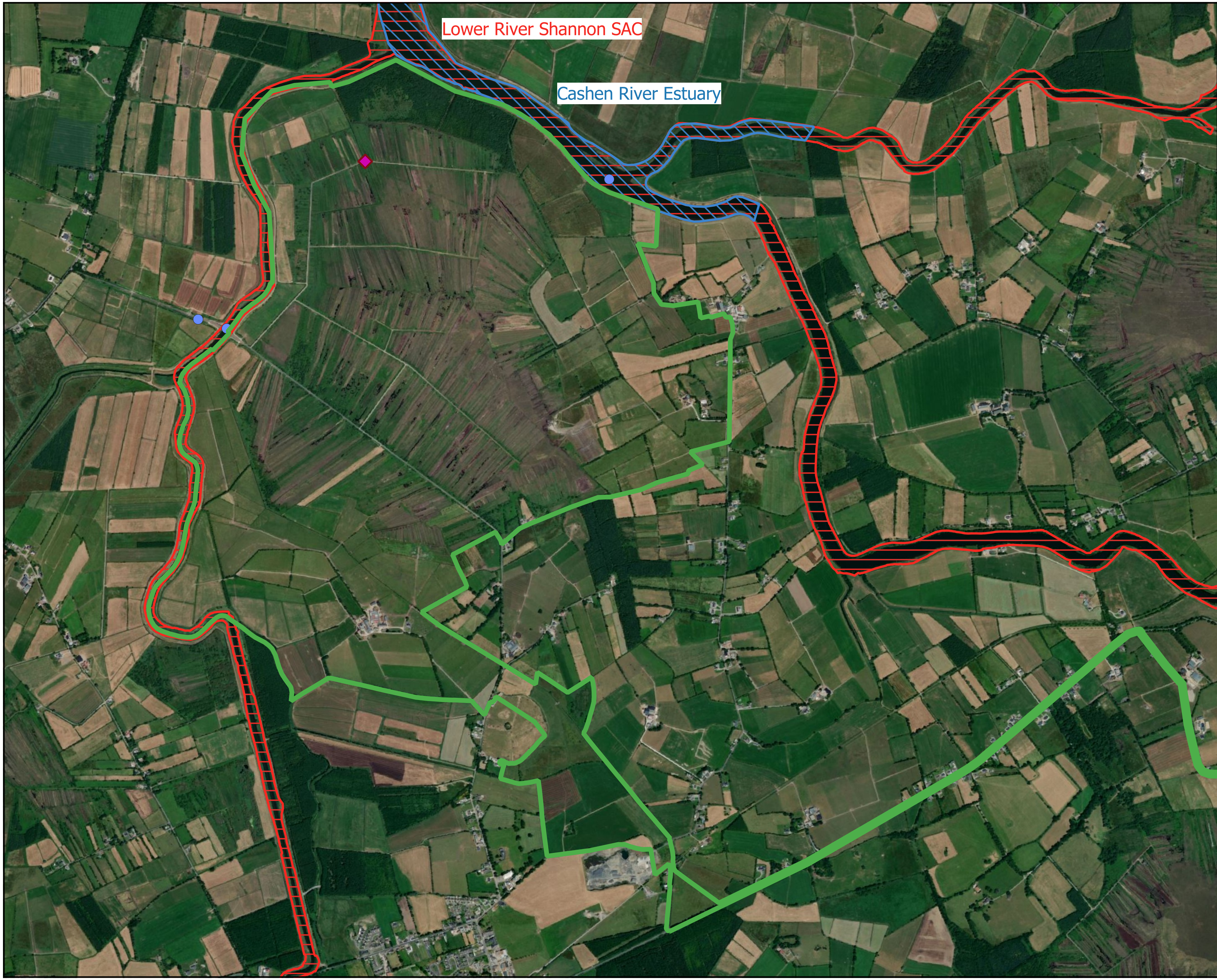
Plate 6- 42 Flow in the Lissahane_23 watercourse channel

Plate 6- 43 Channel of Knockburrane Watercourse

Plate 6- 44 Channel of Knockburrane Watercourse

Plate 6- 45 Overground channel of Pallas watercourse

Plate 6- 46 Bridge structure at Pallas watercourse



Map Legend

- Ballynagare Wind Farm Study Area
- Special Area of Conservation (SAC)
- Prposed Natural Heritae Area (pNHA)

Otter Activity

- Otter Sighting
- Otter Spraint

Drawing Title: Otter Activity Map	
Project Title: Ballynagare Wind Farm	
Drawn By: OOG	Checked By: PR
Project No.: 200512	Drawing No.: Figure 6.7
Scale: 1:24225	Date: 08.10.2021

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Evidence of otter was recorded during the dedicated surveys. Given that evidence of otter was recorded during additional surveys undertaken within the proposed development study site and that there is potential habitat for the species within and adjacent to the proposed development site boundary, it has been demonstrated that otter use the habitats within and surrounding the study area for both commuting and foraging purposes.

6.5.3.4.3 *Bats*

Roost surveys

Following the search for roosts in 2020, no structures containing potential suitable bat roost features were identified within 200m plus the rotor radius (75m) of the Proposed Development footprint. One derelict structure (Grid Ref: E090465 N132422) was identified within the wider site area and was subjected to a roost assessment in May and July 2020. Further details on roost surveys can be found in **Appendix 6-2.**

Overall, the structure was assessed as *Low* suitability due to the state of disrepair and considerable influx of light into the structure. The structure is located outside the Proposed Development footprint. Consequently, there is no potential for significant effect with regard to the loss or disturbance of this roosting habitat.

The Proposed Development site was checked for potential tree roosts but no trees with significant roosting features were identified within the site. Trees may have increased or decreased probability of hosting roosting bats in certain circumstances i.e. Having large broadleaf trees with cavities or other damage such as rot or loose bark increased probability whereas, conifer plantations and young trees with little – no damage have a decreased probability of hosting bats (Kelleher and Marnell, 2006). The surrounding habitats were assessed as largely unsuitable for roosting bats.

Manual transects

Manual transects were undertaken in Spring, Summer and Autumn 2020. Bat activity was recorded on all surveys. In general, Soprano pipistrelle was recorded most frequently, followed by common pipistrelle. Instances of Leisler's bat and brown long-eared bat were less frequent. However, species composition and activity levels varied significantly between surveys. Transect survey results were calculated as bat passes per km surveyed (to account for differences in survey effort). Bat activity was concentrated along hedgerows, scrub, walls and linear (road/track) habitats. **Appendix 6-2** of the EIAR 'bat report' presents results for individual species per survey period and the spatial distribution of bat activity across surveys.

Ground-level Static Surveys

In total, 16,755 bat passes were recorded across all deployments. In general, soprano pipistrelle occurred most frequently, followed by common pipistrelle and Leisler's bat. Instances of *Myotis spp.*, and brown long-eared bat were significantly less. Nathusius' pipistrelle was rare.

Bat activity was calculated as total bat passes per hour (bpph) per season to account for any bias in survey effort, resulting from varying night lengths between seasons. Bat activity was dominated by common pipistrelle in Spring, Leisler's bat in Summer and soprano pipistrelle in Autumn. In addition, soprano pipistrelle occurred frequently in Summer. Instances of *Myotis sp.* were less frequent. Brown long-eared bat and nathusius' pipistrelle were relatively rare.

The Nightly Pass Rate (i.e. total bat passes per hour, per night) was used to determine typical bat activity at the proposed site. Activity is often variable between survey nights. Therefore, the Median Nightly Pass Rate was used as the most appropriate measure of bat activity (Lintott & Mathews, 2018).

Full details of survey results are provided in Section 4.6 of the bat report, provided as **Appendix 6-2** of the EIAR.

6.5.3.4.4 *Marsh Fritillary*

The desk study identified that marsh fritillary and supporting habitat is known to occur in the wider area surrounding the proposed development.

Dedicated surveys were undertaken within the study area to identify areas of suitable marsh fritillary habitat. Suitable breeding habitat was recorded by NPWS within an area of the proposed development study site shown in Figure 6-8. This area of habitat was subject to targeted survey for the Marsh Fritillary food plant, Devils-bit scabious, larval weds and Marsh Fritillary butterfly. No evidence of Marsh Fritillary including larval webs was found.

6.5.3.4.5 *Reptiles and Amphibians*

There was no evidence of Common frog *(Rana temporaria*) Common lizard (*Zootoca vivipara*) or smooth newt *(Lissotriton vulgaris)* recorded within the site within the study area. However, is likely that these species occur within the study area even thought they were not recorded during field visits. Habitat for these species included drains, trackways and wet grasslands. These habitats are common and widespread in the local and wider area and any loss is not likely to result in a significant effect on these species.

The proposed development will not result in a significant loss of suitable habitat for reptiles, amphibians or invertebrates. No likely significant effects on these species are anticipated and therefore further survey/ assessment was not necessary.

6.5.3.4.6 *Other Fauna*

During the walkover survey, additional mammal species were recorded. Irish Hare (*Lepus timidus hibernicus*) droppings were recorded at a number of locations within the cut-over areas of the study.

In addition to Hare, evidence of Fox *(Vulpes vulpes)* and Rabbit (*Oryctolagus cuniculus)* were recorded from within the proposed development study site. It likely due to the size of the proposed development study area that other species which were not recorded during the site surveys carried out also occur on or around the Proposed Development. It is highly likely that other mammals including Stoat (*Mustela erminea*), Pine Marten (*Martes martes*), Mink *(Mustela vison),* Brown Rat (*Rattus norveigicus*) occur. It is also likely that small mammals including Woodmouse (*Apodemus sylvaticus*), Pygmy Shrew (*Sorex minutus*), Bank Vole (*Myodes glareolus*) and Hedgehog (*Erinaceus europaeus*), use the site. No signs of any of these species were recorded during the walkover surveys and no requirement for dedicated surveys was identified.

6.5.3.5 Importance of Fauna

6.5.3.5.1 *Badger*

Evidence of badger was recorded within the vicinity of the proposed development footprint and also within in the wider study area. The badger population using the Proposed Development is of **Local Importance (Higher value)** and the species is not classified as a KER.

6.5.3.5.2 *Otter*

Evidence of Otter were recorded within the study area with an available suitable habitat for species within and immediately adjacent to the proposed development study site. Otter populations within the study area boundary are likely associated with the otter population designated within the Lower River Shannon SAC and this population is considered to be important at an **International level**. The species it is classified as a KER for further assessment.

Drawing Title
Marsh Fritillary Habitat

Project Title
Ballynagare Wind Farm

Drawn By	Checked By
OOG	PR
Project No. 200512	Drawing No. Figure 6.8
Scale 1:10624	Date 20.08.2021

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6.5.3.5.3 *Bats*

The habitats surrounding the proposed works location are likely to be utilised by a bat population of **Local Importance (higher value).** All bat species in Ireland are protected under both national legislation – (Wildlife Act, 1976, as amended in 2019) and European legislation – (Habitats Directive (92/43/EEC). Bats are likely to forage and commute within the vicinity of the Proposed Development. No potential bat roosting features were identified within or adjacent to the development footprint. However, bats were recorded during the dedicated surveys and are classified as a KER.

6.5.3.5.4 *Marsh fritillary*

The desk study identified that marsh fritillary is known to occur in the wider area surrounding the proposed development while Marsh fritillary habitat was recorded within the development site in Article 17 mapping.

A dedicated field survey was undertaken on 1st April 2021. Some habitat for the species was recorded within the area surrounding T4 with the area to the north of the adjacent trackway containing the most suitable Marsh Fritillary habitat within these sections of the study area. Neither Adult marsh fritillary nor larval webs were recorded within this area of habitat. As there is suitable habitat occurring within the study area this species has been assessed as of **Local importance (higher value).** Fisheries and Aquatic fauna.

The aquatic fauna within the study area is assigned **Local Importance (Higher Value)** due to the presence of suitable aquatic habitat downstream of the proposed development study area to which the Proposed Development drains. Neither the Proposed Development site nor the grid connection route are located within a freshwater pearl mussel catchment with the Feale M*argaritifera* area the closest catchment to the development which is classified as a *catchment of other extant populations* of Pearl Mussel. The Feale Catchment is approximately 560metres from the proposed development at the closest point. No instream works are required at any of the watercourse crossing locations along the grid connection route.

Populations of aquatic species listed as Qis (including (i.e., Atlantic Salmon and Lamprey species) of the Lower River Shannon SAC are known to occur within the Cashen Estuary immediately adjacent to site within the SAC. These species are of **International Importance** and are classified as KERs.

6.5.3.6 Identification of Key Ecological Receptors

Table 6.14 lists all identified receptors and assigns them an ecological importance in accordance with the Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009). This table also provides the rationale for this determination and identifies the habitats that are Key Ecological Receptors. These ecological receptors are considered in Section 6.6 of this report and mitigation/ measures will be incorporated into the proposed development where required, to avoid potential significant impacts on the features.

Table 6- 14 Key Ecological Receptors identified during the assessment

Ecological feature or species	Reason for inclusion as a KER	KER
Designated sites	**Nationally Designated Sites** The following Nationally designated site is located downstream of the proposed development and has been identified as being within the likely Zone of Impact: › Cashen River Estuary pNHA This site is assigned **National Importance** and is included as KERs.	Yes
	European Designated Sites The following European Sites are identified in the AA Screening as being within the Likely Zone of Impact and are assessed fully in the NIS that accompanies this application: › Lower River Shannon SAC [002165] This site is assigned **International Importance** and is included as KERs.	Yes
Aquatic Habitats and related species	**Rivers and Streams** Watercourses within the wind farm site have been assigned **Local importance (Higher Value)** as they are of high biodiversity value in the local area and also provide a link to Lower River Shannon SAC which is of international importance. Watercourses within the Lower River Shannon SAC downstream of the proposed development site and at watercourses on the grid connection route are of **International Importance**. The watercourses are classified as a KER due to the potential for indirect effects.	Yes
	Drainage Ditches The site of the proposed development is drained by a network of drainage ditches. These are man-made channels which are either heavily vegetated with little or no flow within the channel or lack any significant vegetation. These drainage ditches are assigned **Local Importance (Lower Value)**.	No

Ecological feature or species	Reason for inclusion as a KER	KER
	Aquatic Fauna – Aquatic species that are associated with the watercourses located within and surrounding the site are considered as **Local Importance (Higher Value).** Populations of aquatic species which are QIs (Atlantic Salmon and Lamprey species) of the Lower River Shannon SAC are known to occur downstream of the development site within the SAC. These species are of International Importance. There is potential for indirect effect on these features and they are classified as a KER, collectively.	Yes
Peatland Habitats	**Cutover (PB4) and degraded remnant raised bog (PB1)** All peatland habitats within and surrounding the development footprint are degraded and do not support active peat formation as the habitats are extensively drained with a network of drainage channels present throughout the peatland habitat. These habitats do not conform to Annex I habitats as to be classified as Annex I peatland habitat, the peat areas must be capable of natural regeneration to active bog within 30 years if their hydrology is repaired. Remnant and degraded peatland habitats recorded within and adjacent to the development footprint are subject to drainage and continued turbary activity and do not correspond to an Annex I peatland habitat. Therefore, these areas have been classified as **Local Importance (Higher Value)**. The peatland habitats are classified as a KER due to the potential for direct and indirect effects.	Yes
Grassland habitats and Scrub	**Improved Agricultural Grassland (GA1), Dry meadows and grassy verges (GS2) and Scrub (WS1)** These habitats are of limited ecological significance and are common and widespread within the wider area. They are not classified as a KER	No
Built and man-made habitats	**Spoil and Bare Ground and Buildings and Artificial Surfaces** These habitats are of limited ecological importance and are not classified as a KER	No
Conifer Plantation (WD4)	Conifer Plantation forestry is dominated by coniferous tree species, predominantly Sitka Spruce. This habitat is considered to be of low ecological importance and generally display low biodiversity. This habitat is considered as **Local Importance (lower value)** and is not classified as a KER.	No
Hedgerows and Treelines	Hedgerow and Treelines within the study area are assigned **Local Importance (higher value)** based on supporting semi-natural habitat types with high biodiversity and high degree of naturalness in a local context. Hedgerow are included as KERs due to the potential for direct impact.	Yes

Ecological feature or species	Reason for inclusion as a KER	KER
Otter	Evidence of otter was recorded during the otter surveys. Additionally, Otters are likely to occur downstream of the development site. Otter populations from the wider area are likely to be associated with the otter population designated within the Lower River Shannon SAC. This population is of significant at an **International** level. This species is classified as a KER due to the potential for indirect effects.	Yes
Marsh Fritillary	No Marsh Fritillary were recorded within the proposed study area boundary during the field surveys. All areas of mapped Marsh Fritillary habitat will be avoided by the proposed development footprint although some areas of habitats occur in the vicinity of the development footprint. As there was no evidence of Marsh Fritillary butterfly occurring within the proposed development boundary and the proposed development footprint avoids mapped areas of habitat, this species was not considered to be a KER	No
Bats	Bat species have been assessed as of **Local Importance (Higher Value)** as they represent a resident or regularly occurring populations assessed to be important at the Local level and are listed in Annex IV of the EU Habitats Directive.	Yes
Badger	Evidence of badger was recorded during any of the dedicated surveys undertaken. The species is considered to be of Local Importance (Higher Value) and is classified as a KER.	Yes
Additional protected fauna	The site surveys did not identify any other protected faunal species with the potential to be significantly affected by the proposed development at the population level	No

6.6 Ecological Impact Assessment

6.6.1 Do-Nothing Effect

If the proposed development were not to proceed, the site would continue to be managed under the various current management practise including turbary activities from the peatland habitats, plantation forestry and agricultural management in the grassland habitats.

6.6.2 Effects on Designated Sites

None of the elements of the proposed development are located within the boundaries of any Nationally or European designated sites important for nature conservation (Figure 6-3). There will be no direct effects on any designated site as a result of the construction, operation and decommissioning of the proposed development.

One nationally designated site was identified as being within the zone of influence and as a KER, The Cashen River Estuary pNHA. This pNHA is located immediately adjacent to the proposed development site. This site is also designated as an SAC and any potential effects on this nationally designated site are fully considered in the AA Screening and NIS in relation to the European designation.

While significant effects on water quality are not anticipated, potential for effects on water quality associated with the construction and operational phase drainage of the site has been fully mitigated through appropriate design and mitigation as fully described in Section 9.6 of Chapter 9: Hydrology and Hydrogeology and Section 6 of the CEMP. No other pathways for effect on this pNHA were identified. Consequently, no significant effects on Cashen River Estuary pNHA are predicted.

No other nationally designated sites were identified as being within the zone of influence or as KERs.

In relation to European sites, an Appropriate Assessment Screening Report and Natura Impact Statement (NIS) have been prepared to provide the competent authorities with the information necessary to complete an Appropriate Assessment for the Proposed development in compliance with Article 6(3) of the Habitats Directive.

As per the aforementioned EPA draft Guidance (2017), *"a biodiversity section of an EIAR, should not repeat the detailed assessment of potential effects on European sites contained in a Natura Impact Statement"* but should *"incorporate their key findings as available and appropriate"*. This section provides a summary of the key assessment findings with regard to Special Areas of Conservation (SACs) and Special Protection Areas (SPAs).

The Screening for Appropriate Assessment identified a potential indirect effect via deterioration of water quality on the QI's of the ***Lower River Shannon SAC [002165]*** while the potential for habitat loss and displacement were identified as possible impacts on the ***Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA [004161]*** and ***Tralee Bay Complex SPA [004188]***

The Screening for Appropriate Assessment concluded as follows:

> "*It cannot be excluded beyond reasonable scientific doubt, in view of best scientific knowledge, on the basis of objective information and in light of the conservation objectives of the relevant European sites, that the proposed development, individually or in combination with other plans and projects, would be likely to have a significant effect on the* ***Lower River Shannon SAC [002165], Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA [004161]*** and ***Tralee Bay Complex SPA [004188].***
>
> *As a result, an Appropriate Assessment is required, and a Natura Impact Statement shall be prepared in respect of the proposed development.*"

The findings presented in the NIS are that, "*it can be objectively concluded that the proposed development, individually or in combination with other plans or projects, will not adversely affect the integrity of any European Site."*

In the context of EIA, it can be concluded that there is no potential for significant effects on European Sites.

6.6.3 Likely Potential Impacts During Construction Phase

6.6.3.1 Effects on Habitats During Construction

Table 6.15 below provide details of the extent of the recorded habitats on the site, the extent of the habitat that will be lost to facilitate each proposed development option and the percentage of the total area of that habitat on the site that it represents.

Table 6- 15 Extent of habitat lost to theTurbine proposed development and the percentage of the total area of that habitat on site

Habitat	Total Area(Ha) /Length (Km) in the site	Area (ha)/length (km) to be lost	Percentage of total to be lost
KER Habitats			
Cutover bog (PB4)	236.5	1.8	0.76
Raised bog (PB1),	6.3	0.3	4.76
Hedgerow (WL1)	9.6	0.235 (235m)	2.4
Treelines (WL2)	1.2	0.122 (122m)	10.1
Depositing/lowland rivers (FW2)	3.0	0 (0.02 to be crossed by new roadway)	0
Non KER Habitats			
Improved agricultural grassland (GA1)	243.0	4.7	1.93
Wet grassland (GS4)	14.1	0	0
Amentiy grassland (GA2)	0.04	0	0
Scrub (WS1)	5.2	0.2	0.34
Conifer plantation (WD4)	20.3	0	0
Reed and Large Sedge Swamp (FS1)	11.4	0.5	4.4
Spoil and bare ground	15.0	0.75	5
Buildings and other artificial surfaces (buildings)	3.2	0	0
Buildings and other artificial surfaces (Roads)	1.8	0.017	0.94
Dry Meadows and grassy verges	Associated with trackways	-	-
Drainage Ditch	Associated with agricultural grassland	-	-

The proposed development will result in the loss of areas of habitat that are of Local Importance (Lower Value) and are not identified as KERs. This mainly involves the loss of improved agricultural grassland of low ecological value. Any direct or indirect impacts on these habitats are not significant.

The effects on habitats that are identified as KERs are described in the sections and tables below.

6.6.3.1.1 Assessment of Potential Effects on Waterbodies and Sensitive Aquatic Faunal Species

Table 6- 16 Assessment of effects on waterbodies and Sensitive Aquatic Species

Description of Impact	The footprint of the Proposed development has been specifically designed to avoid impacts on watercourses within the study area. The grid connection maximises the use of the existing road network and does not require any instream works to take place. There will be no significant direct effects on sensitive aquatic habitats or the species that are associated with them. There is potential for the construction activity to result in the run-off of silt, nutrients and other pollutants such as hydrocarbons and cementitious material into the watercourses including drainage ditches and natural watercourses. This could result from road and turbine base excavations, stockpiling spoil, culverting of watercourses, or the use of concrete and other construction materials. The proposed development will cross watercourse and drainage ditches within the proposed development site, and which provide connectivity to the larger watercourses surrounding the site. This represents a potential indirect effect on the identified aquatic receptors in the form of habitat degradation through water pollution.

	These effects on water quality are fully described in Chapter 9 of this EIAR and are described here and below in relation specifically to ecology. Note: This section assesses the potential for likely significant effects on aquatic receptors including aquatic habitats (i.e., watercourses), salmonids, lamprey, coarse fish, white-clawed crayfish, European eel, aquatic invertebrates, molluscs (including Freshwater Pearl Mussel) and other aquatic species.
Characterisation of unmitigated Impact	In the absence of mitigation, the indirect effect of water pollution on aquatic receptors during construction has the potential be a short-term negative reversible impact on watercourses which act as a conduit to downstream habitats. The magnitude of any such impact is likely to be at worst moderate, given that all major infrastructure such as turbine bases and substation etc. are located over 50 metres from any significant watercourse.
Assessment of Significance prior to mitigation	In the absence of mitigation and following the precautionary principle, there is potential for the Proposed Development to result in significant indirect effects on the identified aquatic habitats and species at a local geographic scale in the form of pollution during the construction phase of the proposed development.
Mitigation	A detailed drainage maintenance plan for the proposed development is provided in Section 4.6 in Chapter 4 of this EIAR. This plan provides details of how water quality will be protected during the construction of the Proposed Development. In addition to this, specific mitigation is provided in relation to water quality in Chapter 9: Hydrology and Hydrogeology of this EIAR. The Construction Environmental Management Plan (CEMP) that is provided as Appendix 4-2 of Chapter 4 provides the details of exactly how the measures will be implemented during construction. Following the implementation of mitigation, there will be no significant effect on aquatic habitats or species, at any geographic scale, as a result of the proposed development.
Residual Effect following Mitigation	Following the implementation of mitigation, there will be no significant effect on aquatic habitats or species, at any geographic scale, as a result of the proposed development.

6.6.3.1.2 *Summary of Water Quality Mitigation Measures*

A detailed drainage maintenance plan for the proposed development is provided in Section 4.6 in Chapter 4 of this EIAR. This plan provides details of water quality protection measures during the construction of the Proposed Development.

Drainage Principles: There will be two distinct methods employed to manage drainage water within the site. The first method involves keeping clean water clean by avoiding disturbance to natural drainage features, minimising any works in or around artificial drainage features, and diverting clean surface water flow around excavations and construction areas. The second method involves collecting any drainage waters from works areas within the site that might carry silt or sediment, to allow attenuation and settlement prior to controlled diffuse release.

The drainage methodology incorporated in Chapter 4 is summarised below:

- No routes of any natural drainage features will be altered as part of the proposed development and only three new watercourse crossings are proposed as part of the proposed development.
- Turbine locations and associated roadways were originally selected to avoid natural watercourses, and existing roads are to be used wherever possible.
- There will be no direct discharges to any natural watercourses, with all drainage waters being dispersed as overland flows.
- There will be no direct discharges to natural watercourses. All discharges from the proposed works areas will be made over vegetation filters at a minimum of 50 metres distance from natural watercourses.

- Buffer zones around the existing natural drainage features have informed, wherever possible, the layout of the proposed development.
- Where there is infrastructure proposed within 50 metres of a natural watercourse, stringent drainage measures will be put in place to ensure the protection of the water quality of the natural watercourse
- Interceptor drains will be installed upgradient of any works areas to collect surface flow runoff and prevent it reaching excavations and construction areas of the site where it might otherwise have come into contact with exposed surfaces and picked up silt and sediment.
- The drains will be used to divert upslope runoff around the works area to a location where it can be redistributed over the ground surface as sheet flow.
- The interceptor drains will be installed in advance of any main construction works commencing.
- On completion of the construction phase works, it is envisaged that the majority of the interceptor drains could be removed.
- Drainage swales will be installed downgradient of any works areas to collect surface flow runoff where it might have come into contact with exposed surfaces and picked up silt and sediment. Swales will intercept the potentially silt-laden water from the excavations and construction areas of the site and prevent it reaching natural watercourses.
- The velocity of flow in the interceptor drains and drainage swales, particularly on sloped sections of the channel, will be controlled by check dams,
- Check dams will not be used in any natural watercourses, only artificial drainage channels and interceptor drains. The check dams will be left in place at the end of the construction phase to limit erosive linear flow in the drainage swales during extreme rainfall events.
- A level spreader which will distribute clean drainage water will be constructed at the end of each interceptor drain to convert concentrated flows in the drain, into diffuse sheet flow on areas of vegetated ground.
- The levels spreaders will be located downgradient of any proposed works areas in locations where they are not likely to contribute further to water ingress to construction areas of the site.
- Piped slope drains will be used to convey surface runoff from diversion drains safely down slopes to flat areas without causing erosion.
- Piped slope drains will be used to transfer water away from areas where slopes are too steep to use level spreaders.
- Suitable area for use as vegetation filters, which are the existing vegetated areas of land that will be used to accept surface water runoff from upgradient areas, will be determined by the
- Stilling ponds, which will reduce sediment run-off, will be used to attenuate runoff from works areas of the site during the construction phase, and will remain in place to handle runoff from roads and hardstanding areas of the proposed development during the operational phase.
- Culverts will be installed where necessary. All new proposed and proposed culvert upgrades will be suitably sized for the expected peak flows in the watercourse.
- Silt fences will be installed as an additional water protection measure around existing watercourses in certain locations, particularly where works are proposed within the 50-metre buffer zone from natural watercourses, which is inevitable where existing roads in proximity to watercourses are to be upgraded as part of the proposed development.
- Run-off from the proposed borrow pit area will be controlled via a single outlet that will be installed at the edge of the borrow pit. Interceptor drains will have been already installed upgradient of the borrow pit area before any extraction begins.
- Run off from the single outlet point will be diverted via a drainage swale to a series of settlement ponds and onwards to a level spreader, which will convert concentrated flows in the drain, into diffuse sheet flow on areas of vegetated ground.
- Where sections of floating road are to be installed instead of excavated roads, cross drains will be installed beneath the road construction corridor to maintain existing clean water drainage paths.
- Cable trenches are typically developed in short sections, thereby minimising the amount of ground disturbed at any one time and minimising the potential for drainage runoff to pick up silt or suspended solids. Each short section of trench is excavated, ducting installed and

bedded, and backfilled with the appropriate materials, before work on the next section commences.
- Silt fences, where required will be installed temporarily downgradient of the cable trench works area, or on the downhill slope below where excavated material is being temporarily stored to control run-off.

In addition to this, specific mitigation is provided in relation to water quality in Chapter 9: Hydrology and Hydrogeology of this EIAR. This mitigation is summarised below:

The main mitigation measure during the construction phase is the avoidance of sensitive aquatic areas, by application of suitable buffer zones (i.e. 50m to main watercourses, and 10m to main drains). With the exception of the met mast and the proposed substation location, all of the key proposed infrastructures within the site are located significantly away from the delineated 50m watercourse buffer zone. Both grid route options contain several watercourse crossings. It is proposed to limit any works in any areas located within 50m of any watercourse/waterbody including the stockpiling of excavated soils and subsoils.

- Avoid physical damage to watercourses, and associated release of sediment;
- Avoid excavations within close proximity to surface watercourses
- Avoid the entry of suspended sediment from earthworks into watercourses; and,
- Avoid the entry of suspended sediment from the construction phase drainage system into watercourses, achieved in part by ending drain discharge outside the buffer zone and allowing percolation across the vegetation of the buffer zones
- Interceptor drains, vee-drains, diversion drains, flume pipes, erosion and velocity control measures such as use of sandbags, oyster bags filled with gravel, filter fabrics, and other similar/equivalent or appropriate systems.
- Small working areas, covering stockpiles, weathering off stockpiles, cessation of works in certain areas or other similar/equivalent or appropriate measures.
- Temporary sumps and attenuation ponds, temporary storage lagoons, sediment traps, and settlement ponds, and proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems.
- Apart from interceptor drains, which will convey clean runoff water to the downstream drainage system there will be no direct discharge (without treatment for sediment reduction, and attenuation for flow management) of runoff from the proposed wind farm drainage into the existing site drainage network. This will reduce the potential for any increased risk of downstream flooding or sediment transport/erosion;
- Silt traps will be placed in the existing drains upstream of any streams where construction works / tree felling is taking place, and these will be diverted into proposed interceptor drains, or culverted under/across the works area;
- Buffered outfalls which will be numerous over the site will promote percolation of drainage waters across vegetation and close to the point at which the additional runoff is generated, rather than direct discharge to the existing drains of the site; and,
- Drains running parallel to the existing roads requiring widening will be upgraded. Velocity and silt control measures such as check dams, sandbags, oyster bags, straw bales, flow limiters, weirs, baffles, silt fences will be used during the upgrade construction works. Regular buffered outfalls will also be added to these drains to protect downstream surface waters.
- No batching of wet-cement products will occur on site/along the grid route works or near other ancillary construction activities. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place;
- Pre-cast elements for culverts and concrete works will be used;
- No washing out of any plant used in concrete transport or concreting operations will be allowed on-site;
- Where concrete is delivered on site, only the chute need be cleaned, using the smallest volume of water possible. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water is to be directed into a dedicated concrete wash out pit. Decommissioning of

this pit will occur at the end of the construction phase and water and solids will be tanked and removed from the site to a suitable, non-polluting, discharge location;
- All concrete will be paced in shuttering and will not be in contact with soils or groundwater until after it has set;
- Use weather forecasting to plan dry days for pouring concrete; and,
- Ensure pour site is free of standing water and plastic covers will be ready in case of sudden rainfall event.
- Avoid physical damage to surface water channels;
- Provide a buffer against hydraulic loading by additional surface water run-off;
- Avoid the entry of suspended sediment and associated nutrients into surface waters from excavation and earthworks;
- Provide a buffer against direct pollution of surface waters by pollutants such as hydrocarbons; and,
- Provide a buffer against construction plant and materials entering any watercourse.
- Protection of the riparian zone watercourses by implementing a constraints zone around stream crossings, in which construction activity will be limited to the minimum, i.e. works solely in connection with duct laying at the stream crossing;
- No stock-piling of construction materials will take place within the constraints zone. No refuelling of machinery or overnight parking of machinery is permitted in this area;
- No concrete truck chute cleaning is permitted in this area;
- Works shall not take place at periods of high rainfall, and shall be scaled back or suspended if heavy rain is forecast;
- Plant will travel slowly across bare ground at a maximum of 5km/hr.
- Machinery deliveries shall be arranged using existing structures along the public road;
- All machinery operations shall take place away from the stream and ditch banks, although no instream works are proposed or will occur;
- Any excess construction material shall be immediately removed from the area and taken to a licensed waste facility;
- No stockpiling of materials will be permitted in the constraint zones;
- Spill kits shall be available in each item of plant required to complete the stream crossing; and,
- Silt fencing will be erected on ground sloping towards watercourses at the stream crossings if required.

In addition, the Construction Environmental Management Plan (CEMP) that is provided as Appendix 4-2 of Chapter 4 provides the details of exactly how the measures will be implemented during construction.

6.6.3.1.3 Assessment of Potential Effects on Peatland Habitats

Table 6- 13 Assessment of effects on Peatland Habitats

Description of Effect	The majority of the Ballnagare bog has been significantly modified as a result of peat cutting activities with the hydrology altered via a network of drainage channels throughout the extent of the bog. These have served to drain and dry out the peatland. There are two relatively small remaining uncut areas of bog within the study area boundary which are surrounded by the larger areas of cut-over peatland. Al areas of peatland within the study area are severely degraded as a result of the peat cutting and the existing manmade drainage network. T3 is located just within the remanent intact bog which is adjacent to the bog trackway while a proposed new road will cross this section of remnant peat. This section of peat is approximately 3.5 ha in area. Approximately 1.8ha of cutover and 0.3ha uncut bog habitats will be lost. The degraded peatland areas are classified as local importance due to their degraded and highly

	modified nature. The overall loss of peatland associated with the development amounts to approximately 5.5% of the overall amount of the habitat recorded within the study area. The loss of this non-Annex I cutover and/or drained Raised Bog is negligible within the context of the site and similar peatland habitat in the wider area. No potential for significant drainage related effects were identified given the highly altered local hydrology within and surrounding the proposed development footprint.
Characterisation of unmitigated effect	The loss of cutover and degraded habitat is classified as a permanent and irreversible impact on habitats of Local Importance. The magnitude of this impact is *Not Significant* as it affects a small area of remnant and degraded areas of this habitat type.
Assessment of Significance prior to mitigation	The loss of degraded and cutover bog habitat is not deemed significant at any geographic scale as the habitat has been assessed as remnant and degraded.
Mitigation	The Proposed Development has been deliberately designed to minimise loss of peatland habitat within the site.
Residual Effect following Mitigation	Based on the nature of the habitats within the development footprint and the highly altered state of the existing hydrology; no significant residual impact on peatland habitats exists. .

6.6.3.1.4 Assessment of Potential Effects on Hedgerows and Treelines

Table 6- 18 Assessment of effects in relation to Hedgerows and Treelines

Description of Effect	The construction of the proposed windfarm and implementation of mitigation measures for the protection of bats (i.e., turbine buffering) will result in the direct loss of approximately 236m of hedgerow and 122 m of habitat treeline. The turbine delivery route will require the alteration of the roadway margins to include trimming and/or cutting back treeline and/or hedgerow habitats. In some locations, there will be a requirement to remove treeline and/or hedgerow habitat.
Characterisation of unmitigated effect	This is a permanent but reversible impact on habitats of Local Importance (Higher Value). The magnitude of this impact is Slight as it only affects a tiny percentage of the overall habitat type, which is widespread throughout the site and along the roadways along the turbine delivery route.
Assessment of Significance prior to mitigation	The loss or degradation of these features is not a significant effect as it covers a very small percentage of the overall habitat at the development site and in the surrounding areas.
Mitigation	The footprint of the Proposed Development will be clearly marked out and fenced off prior to works commencing by a qualitied ecologist. All machinery will work from the existing access road corridor. Vegetation removal will be conducted in line with the provisions of the Wildlife Act, specifically there will be no removal of vegetation between 1st March and 31st August. Hedgerow will be replanted along an internal farm trackway within the proposed development site which will be of a greater length than that which will be lost and will ensure that there are no long-term negative effects, see Figure 1.1 of the Biodiversity Management and Enhancement Plan that is included as Appendix 6.4. The additional planting will result in a net gain of these habitats on the site.

	Similarly, where cutting or trimming of vegetation to include treeline or hedgerow habitat is required to facilitate the turbine delivery, vegetation removal will be conducted in line with the provisions of the Wildlife Act, specifically there will be no removal of vegetation between 1st March and 31st August. Where any treeline or hedgerow is removed to facilitate the turbine delivery route an equal extent of hedgerow or treeline will be replanted along the turbine delivery route to replace any loss of linear features. The species used for replanting should be native and indigenous to the local area. This replanting will ensure that there will be no net loss of linear features due to the alterations required to facilitate the turbine delivery route.
Residual Effect following Mitigation	Following the mitigation measures above, there will be no significant effect on hedgerow or treelines as a result of the Proposed Development site.

6.6.3.2 Effects on Protected Fauna During Construction

The proposed development has the potential to result in habitat loss and disturbance impacts on faunal species that were recorded on the site but were not included as KERs. Given the extensive area of habitat that will remain undisturbed throughout the site, no significant effects on non-KER faunal biodiversity is anticipated as a result of the proposed development.

It should be noted that no significant habitat for salmonids, lamprey, coarse fish, white-clawed crayfish, European eel, aquatic invertebrates or other aquatic species was recorded within the footprint of the proposed development and all major infrastructure designed to avoid direct impact on watercourses. The potential for significant effects on the above aquatic species is restricted to indirect effects on their habitat resulting from water pollution

6.6.3.2.1 *Assessment of Potential Effects on Otter*

Table 6- 19 Assessment of Potential Impacts on Otter

Description of Effect	As described above in relation to aquatic habitats and species, the proposed development has been deliberately designed such that all major infrastructure avoids the larger watercourses and wetland habitats within the Proposed Development site and no instream works is proposed in these habitats. There is no potential for direct effect on habitat that is significant for otter. Potential for effects on Otter has been considered regarding NPWS Threat Response Plan [4](TRP) which identifies four significant threats facing Otter in an Irish context: Habitat destruction, Water pollution, Disturbance (Recreational sources) and Accidental death/persecution
Characterisation of unmitigated effect	Evidence of otter was recorded during the dedicated Otter surveys. However this was not located within the footprint of the proposed development. There will be no significant habitat destruction, no loss of breeding or resting places and no direct mortality related impacts on this species. No instream works are required along the grid connection route. Therefore, there is no potential for the Proposed Development to result in any barrier to the movement of otter. Otter have been recorded downstream of the study area and there is potential for the construction activity to result in the run-off of silt, nutrients and other pollutants such as hydrocarbons and cementitious material into land drains and minor watercourses. This represents a potential indirect effect on Otter in the form of habitat degradation via water pollution.

[4] *NPWS (2009) Threat Response Plan: Otter (2009-2011). National Parks & Wildlife Service, Department of the Environment, Heritage & Local Government, Dublin.*

	In relation to disturbance, Otter are predominantly crepuscular in nature and it is anticipated that construction activity will mostly be confined to daytime hours, thus minimizing potential disturbance related impacts to the species. Chanin P (2003) provides a literary review with regard to anthropogenic disturbance and refers to several reports which have found that disturbance is not detrimental to Otters (Jefferies (1987), (Durbin 1993). (Green & Green 1997). The report also describes successful breeding in towns, under ferry terminals and under the jetties of one of Europe's largest oil and gas terminals at Sullom Voe in Shetland. Irish Wildlife Manual No 76 (National Otter Survey of Ireland 2010/2012) notes that the occurrence of Otter was unaffected by perceived levels of disturbance at the survey sites. It also notes that there is little published evidence demonstrating any consistent relationship between Otter occurrence and human disturbance (Mason & Macdonald 1986, Delibes et al. 1991; Bailey &Rochford, 2006).
Assessment of Significance prior to mitigation	Significant effects regarding habitat destruction, barrier effect, disturbance and mortality are not anticipated. In the absence of mitigation, the indirect effect of water pollution on otter during construction has the potential to be a short-term reversible impact. The magnitude of any such impact is likely to be at worst moderate, given that the majority of new infrastructure such as turbine bases, substation and construction compounds are located over 50metres from any significant watercourse.
Mitigation	A detailed drainage maintenance plan for the proposed development is provided in Section 4.6 in Chapter 4 of this EIAR. This plan provides details of how water quality will be protected during the construction of the Proposed Development. In addition to this, specific mitigation is provided in relation to water quality in Chapter 9: Hydrology and Hydrogeology of this EIAR. The Construction Environmental Management Plan (CEMP) that is provided as Appendix 4.2 of Chapter 4 provides the details of exactly how the measures will be implemented during construction. See section 6.6.3.1.2 for a summary for these measures.
Residual Effect following Mitigation	Following the implementation of mitigation, there will be no significant residual effect on otter as a result of the proposed development.

6.6.3.2.2 Assessment of Potential Effects on Bats

Table 6- 20 Assessment of Potential Impacts on Bats

Description of Effect	As per NatureScot Guidance, wind farms present four potential risks to bats: • Collision mortality, barotrauma and other injuries; (**Operational Phase Impact**) • Loss or damage to commuting and foraging habitat; • Loss of, or damage to, roosts; • Displacement of individuals or populations. For each of these four risks, the detailed knowledge of bat distribution and activity within the study area has been utilised to predict the potential effects of the Proposed Development on bats.
Characterisation of unmitigated effect	**Loss or damage to commuting and foraging habitat** In absence of appropriate design, the loss or degradation of commuting/foraging habitat has potential to reduce feeding opportunities and/or displace bat populations. However, the Proposed Development is predominantly located within cutover bog and open agricultural grassland habitats and there will be no net loss of bat foraging/commuting habitat associated with the Proposed Development.

	There are no large areas of forestry within the Proposed Development site. Approximately 236m of hedgerow and 122m of treeline will be permanently removed within the bat buffer at T7. The removal of trees is provided to achieve the required buffer distance for the protection of bats, from the turbines to the canopy of the nearest habitat feature, as recommended by the Natural England (2014) and NatureScot (2021). Further details on buffer calculations can be found in section 6.1.3 of **Appendix 6-2**. Section 6.1.4, **Appendix 6-2** provides further details on proposed replanting. This loss is not significant as there is an extensive network of linear landscape features in the general area that will be fully retained. Consequently, there will be no significant habitat fragmentation, loss of commuting habitat or loss of foraging habitat associated with the buffering requirement. The loss of these short sections will not result in any significant effect in relation to habitat fragmentation or loss of foraging habitat for bats in the area. **Loss of, or damage to, roosts** The Proposed Development is predominantly located within an area dominated by cutover raised bog and agricultural grasslands. There are a number of relatively small conifer plantation within the proposed development site. The trees in the conifer plantations do not provide suitable roosting habitat of significance for bats. One structure was identified within the proposed site boundary and roost assessment in May and July 2020. Overall, the structure was assessed as *Low* suitability due to the state of disrepair and considerable influx of light into the structure. The structure is located outside the Proposed Development footprint and will be avoided as part of the Proposed Development. Consequently, there is no potential for significant effect with regard to the loss or disturbance of this roosting habitat. Overall, no roosting sites suitable for maternity colonies, swarming or hibernation will be impacted by the proposed development. No significant effects with regard to loss of, or damage to, roosts will occur. **Displacement of individuals or populations** The Proposed Development is largely located within a cutover bog surrounded predominately by improved agricultural grassland, trackways and roadways. There will be no net loss of linear landscape features for commuting and foraging bats and there will be no loss of any roosting site of ecological significance. The habitats on the site will remain suitable for bats and no significant displacement of individuals or populations is anticipated.
Assessment of Significance prior to mitigation	No significant effects with regard to loss of commuting and foraging habitat are anticipated. No significant effects with regard to loss of, or damage to, roosts are anticipated. No significant displacement of individuals or populations is anticipated.
Mitigation	The Proposed Development is predominantly located within a cutover raised bog surrounded predominantly by improved agricultural grassland. The proposed development site comprises areas of linear landscape features such as hedgerows and treelines which have been largely avoided. Although no significant effects are anticipated, it is proposed to plant a new area of treeline/hedgerow in the vicinity of T7 to offset any potential loss in linear habitat features and to provide additional new opportunities for commuting and foraging bats, see section 6.1.4 of **Appendix 6-2.** Full details of the proposed bat mitigation is provided in the Bat Report (**Appendix 6-2**) and is summarised below;

	• During the construction phase, plant machinery will be turned off when not in use and all plant and equipment for use will comply with the Construction Plant and Equipment Permissible Noise Levels Regulations (S.I. No. 632 of 2001). • Lighting in general throughout the development has been minimised and the applicant commits to not using LED lighting. • Where lighting is required, directional lighting will be used to prevent overspill • Exterior lighting, during construction shall be designed to minimize light spillage, thus reducing the effect on areas outside the Proposed Development, • The applicant commits to the use of lights during construction, operation and decommissioning (such that they are necessary) in line with the following guidance that is provided in the Institute of Lighting Professionals Guidance Note 08/18 Bats and artificial lighting in the UK and Dark Sky Ireland Lighting Recommendations. • A 50m buffer from the blade tip to all habitat features used by bats (e.g. hedgerows, tree lines etc.), as recommended by the Natural England (2014) and NatureScot (2021) guidelines, shall be applied to the siting of all wind turbines. These vegetation-free areas will be maintained during the operational life of the development. All turbines, except for T7, are located in open peatland/grassland habitats and do not require a buffer (See section 6.1.3 **Appendix 6-2** for further details). • It is proposed to plant a new area of treeline/hedgerow in the vicinity of T7 to offset any potential loss in linear habitat features and to provide additional new opportunities for commuting and foraging bats. The location in which the proposed planting will take place will be subject to final landowner agreement. Planting will be of species indigenous to the local area. • As per NatureScot and NIEA Guidance at least 3 years of post-construction monitoring is required to assess the effects of construction related habitat modification on bat activity. • An adaptive bat mitigation and monitoring plan will be implemented from the outset, on a precautionary basis. **Appendix 6-2** describes this in further detail.
Residual Effect following Mitigation	There is no potential for the construction of the Proposed Development to result in significant effects on the local bat population at any geographic scale.

6.6.3.2.3 *Assessment of Potential Effects on Badger*

Table 6- 14 Assessment of Potential Impacts on Badger

Description of Effect	Badger setts and foraging activity were recorded within the study area however, the proposed development has been designed to avoid all identified setts. There is some potential for small scale loss of foraging habitat to facilitate the construction footprint. The proposed infrastructure will pass approximately 115m within an identified badger sett located within the central section of the study area (see Figure 6.6 in Confidential Appendix 6.3) In the absence of mitigation/best practice, this has the potential to result in disturbance/displacement, and possible mortality, during the construction phase of the proposed development. In addition, construction works in close proximity to the sett could prevent occupancy.
Characterisation of unmitigated effect	As the development footprint in small relation to the size of the study area, the loss of foraging habitat to the footprint of the proposed development will result in a permanent slight negative effect. This would not be reversible as it is within the construction footprint., As there will be no barriers to movement throughout the site as a result of the proposed work, the proposed development will not result in any fragmentation of badger habitat. Given that there will be turbine infrastructure and an access track proposed close to the identified badger sett, following the precautionary approach, there is potential for short term slight negative effects on the local badger population in terms of disturbance, displacement and potential mortality.

Assessment of Significance prior to mitigation	There is no potential for significant loss of badger habitat as a result of the proposed development. There is no potential for significant disturbance/displacement and/or mortality on the local badger population as a result of the proposed development, given the distance of the proposed works from the identified sett. There is no potential for significant effects on this species.
Mitigation	The following measures will be undertaken for the avoidance of disturbance/displacement and direct mortality will be implemented during the construction phase of the proposed development: › An exclusion zone around the sett will be maintained for the duration of the construction works. No works will be undertaken within 100m of the sett. › All of the above works will be undertaken or supervised by an appropriately qualified ecologist. To protect individual badgers during the construction phase of the proposed development, all open excavations on site will be covered when not in use and backfilled as soon as possible. Excavations will also be covered at night and any deep excavations left open will have appropriate egress ramps in place to allow mammals to safely exit excavations should they fall in.
Residual Effect following Mitigation	Following the implementation of the mitigation as described above, there is no potential for any significant negative effect on badger at geographic scale.
Potential for Cumulative Effect	There will be no significant residual effect at any geographic scale. It can therefore be concluded that there is no potential for the Proposed Development to contribute to a cumulative effect in this regard.

6.6.4 Likely Significant Effects During Operational Phase

6.6.4.1 Effects on Habitats during Operation

The operation of the Proposed Development will not result in any additional land take and as such there is no potential for any significant effects in this regard. These habitats are not considered to be a KER in the context of the operation of the Proposed Development.

Potential for effects on rivers, streams and sensitive aquatic species remains a KER during operation and is assessed in detail in the following subsections.

6.6.4.1.1 *Effects on waterbodies and sensitive aquatic faunal species.*

Table 6- 215 Assessment of Potential Impacts on waterbodies and Sensitive Aquatic Faunal Species

Description of Effect	The increase in the amount of hard standing associated with the proposed infrastructure has the potential to result in faster water runoff from the site to the surrounding watercourses. This may have the indirect effect of causing erosion, which could lead to deterioration of surface water and supporting habitat quality. Additionally, there is the potential for the faster run-off of any pollutants that may be associated with vehicular usage on the site. These impacts on water quality are fully described in Chapter 9: Hydrology and Hydrogeology of this EIAR and are described here in relation specifically to biodiversity.

	Note: This section assesses the potential for likely significant effects on aquatic receptors including aquatic habitats (i.e., watercourses), salmonids, lamprey, coarse fish, white-clawed crayfish, European eel, aquatic invertebrates, molluscs (including Freshwater Pearl Mussel) and other aquatic species.
Characterisation of unmitigated effect	Impact on water quality during the operational phase of the proposed development has been assessed as a permanent negative effect in the absence of mitigation. The magnitude of this impact is slight because all major infrastructure will be located over 50 metres from any significant watercourse and the footprint of the proposed development will be minimal when compared to the overall size of the site.
Assessment of Significance prior to mitigation	Significant effects on water quality are not anticipated at any geographic scale during the operation of the proposed development.
Mitigation	Whilst no significant effects on water quality are anticipated, potential for effects on water quality associated with the operational phase has been fully mitigated through appropriate design and mitigation as fully described in Section 9.5 of Chapter 9: Hydrology and Hydrogeology and Section 6 of the CEMP.
Residual Effect following Mitigation	No potential for significant effect has been identified at any geographic scale as a result of the proposed development.

6.6.4.2 Effects on Fauna During Operation

The operation of the Proposed Development will not result in any additional habitat loss or deterioration.

There is no potential for significant negative effects on terrestrial fauna such as otter that was identified as a KER during the construction phase of the development.

It should be noted that no significant habitat for salmonids, lamprey, freshwater pearl mussel, European eel, or other aquatic species was recorded within the footprint of the Proposed Development and all new major infrastructure such as turbine bases are located over 50 metres from the watercourses within the site. The potential for significant effects on the above aquatic species is restricted to indirect effects on their habitat resulting from water pollution. This has been assessed in Section 6.6.4.1.1 and is not repeated below.

Potential for effects on bat species resulting from the operation of the Proposed Development was identified and therefore, these taxa are discussed and assessed in relation to the operational phase below.

6.6.4.2.1 *Assessment of Potential Effects on Bats During Operation*

Table 6- 164 Assessment of Potential Impacts on Bats During Operation

Description of Effect	As per NatureScot (previously SNH) Guidance, wind farms present four potential risks to bats: • Collision mortality, barotrauma and other injuries; • Loss or damage to commuting and foraging habitat; • Loss of, or damage to, roosts; • Displacement of individuals or populations.

	No effects in relation to 1) Loss or damage to commuting and foraging habitat; 2) Loss of, or damage to, roosts; and 3) Displacement of individuals or populations are anticipated as a result of the operation of the Proposed Development.
Characterisation of unmitigated effect	**Collision Risk** Activity levels for low-risk species at the site including *Myotis* species and brown long eared bat were *Low*. As per NatureScot guidance, these species are not identified as being particularly vulnerable to collision mortality therefore no significant collision related effects are anticipated. The following high-risk species were recorded during the dedicated surveys: • Leisler's bat; • Common pipistrelle; • Soprano pipistrelle; and • Nathusius' pipistrelle Overall Risk was determined, in accordance with Table 3b of NatureScot guidance, by a cross-tablature of the site risk level (i.e. Low) and Ecobat bat activity outputs for each species. Overall risk levels for high collision risk bat species was typically ***Medium,*** except for nathusius' pipistrelle which was *Low*. This risk level is reflective of the nature of the site, which is predominantly cutover bog and open agricultural grassland habitats with low levels of bat activity recorded during the static detector surveys as well as walked and driven transects undertaken. However, taking a precautionary approach and given the potential for high collision risk, at three turbine locations, was recorded at median activity levels, an adaptive monitoring and mitigation strategy has been devised for the Proposed Development. Further details can be found in **Appendix 6-2**.
Assessment of Significance prior to mitigation	Death may occur through collision with turbine blades or as a result of barotrauma. Fatalities may negatively affect local bat populations. No maternity roosts of significance were identified within the Proposed Development site. Significant effects are not anticipated at the international, county or national scale. To date, no studies have conclusively linked pre-construction activity surveys to post-construction fatality rates (Hein *et al.* 2013). However, there is a strong positive correlation between post-construction activity and fatality at wind farms (Kunz *et al.* 2007, Baerwald and Barclay 2009, Amorim *et al.* 2012, Korner-Nievergelt *et al.* 2013). The magnitude of this effect, in respect of local bat populations, in the absence of mitigation is **Moderate** at the local scale.
Mitigation	› A 50m buffer from the blade tip to all habitat features used by bats (e.g. hedgerows, tree lines etc.), as recommended by the Natural England (2014) and NatureScot (2021) guidelines, shall be applied to the siting of all wind turbines. These vegetation-free areas will be maintained during the operational life of the development. All turbines, except for T7, are located in open peatland/grassland habitats and do not require a buffer (See section 6.1.3 **Appendix 6-2** for further details). › In accordance with NIEA Guidelines, blade feathering will be implemented as a standard across all proposed turbines when wind speeds are below the cut-in speed of the turbine. › The proposed lighting around the site shall be designed in accordance with the Institute of Lighting Professionals Guidance Note 08/18 Bats and artificial lighting in the UK. In addition, the applicant commits to the use of lights during construction, operation and decommissioning (such that they are necessary) in line with the Dark Sky Ireland Lighting recommendations. With regard to the potential for lighting to increase collision risk, it is noted that there will be some illumination of the turbines in

	the form of aviation lighting, and whilst this lighting is unlikely to result in any significant increase in collision risk, a comprehensive and site-specific mitigation and monitoring programme for a period of at least 3 years post construction. › It is noted in the NatureScot (SNH) 2021 guidelines that bat activity on windfarm sites is highly liable to change following construction of a wind farm due to the changes in habitat that occur to facilitate construction. Therefore, continued monitoring of operational wind farms for at least three years' post construction is recommended in the guidelines and will be undertaken at this site, to verify the predicted post construction effects on the local bat populations. Full details of the proposed monitoring programme are provided in Appendix 6-2 and include measurement of bat activity, weather conditions and any correlation between the two. The monitoring will also include corpse searching in the areas surrounding the turbines to gather data on any actual collisions. The effectiveness of curtailment will be monitored in order to determine (a) whether it is working effectively (i.e. whether bat mortality is detected, thereby confirming its effectiveness), and (b) whether the curtailment regime can be refined such that turbine down-time can be minimised whilst ensuring that it remains effective at preventing casualties.
Residual Effect following Mitigation	Following the implementation of the monitoring and mitigation described above, there is no potential for significant effects on bat species.
Potential for Cumulative Effect	There is no significant residual effect on bats associated with the Proposed Development. It therefore cannot contribute to any cumulative effect in this regard.

6.6.4.2.2 *Measures to be undertaken when working within the vicinity of Invasive Species*

- Any works required within seven metres of an identified stand of invasive species will be supervised by a suitably qualified ecologist (within the fenced or marked areas).

Rhododendron

Rhododendron was only found in locations where it is unlikely to be affected by the proposed works within the windfarm site and adjacent to the works areas along the grid connection route. It is unlikely to be significantly affected by the proposed works. However, the following measures are in place to ensure that biosecurity is maintained.

- In the case of rhododendron, it will be ensured that, where possible, there is no contact with the plant during the operations. This will avoid the potential for the works to assist in it spreading or the dispersal of seed.
- In the unlikely event that there is the requirement to remove rhododendron, the plant will be cut and chipped on site or removed to a licenced waste facility in a sealed container (under licence from the NPWS).

Japanese Knotweed

This species was not recorded on the wind farm site but was recorded at seven locations along the grid connection and turbine delivery route. Whilst, the stands will not be disturbed, there will be the excavation of the existing road within 7metres of them. Thus, there is potential for the excavated material to be contaminated with rhizomes. This could lead to the spreading of contaminated spoil if undertaken without the necessary precautions in place. The biosecurity measures that will be employed in these areas are described below:

- Where works occur within 7m of a Knotweed stand these will be carried out under the supervision of a suitably qualified ecologist.

- Machinery will no leave the contaminated area without being thoroughly washed/brushed down and inspected by the supervising ecologist to ensure that it is clean and free from Knotweed material. Any run-off or spoil will be isolated and treated as contaminated material.
- The supervising ecologist will survey the excavations and will determine whether the material is contaminated (by searching for rhizomes).
- Any contaminated material will be retained within the contaminated area and used for backfilling of the trench.
- The cables will be wrapped in root barrier membrane prior to being laid within 7m of the contaminated areas.
- The trench will be backfilled and the road resurfaced as required.
- It is likely that all contaminated material will be used in the backfilling of the trench. However, should any Knotweed material be required to be removed off site, this will be taken to a licenced waste facility under licence from the NPWS. Information required by the Wildlife Licensing Unit, NPWS, DAHG typically includes
  - Methods of removal
  - Methods of transport
  - Biosecurity measures
  - Copy of Management Plan
  - Timeframe for completion of works
  - Documentary evidence that chosen landfill facility will accept the material
- The machinery must be thoroughly cleaned down under supervision of an ecologist prior to moving away from the Knotweed contaminated area.
- All contractors and staff will be briefed about the presence, identification and significance of Knotweed before commencement of works.
- Good construction site hygiene will be employed to prevent the spread of these species with vehicles thoroughly cleaned down prior to leaving any site with the potential to have supported invasive species. All plant and equipment employed on the construction site (e.g. excavator, footwear, etc.) will be thoroughly cleaned down on site to prevent the spread of invasive plant species such as Knotweed. All clean down must be undertaken in areas with no potential to result in the spread of invasive species.

The treatment and control of invasive alien species will follow guidelines issued by the National Roads Authority - *The Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (NRA 2010) and Irish Water (2016) *Information and Guidance Document on Japanese Knotweed*.

6.6.5 Likely Significant Effects During Decommissioning phase

There will be no additional habitat loss associated with the decommissioning of the proposed development and therefore there will be no significant effects in this regard. In addition, the removal of the infrastructure will involve similar operations to those involved in construction but without the large-scale earth moving or excavations as the turbine bases and roads etc. will be left in place. These works would therefore be of a smaller scale but would have similar impacts on ecology to those experienced during construction. There would be no additional or ancillary impacts associated with the decommissioning phase.

The same mitigation to prevent significant impacts on water quality and associated aquatic fauna, marsh fritillary, and other terrestrial fauna during construction will be applicable to the decommissioning phase. Any measures to minimise or avoid disturbance will also be applicable. The CEMP for the project provides the details of the mitigation and best practice that will be employed to avoid any potential for significant residual effects on biodiversity during decommissioning of the proposed wind farm.

6.7 Cumulative Impact Assessment

Cumulative effects arising from two or more developments may be:

- **Additive** (i.e. a multiple independent additive model)
- **Antagonistic** (i.e. the sum of impacts are less that in a multiple independent additive model)
- **Synergistic** (i.e. the cumulative impact is greater than the sum of the multiple individual effects)

Data for this assessment of cumulative effects was compiled on the relevant developments near the proposed development site. This included a review of online Planning Registers and identified past and future projects, their activities and their predicted environmental effects. The Proposed Development was considered in combination with other plans and projects in the area that could result in cumulative impacts on European Sites, Nationally designated sites and protected species. This included a review of online Planning Registers and served to identify past and future plans and projects, their activities and their predicted environmental effects. The projects considered are listed in Chapter 2 of the EIAR.

6.7.1 Assessment of Plans

The following development plan has been reviewed and taken into consideration as part of this assessment:

- Kerry County Development Plan 2015- 2021 (Kerry County Council 2015).

The review focused on policies and objectives that relate to designated sites for nature conservation, biodiversity and protected species. Policies and objectives relating to the conservation of peatlands and sustainable land use were also reviewed, particularly where the policies relate to the preservation of surface water quality. An overview of the search results with regard to plans is provided in Table 6.28.

Table 6- 25 Review of plans and policies

Plans	Key Policies/Issues/Objectives Directly Related To European Sites, Biodiversity and Sustainable Development In The Zone of Influence	Assessment of development compliance with policy
Kerry County Development Plan 2015 - 2021	The County Council have a number of objectives relating to the protection, conservation and restoration natural heritage sites including specific objectives relating to the Natura 2000 network. It is an objective of the plan to protect European sites that form part of the Natura 2000 network and for proposed developments to pose no loss of protected habitats and species during the lifetime of the Plan. The no./percentage of developments in/near Natura 2000 network is to be monitored and recorded kept on the percentage of qualifying interest features which have achieved their specific objectives of maintenance or restoration. It is the policy of the Council to facilitate new development with no compromise in the favourable conservation condition of European sites. No compromise or impact on the achievement of the favourable conservation condition objectives (whether maintain or restore) of European sites. Designation of additional areas due to biodiversity and/or geological value. Percentage of unique habitats and species lost in designated sites through trending of annual surveys. **<u>Natural Heritage and Biodiversity Policies and Objectives</u>** **ES-11** - Ensure all economic development proposals shall demonstrate compliance with the objectives of this Plan and the Development Management, Standards and Guidelines specifically as they relate to landscape flood risk management, biodiversity, built and cultural heritage. **NR-1** - Maximise the economic potential and development of natural resources in a sustainable manner while ensuring no significant adverse effect on the environment including the integrity of the Natura 2000 Network through the implementation of the objectives and the Development Management Guidelines and Standards of this Plan. **NE-1** - Work with all stakeholders in order to conserve, manage and where possible enhance the County's natural heritage including all habitats, species, landscapes and geological heritage of conservation interest and to promote increased understanding and awareness of the natural heritage of the County. **NE-5** - Ensure that the cumulative impacts are taken into account when evaluating the impacts of a particular proposal on biodiversity, particularly in relation to habitat loss and wildlife disturbance. **NE-6** - Ensure compliance with the provisions of Actions for Biodiversity 2011-2016 - Ireland's National Biodiversity Plan and any subsequent document adopted during the lifetime of this Plan.	The Development plan was comprehensively reviewed, with particular reference to Policies and Objectives that relate to the Natura 2000 network and other natural heritage interests. There will be no impact on European designated sites as a result of the proposed development. The development will not affect the conservation status of any QI species or habitat or SCI species of any EU designated site. The development will not prevent the QIs/SCIs of the European Sites from achieving favourable conservation status in the future as defined in Article 1 of the EU Habitats Directive. The proposal has been designed to avoid all significant effects on biodiversity and the receiving environment. No potential for cumulative impacts were identified in conjunction with the current proposed development.

Plans	Key Policies/Issues/Objectives Directly Related To European Sites, Biodiversity and Sustainable Development In The Zone of Influence	Assessment of development compliance with policy
	EE-9 - Liaise with the OPW on all issues involving river drainage and flood relief, especially when dealing with any development consent applications in the vicinity of important drainage channels. **NE-11** - Ensure that all projects likely to have a significant effect on a Natura 2000 / European site will be subject to Habitats Directive Assessment prior to approval. **NE-12** - Ensure that no projects which will be reasonably likely to give rise to significant adverse direct, indirect or secondary impacts on the integrity of any Natura 2000 sites having regard to their conservation objectives, shall be permitted on the basis of this Plan (either individually or in combination with other plans or projects) unless imperative reasons of over riding public interest can be established and there are no feasible alternative solutions. **NE-13** - Maintain the nature conservation value and integrity of all Natural Heritage Areas (NHAs), proposed Natural Heritage Areas (pNHAs), Nature Reserves and Killarney National Park. This shall include any other sites that may be designated at national level during the lifetime of the plan in co-operation with relevant state agencies **ES-28** - Proposals for any economic development in rural areas must demonstrate: - That there will be no significant adverse effects on the environment including the integrity of Natura 2000 network - That there is existing or programmed capacity in the water infrastructure (supply and/or effluent disposal) or suitable developer-led improvements can be identified, delivered and maintained. - The proposal shall include sustainable waste management practices both at the construction and operation stages of the proposal. - The proposal will not compromise water quality nor the programme of measures contained within the South Western or Shannon River Basin Management Plans 2009-2015 (or subsequent updates). - Compliance, where appropriate, with the measures contained in the Plan as they relate to biodiversity protection and enhancement. **EP-1** - Support and facilitate the sustainable provision of a reliable energy supply in the County, with emphasis on increasing energy supplies derived from renewable resources whilst seeking to protect and maintain biodiversity, archaeological and built heritage, the landscape and residential amenity.	

6.7.2 Assessment of Projects

As described in Section 2.7 of Chapter 2 of the EIAR, relevant projects have been assessed in-combination with the proposed wind farm development and include planning applications in the vicinity of the site and other wind energy applications within the wider area. These are detailed in the following sections.

Other Wind Turbines

There are a number of other wind farm developments located within a 20 kilometre radius of the proposed development site. The other wind farm developments have been listed in full in section 2.5 of this chapter of the EIAR and are also detailed in Table 6-26. The other wind farm developments have been considered under the overall cumulative assessment of the proposed development. Any cumulative affects arising are considered in the relevant chapters of this EIAR.

Table 6-26 Wind Energy Applications within 20km of the Development Site

Pl.Ref	Description	Decision and status
Ballylongford Wind Farm		
17/902	Construct a windfarm consisting of 8 wind turbines, battery units, and all associated works.	Refused by KCC Refused by An Bord Pleanála (300368-17) 08/01/2019
19/381	Construct a windfarm consisting of six wind turbines include battery units, and all associated works.	Refused by KCC Granted by An Bord Pleanála (304807-19) 06/01/2020 Not constructed.
Shronowen Wind Farm		
SID 08.309156	12 wind turbines, substation, grid connection and ancillary site works.	New Application
Tullahennel Wind Farm (made up of Tullahennel South, Tullahennel North and Larha wind farm)		
08/2086	Construct a wind farm of two wind turbines, and all associated works.	Granted by KCC 11/05/2009 2 turbines constructed.
08/2500	Erect an electricity generating windfarm consisting of two (2) wind turbines of hub height and all associated works	Granted by KCC 29/09/2009 2 turbines constructed.
09/1175	Construct a wind farm consisting of 9 no. wind turbines, control building, access roads, electrical sub-station, anemometer and ancillary works	Granted by KCC 04/05/2010 9 turbines constructed.
15/679	Modify the operational period of the permitted wind farm under planning reg. no. 08/2500 from a period of 10 years to a period of 25 years	Granted by KCC 28/10/2015
15/725	Modification of 20-year operational period of wind farm permitted under 09/1175 to 25 years	Refused by KCC 12/10/2015
17/1146	Extend the operational life of the existing wind farm from 20 to 25 years. the permission relates to the continuance of use of the existing wind farm granted under planning ref 09/1175 and 15/725 for a further period of five years.	Granted by KCC 22/02/2018
Tylagh Wind Farm		
02/2123	Erect a windfarm consisting of 4no. wind turbines, a meteorological mast, associated access road and control building.	Granted 21/11/2003 4 turbines constructed.
02/92123	Extension of duration for 02/2123.	Granted 10th November 2008 4 no turbines constructed

Pl.Ref	Description	Decision and status
12/169	Construct two (2 no.) wind turbines extension (maximum hub height of 55.6 metres, maximum rotor blade diameter of 48 metres, maximum blade tip height of 79.6 metres) and all associated works.	Granted by KCC Granted by ABP on appeal (08.241171) 01/05/2013 No turbines constructed.
Ballincollig Hill		
02/3135	Construct a wind farm consisting of 15 wind turbines (50m hub height and 52m blade diameter, with a total height not exceeding 76m).	Granted by KCC Granted by ABP (08.204645) 18/06/2004 8 turbines constructed.
02/93135	Extension of duration for 02/3135.	Granted by KCC 08/06/2009
Stacks Mountain		
03/1749	Four no. wind turbine generators, meteorological tower, one control building, a control building compound and associated access roads.	Granted by KCC 09/01/2004 4 turbines constructed.
03/91749	Extension of duration for 03/1749.	Granted by KCC 08/01/2009
Knocknagoum/Maghanknockane		
03/886	Construction of a wind farm consisting of no.2 mw turbines (78 meters hub height and 80 meters rotor blade diameter).	Granted by KCC 24/02/2004
03/2676	Construct a wind farm consisting of 6 no. 2mw turbines (78metres hub height and 80 metres rotor blade diameter).	Granted by KCC 28/07/2004
03/9886	Extension of duration for 03/886.	Granted by KCC 07/04/2009
03/92676	Extension of duration for 03/2676	Granted by KCC 17/09/2009
10/874	Construction of a 9 turbines and ancillary works	Granted by KCC 05/07/2011
11/912	Construct a wind farm consisting of 15 turbines and ancillary works	Granted by KCC 06/06/2012 15 turbines constructed.
Beennageeha		
98/487	A wind farm comprising of 6 turbines and ancillary works	Granted by KCC 26/04/2016 Operational
Pallas/Clahane Wind Farm		
01/2720	To construct a windfarm comprising of 26 turbines and ancillary works	Granted by KCC Granted by An Bord Pleanála (08.130918) 17/04/2003 26 turbines constructed.
01/92720	Extension of duration for 01/2720	Granted by KCC 22/02/2008.
01/82720	Second extension of duration to a wind farm granted under Pl. Ref: 01/2720	Granted by KCC 21/06/2013
08/471	Construct a wind turbine with a hub height of 65 metres and a rotor diameter of 72 metres, connecting road and all associated ancillaries.	Granted by KCC 28/05/2008
08/1461	Construct three no. wind turbines with a hub height of 65 metres and a rotor diameter of 72 metres, connecting roads and all associated ancillary site works	Granted by KCC 22/05/2009
11/571	Relocate proposed wind turbine to new location, 127 metres west (planning reg. no. 08/471)	Granted by KCC 19/01/2012
Beale Hill		
97/2365	Construct a wind-farm incorporating a) 7 turbines, b) a control house, c) an anemometer station, d) service road	Granted by KCC 19/10/1998

Pl.Ref	Description	Decision and status
		6 turbines constructed.
99/30	Change turbine no. 7 to a 1.65 megawatt wind turbine from that granted under previous planning	Granted by KCC 05/03/1999
04/1065	Erect two vestas v52 wind turbines and construct an extra sub-station on existing wind farm	Granted by KCC 09/06/2004
04/91065	Extension of duration for 04/1065.	Granted by KCC 17/07/2009
09/689	2no. Vestas V52 wind turbines with 55m towers and substation.	Granted by KCC 09/11/2009 2 turbines constructed.
09/9689	Extension of duration for 09/689.	Granted by KCC 17/11/2014
14/163	Erect 2 no. wind turbines (vestas v52) having a maximum ground to blade tip height of 91m (with a tower height of 65m)	Refused 23rd May 2014
Cahercullanagh		
03/1284	To construct a windfarm consisting of 17 turbines and ancillary works	Granted by KCC 17/02/2004 11 turbines constructed
03/91284	Extension of duration for 03/1284.	Granted by KCC 30/03/2009
03/991284	Second extension of duration to the permission granted under Pl. Ref. 03/1284	Granted by KCC 08/10/2012
05/1961	Construct wind farm consisting of 5 turbines vestas v52 and all ancillary works.	Granted by KCC 25/10/2006
05/3286	Construction of a wind farm consisting of 1 turbine vestas v52 (65m hub height, 52 metres rotor blade diameter and a power installed of 0.85mw).	Granted by KCC 31/01/2007
05/991961	Extension of duration for 05/1961	Granted by KCC 25/10/2006
07/595	Construct a wind farm consisting of 2 wind turbines (65mm hub height, 52 metres rotor blade diameter) and ancillary works	Granted by KCC 16/05/2007
07/9595	Extension of duration for 07/595.	Granted by KCC 19/12/2011
Muingnaminane		
01/635	Windfarm with 21 turbines, service roadways, construction of transformer/control housing compound and 50-metre anemometer mast	Granted by KCC Granted by An Bord Pleanála (08.130019) 05/11/2002 18 turbines constructed
01/9635	Extension of duration for 01/635	Granted by KCC 08/01/2008
Wind Farm at Urlea		
98/3014	Erect a wind farm consisting of four wind turbines, associated roads and electrical/control buildings.	Refused by KCC Refused by An Bord Pleanála (08.119245) 27/11/2000
Single Turbine at Aghamore North		
15/341	Erect a single electricity generating wind turbine with a hub height of up to 65m and a rotor diameter of up to 55m giving an overall tip height of up to 92.5m and all ancillary works.	Granted by KCC Granted by An Bord Pleanála (08.245921) 07/07/2016 Not constructed
Dromadda Beg		
01/2719	Erect 3 no 1mw wind turbines, service roadways and control house.	Granted by KCC 19/06/2002
01/92719	Extension of duration for 01/2719	Granted by KCC 09/09/2007
01/992719	Extension of duration for 01/2719	Granted by KCC 20/07/2012

Pl.Ref	Description	Decision and status
13/544	Construction of a wind farm comprising of 3 no. turbines and ancillary work	Granted by KCC Granted by An Bord Pleanála (08.243573) 8/12/2014 Under construction
Dromadda More		
04/2947	Erect 10 no. 2MW wind turbines with a hub height of 82m and a rotor diameter of 82m maximum. 1 no. 60m wind monitoring mast (temporary), associated hardstanding areas, access roadways and control house.	Granted by KCC 11/11/2005
04/92947	Extension of duration for 04/2947.	Granted by KCC 04/10/2010
10/571	Construct 10 no. wind turbine generators with a maximum hub height of 90m, a maximum rotor diameter of 112m and a maximum overall height of 145m, an electrical substation and all associated works.	Granted by KCC 20/05/2011
10/692	Construction of wind farm comprising 28 turbines and ancillary works.	Refused by KCC Granted by An Bord Pleanála (08.239473) 11/05/2012
12/623	An extension of one turbine to 10/692	Granted by KCC 22/11/2012
Wind Farm at Knocknacaheragh		
03/562	To construct a wind farm consisting of 2 turbines (67 metres hub height and 80 metres rotor blade diameter) and all ancillary works.	Granted by KCC 22/12/2003 2 turbines constructed.
Moyvane Wind Farm		
11/293	Erect 2 no. 500 kw wind turbines	Refused by KCC 7th June 2011
13/106	Erect 2 no. 500kw wind turbines (hub height 45.00m) and the construction of a 25.00 sq.m. electrical sub-station, site access road and ancillary works	Grant by KCC Grant by An Bord Pleanála (08.242798) 30/04/2014
13/9106	Extension of Duration for 13/106	Granted by KCC 26/03/2019
Beennanaspuck		
14/571	Develop a wind farm, the development will consist of three (3) no. wind turbines (with a maximum height of up to 125m), provision of two (2) no. new site entrances, the provision of new and upgraded internal site service roads, underground cabling and all associated infrastructure	Granted Granted by An Bord Pleanála (08.245464) 09/09/2015 3 turbines constructed
Kilathmoy-Toberatooreen		
12/431	Develop a wind farm including seven (7) no. wind turbines (with a maximum height of up to 125m), one (1) no. permanent meteorological mast, one (1) no. substation, provision of two (2) no. new site etnrances, the provision of new and upgraded internal site service roads, underground cabling and all associated infrastructure, a ten-year planning permission is being sought to construct the development. An Environmental Impact Statement and Natura Impact Statement have been prepared and submitted as part of this application.	Granted by KCC 13/06/2013 Granted by An Bord Pleanála (08.242170) 12/11/2013 4 turbines constructed
Wind Farm located at Curraghderrig		
06/3997	Erect an electricity generating windfarm consisting of two (2) wind turbine generators of hub height 64m and rotor diameter 71m, a control building, 2 car park spaces and associated site roads and site works.	Refused by KCC Granted by An Bord Pleanála (08.221493) 01/10/2007
06/93997	Extension of duration for 06/3997	Granted by KCC 27/11/2012 2 turbines constructed

Pl.Ref	Description	Decision and status
Wind Farm at Cloghaneleskirt		
02/2011	Erect 5 no. wind turbines, 40m wind monitoring mast (temporary), service roadways and control house.	Refused by KCC 03/10/2002
03/1264	Construct 5 no. 2mw wind turbines 1 no. 60m wind monitoring mast (temporary) service roadways and control house	Granted by KCC 15/12/2003 5 turbines constructed
03/991264	Extension of duration for 03/1264	Granted by KCC 07/10/2015
Tursillagh 1		
97/1865	Construction of a wind farm comprising of 23 turbines and ancillary works	Granted by KCC Granted by An Bord Pelanála (08.105339) 14/07/2998 23 turbines constructed
Tursillagh 2		
01/390	Construction of a wind farm comprising of 8 turbines and ancillary works	Granted by KCC Granted by An Bord Pleanála (08.126623) 09/05/2002 8 turbines constructed
Leanamore		
11/299	Erect (9) no. wind turbines with a maximum height of up to 125m, one (1) no. permanent meteorological mast, one (1) no. substation, provision of three (3) no. new site entrances, the provision of new and upgraded internal site service road, and all underground cabling and associated infrastructure.	Refused Granted by An Bord Pleanála (08.239233) 10/11/2011 9 turbines constructed
Toberatooreen		
12/431	Develop a wind farm including seven (7) no. wind turbines (with a maximum height of up to 125m) and all associated infrastructure.	Granted Granted by An Bord Pleanála (08.242170) 12/11/2013 4 turbines constructed. (3 turbines omitted under ABP decision)
Ballyhorgan Wind Farm		
14/13	Provision of a total of 10 no. wind turbines, having a maximum ground to blade tip height of up to 156.5 metres and all ancillary works.	Refused by KCC Granted by An Bord Pleanála (08.244066) Subsequently quashed following judicial review and currently under the consideration of An Bord Pleanála under 08.301852.
Meenbannivane		
11/771	Construct one wind turbine generator and ancillary works.	Refused 10/11/2011
Cloghboola		
00/4099	Construct a wind farm comprising 24 wind turbines, service roadways, swithgear/ transformer compound, borrow pit, control house and meteorological mast	Granted by KCC 10/06/2002
00/84099	Extension of duration 00/4099	Granted by KCC
00/94099	Extension of duration for 00/4099	Granted by KCC 12/01/2007
00/994099	Extension of duration for 00/4099	Granted by KCC 12/01/2007

Pl.Ref	Description	Decision and status
08/1454	Erect 20 no. wind turbine generators of 125m overall height, extension of existing site roads and construction of a windfarm control building as an amendment to planning ref. no. 00/4099	Refused by KCC 01/07/2009
10/616	Erect twenty (20) wind turbines of 125 metre overall height, 110kv sub-station/compound and control buildings, extension of existing site roads, associated drainage and site works as an amendment to planning reference no. 00/4099	Granted by KCC 30/03/2011 16 turbines constructed.
Breehva (Co.Clare)		
00/2417	Build a wind farm comprising 4 no. wind turbine generators with towers not exceeding 52m & ancillary equipment for generator of electricity & control building.	Granted by CCC Granted by An Bord Pleanála 03/09/2004 2 turbines constructed.
09/911	Extension of duration for 00/2417.	Granted by CCC 13/10/2009

Other Developments/Landuses

The review of the Kerry County Council planning register documents relevant general development planning applications in the vicinity of the proposed site of the wind farm and all its associated works, these are described under Section 2.5 of Chapter 2. These applications (which include those listed previously in Section 2.5) have also been taken account in describing the baseline environment and in the relevant assessments. Non-wind energy related planning applications within 2km of the application site are set out in Appendix 2-1 of Chapter 2 of the EIAR. Planning applications within a 200m radius of the preferred grid connection route are set out in Appendix 2-2 of Chapter 2 of the EIAR.

Furthermore, the cumulative impact assessments carried out in each of the subsequent chapters of this EIAR consider all potential significant cumulative effects arising from all land uses in the vicinity of the proposed development. Overall, the proposed development has been designed to mitigate impacts on the environment and particularly water, and a suite of mitigation measures is set out within the EIAR. The mitigation measures set out in this EIAR have been developed to ensure that significant cumulative affects do not arise during construction, operational or decommissioning phases of the proposed development. Additional detail in relation to the potential significant cumulative effects arising and, where appropriate, the specific suite of relevant mitigation measures proposed are set out within each of the relevant chapters of this EIAR.

6.7.3 Assessment of Cumulative Effects

The residual construction, operational and decommissioning impacts of the proposed development are considered cumulatively with other plans and projects as described above. Particular focus has been placed on those plans and projects that are in closest proximity to the proposed development and those that could be potentially affected via downstream surface water.

The proposed development will result in a loss of approximately 1.8 ha of cutover peatland and 0.3ha of remnant intact peatland habitat within the study area. This does not represent a significant loss of peatland habitat. There is no potential for the proposed development to contribute to any significant cumulative habitat loss when considered in combination with any other plans and projects.

The potential for the proposed development to contribute to a cumulative effect on water quality in the Shannon catchment was considered in this chapter and in Chapter 9 of this EIAR. The proposed development includes a range of measures that are in place to prevent any water pollution or hydrological effects outside the development footprint. The implementation of these measures ensures that there is no potential for significant cumulative effects on any downstream receptors, whether the proposed development is considered on its own or in combination with other plans or projects.

No significant effects as a result of the proposed development in relation to disturbance, displacement or mortality of faunal species has been identified. Therefore, there is no potential for the proposed development to contribute to any cumulative effect in this regard.

The proposed development will not result in any significant residual effects on biodiversity and will not contribute to any cumulative effect when considered in combination with other plans and projects.

In the review of the projects that was undertaken, no connection that could potentially result in additional or cumulative impacts was identified. Neither was any potential for different (new) impacts resulting from the combination of the various projects and plans in association with the proposed development.

6.8 Conclusion

Following consideration of the residual effects (post mitigation) it is concluded that the Proposed Development will not result in any significant effects on any of the identified KERs.

The potential for effects on the European Sites is fully described in the Natura Impact Statement that accompanies this application.

The findings presented in the NIS are that:

"*it can be objectively concluded that the proposed development, individually or in combination with other plans or projects, will not adversely affect the integrity of any European Site.*"

No potential for significant effects on any Nationally Designated Site was identified following the implementation of mitigation.

Provided that the proposed development is constructed and operated in accordance with the design, best practice and mitigation that is described within this application, there will be no significant individual or cumulative effects on biodiversity.

BIBLIOGRAPHY

Bailey, M. and Rochford J. (2006) Otter Survey of Ireland 2004/2005. Irish Wildlife Manuals, No. 23. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

Birds Directive (2009/47/EC) – *http://ec.europa.eu/environment/nature /legislation/birdsdirective /index _en.htm*

Bowers Marriott, B. (1997) Practical Guide to Environmental Impact Assessment: A Practical Guide. Published by McGraw-Hill Professional, 1997, 320 pp.

Chanin P (2003). *Ecology of the European Otter.* Conserving Natura 2000 Rivers Ecology Series No. 10. English Nature, Peterborough.

Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) and Directive 2009/147/EC (codified version of Directive 79/409/EEC as amended) (Birds Directive) – transposed into Irish law as European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477/2011).

CIEEM (2018) Institute of Ecology and Environmental Management Draft Guidelines for Ecological Impact Assessment.

DEHLG (2009) Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities. DEHLG, Dublin.

DoEHLG (2010). Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities. Revision, February, 2010. Department of the Environment, Heritage and Local Government.

EC (2018) Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC, Office for Official Publications of the European Communities, Luxembourg. European Commission.

EC (2001) Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Articles 6(3) and (4) of the Habitats Directive 92/43/EEC.

EC (2002) Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC, Office for Official Publications of the European Communities, Luxembourg. European Commission.

EC (2007a) Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC – Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the commission. Office for Official Publications of the European Communities, Luxembourg. European Commission.

EC (2007b) Interpretation Manual of European Union Habitats. Version EUR 27. European Commission, DG Environment.

EPA (2002) Guidelines on the information to be contained in Environmental Impact Statements. Environmental Protection Agency.

EPA (2003) Advice Notes on current practice in the preparation of Environmental Impact Statements. Environmental Protection Agency.

EPA website: *http://www.epa.ie.*

European Communities (Conservation of Wild Birds) Regulations, 1985, SI 291/1985 & amendments – *http://www.irishstatutebook.ie.*

European Communities (Environmental Impact Assessment) Regulations, 1989 to 2001.

European Communities (Natural Habitats) Regulations, SI 94/1997, SI 233/1998 & SI 378/2005 – *http://www.irishstatutebook.ie.*

Fossitt, J. A. (2000). A Guide to Habitats in Ireland. Dublin: The Heritage Council.

Habitats Directive (92/43/EEC).

Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites. Eastern Regional Fisheries Board, Dublin.

National Biodiversity Data Centre website *http://www.biodiversityireland.ie/*

NPWS (2008) The Status of EU Protected Habitats and Species in Ireland. Conservation Status in Ireland of Habitats and Species listed in the European Council Directive on the Conservation of Habitats, Flora and Fauna 92/43/EEC.

NPWS of the DEHLG (2008) The Report on Status of Habitats and Species in Ireland: Technical Reports and Forms.

NPWS (2013) The Status of EU Protected Habitats and Species in Ireland. Conservation Status in Ireland of Habitats and Species listed in the European Council Directive on the Conservation of Habitats, Flora and Fauna 92/43/EEC.

NPWS (2019) The Status of EU Protected Habitats and Species in Ireland. Conservation Status in Ireland of Habitats and Species listed in the European Council Directive on the Conservation of Habitats, Flora and Fauna 92/43/EEC.

NPWS Protected Areas Site Synopses and maps available on *http://www.npws.ie/en/ProtectedSites/.*

NRA (2004) Environmental Impact Assessment of National Road Schemes – A Practical Guide, National Roads Authority, Dublin.

NRA (2005) Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes. Dublin: National Roads Authority.

NRA (2006) Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post-Construction of National Road Schemes. Dublin: National Roads Authority.

NRA (2008) *Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes.*

NRA (2009). Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes. Dublin: National Roads Authority.

Preston C.D. et. al. (2002). New Atlas of the British and Irish Flora. Oxford University Press.

Scottish Natural Heritage (SNH) (July 2013) Assessing Connectivity with Special Protection Areas (SPA)

The Central and Regional Fisheries Board, (2008) Cashen- Feale Estuary, Sampling fish for the water framework directive – transitional waters.

Water status data available on *http://www.epa.ie* and *http://www.wfdireland.ie*

Wildlife Act 1976 and Wildlife (Amendment) Act 2000.

7. ORNITHOLOGY

7.1 Introduction

This chapter assesses the likely significant impacts of the Ballynagare Wind Farm development (hereafter the "Proposed Development") on avian receptors. Particular attention has been paid to bird species with national and international protection under the Irish Wildlife Acts 1976-2021 and the European Union (EU) Birds Directive (2009/147/EC). Where potential impacts on avian receptors are identified, mitigation is described and the residual effects are assessed.

This chapter is supported by Technical Appendices 7-1 to 7-4, which contain data from the ornithological surveys undertaken at the Proposed Development, including full details of the survey effort, weather conditions and bird records. Technical Appendix 7-5 contains a collision risk assessment of birds with turbines, illustrating how collision risk modelling was undertaken for the Proposed Development. Appendix 7-6 contains a bird monitoring programme and Appendix 7-7 contains a whooper swan enhancement plan. Finally, a confidential Appendix 7-8 contains hen harrier and whooper swan roost data, which is considered highly sensitive information.

The chapter is structured as follows:

- The Introduction provides a description of the Proposed Development and the relevant legislation, guidance and policy context.
- The Assessment Approach and Methodology section is a comprehensive description of the ornithological surveys and impact assessment methodology used to inform a robust assessment of potential impacts of the Proposed Development on birds.
- The Baseline Ornithological Conditions section describes the existing bird population at the Proposed Development site.
- The Receptor Evaluation section identifies key ornithological receptors and determines their sensitivity.
- The Potential Impacts section details the impact assessment (including direct habitat loss, displacement and collision risk). Impacts are described with regard to each phase of the Proposed Development: construction, operation and decommissioning.
- The Mitigation and Best Practice Measures section describes proposed mitigation and best practice measures to ameliorate the identified impacts. It also includes details of a whooper swan enhancement plan.
- The Monitoring section outlines a schedule for monitoring birds during each phase of the Proposed Development if planning permission is granted: commencement and construction, post construction, and decommissioning.
- The Residual Effects section considers the implications of the proposed mitigation, best practice, enhancement measures and monitoring.
- Finally, the Cumulative Effects section fully assesses potential cumulative effects of the Proposed Development in combination with other projects.
- The Conclusion provides a summary statement on the overall significance of predicted effects on birds.

The following list defines the meaning of the technical terms used in this chapter:

- The EIAR boundary comprises the entire wind farm site, grid connection and turbine delivery routes. This is referred to as the "Proposed Development" or the "Proposed Development site", where relevant.
- The "wind farm study area" or "study area" refers to all within the EIAR boundary except the grid connection and turbine delivery routes (ie. the boundary shown in Figure 7-1 to 7-7).

- The infrastructural layout of the Proposed Development is referred to as the "Development Footprint".
- "Zone of Influence" (ZOI) for individual ornithological receptors refers to the zone within which potential effects are anticipated. ZOIs differ depending on the sensitivities of particular species and were assigned in accordance with best available guidance (SNH, 2016 and McGuinness et al., 2015), adopting a precautionary approach.
- "Key Ornithological Receptor" (KOR) is defined as a species occurring within the zone of influence of the development upon which potential impacts are anticipated and assessed.

7.1.1 Description of the Proposed Development

A full description of the Proposed Development is provided in Chapter 4 of this EIAR. In brief, the applicant is seeking a 10-year planning permission for a project consisting of 7 turbines and the associated meteorological mast, construction compounds, grid connection route and substation. The development also includes upgrades of existing roads, provision of new site entrances, roads and hardstands, site drainage and peat storage areas. The turbines will be 95m at hub height, with 3 blades of a diameter between 149 and 150m, giving a maximum rotor height of between 169.5m and 170m and minimum rotor height of between 20.5 and 20m. The Proposed Development will have an operation life of 35 years from the date of commissioning.

7.1.2 Legislation, Guidance and Policy Context

This EIAR is prepared in accordance with the requirements of the EU EIA Directive (2014/52/EU). The following key legislative provisions are applicable to habitats and fauna in Ireland:

- Irish Wildlife Acts 1976 to 2021. The original Act of 1976 (39/1976) was amended in 2000 (38/2000), 2010 (19/2010) and 2012 (29/2012), as well as in Part 3 of the Heritage Act 2018 (15/2018) and in Part 2 Chapter 3 of the Planning and Development, Heritage and Broadcasting (Amendment) Act 2021 (11/2021).
- The European Communities (Birds and Natural Habitats) Regulations 2011, as amended (S.I. no. 477 of 2011). These regulations transpose the EU Birds Directive into Irish law.
- The International Convention on Wetlands of International Importance (the Ramsar Convention), 1971. This convention protects 45 wetland sites of significant value for nature in Ireland.

In the absence of specific national ornithological survey guidance for Ireland, the following guidance documents published by NatureScot (formerly Scottish Natural Heritage [SNH]) have been followed to inform this assessment:

- SNH (2000). Wind farms and birds: calculating a theoretical collision risk assuming no avoidance action. Scottish Natural Heritage, Inverness, Scotland. Available at: https://www.nature.scot/sites/default/files/2017-09/Guidance%20Note%20-%20Windfarms%20and%20birds%20-%20Calculating%20a%20theoretical%20collision%20risk%20assuming%20no%20avoiding%20action.pdf (accessed 27/05/2021).
- SNH (2009). Monitoring the impact of onshore wind farms on birds. Scottish Natural Heritage, Inverness, Scotland. Available at: https://www.nature.scot/sites/default/files/2017-09/Guidance%20Note%20-%20Monitoring%20the%20impact%20of%20onshore%20windfarms%20on%20birds.pdf (accessed 27/05/2021).
- SNH (2016). Assessing connectivity with Special Protection Areas (SPAs). Scottish Natural Heritage, Inverness, Scotland. Available at: https://www.nature.scot/sites/default/files/2018-

08/Assessing%20connectivity%20with%20special%20protection%20areas.pdf (accessed 27/05/2021).
- SNH (2017). Recommended bird survey methods to inform impact assessment of onshore wind farms. Scottish Natural Heritage, Inverness, Scotland. Available at: https://www.nature.scot/sites/default/files/2018-06/Guidance%20Note%20-%20Recommended%20bird%20survey%20methods%20to%20inform%20impact%20assessment%20of%20onshore%20windfarms.pdf (accessed 27/05/2021).
- SNH (2018) Avoidance rates for the onshore SNH wind farm collision risk model. Scottish Natural Heritage, Inverness, Scotland. Available at: https://www.nature.scot/sites/default/files/2018-09/Wind%20farm%20impacts%20on%20birds%20-%20Use%20of%20Avoidance%20Rates%20in%20the%20SNH%20Wind%20Farm%20Collision%20Risk%20Model.pdf (accessed 27/05/2021).
- SNH (2018). Assessing the cumulative impacts of onshore wind farms on birds. Scottish Natural Heritage, Inverness, Scotland. Available at: https://www.nature.scot/sites/default/files/2018-08/Guidance%20-%20Assessing%20the%20cumulative%20impacts%20of%20onshore%20wind%20farms%20on%20birds.pdf (accessed 27/05/2021).
- SNH (2018). Assessing significance of impacts from onshore wind farms outwith designated areas. Scottish Natural Heritage, Inverness, Scotland. Available at: https://www.nature.scot/doc/guidance-assessing-significance-impacts-bird-populations-onshore-wind-farms-do-not-affect-protected (accessed 23/09/2021).

The following Irish guidance documents were also consulted:

- Percival, S.M. (2003). Birds and wind farms in Ireland: A review of potential issues and impact assessment. Ecology Consulting, Durham, UK. Available at: https://tethys.pnnl.gov/sites/default/files/publications/Percival_2003.pdf (accessed 27/05/2021).
- McGuinness, D., Muldoon, C., Tierney, N., Cummins, S., Murray, A., Egan, S. and Crowe, O. (2015). Bird Sensitivity Mapping for Wind Energy Developments and Associated Infrastructure in the Republic of Ireland. Birdwatch Ireland, Wicklow, Ireland. Available at: https://birdwatchireland.ie/app/uploads/2019/09/BWI-Bird-Wind-Energy-devt-Sensitivity-Mapping-Guidance_document.pdf (accessed 27/05/2021).
- Gilbert, G., Stanbury, A. and Lewis, A. (2021). Birds of Conservation Concern in Ireland 4: 2020-2026. *Irish Birds,* 43:1-22. Available at: https://birdwatchireland.ie/birds-of-conservation-concern-in-ireland/ (accessed 27/05/2021).

Furthermore, this assessment has been prepared with respect to the various planning policies and strategy guidance documents listed below:

- European Commission (2002). Assessment of plans and projects significantly affecting Natura 2000 sites. Publications Office of the European Union, Luxembourg.
- European Commission (2020). Guidance document on wind energy developments and EU nature legislation. Publications Office of the European Union, Luxembourg.
- Planning and Development Acts 2000 – 2021 (30/ 2000 as amended).
- NRA (2009). Guidelines for Assessment of Ecological Impacts of National Road Schemes. National Roads Authority, Ireland.
- EPA (2017). Guidelines on the information to be contained in Environmental Impact Statement reports. Environmental Protection Agency, Johnstown Castle Estate, Wexford.
- DoHPLG (2018). Guidelines for planning authorities and An Bord Pleanála on carrying out Environmental Impact Assessment. Department of Housing, Planning and Local Government, Government of Ireland, Dublin.

- Kerry County Council (2020). Kerry County Development Plan 2022-2028. Kerry County Council, Tralee, Kerry.

7.1.3 Statement of Authority and Competence

This ornithology chapter has been prepared by Susan Doyle (MSc.), Project Ornithologist of MKO and reviewed by Padraig Cregg (MSc.), Senior Ornithologist. Both are suitably qualified, professional ecologists with extensive experience in completing avifaunal assessments and are competent for the purposes of the preparation of this EIAR. The scope of works and survey methodology was devised by Padraig Cregg and is fully compliant with recent NatureScot guidance. Field surveys were undertaken by Ciaran McKenna (BSc.) and Gerry Murphy (Dip.). Both surveyors are suitably qualified for the purposes of the preparation of this EIAR.

7.2 Assessment Approach and Methodology

7.2.1 Desk Study

A comprehensive desk study was undertaken to search for any relevant information on species of conservation concern that may use the study area. The assessment included a thorough review of the available ornithological data including:

- Designated sites within the likely ZOI of the Proposed Development.
- Bird Atlases.
- Bird sensitivity mapping tool.
- Online web-mappers from the National Biodiversity Data Centre.
- Irish Wetland Bird Survey (IWeBS) data.
- Review of specially requested records from the NPWS Rare and Protected Species Database.

7.2.2 Consultation

Consultation was undertaken with the relevant statutory and non-statutory organisations as part of the EIAR scoping to inform the current assessment. Full details can be found in Chapter 2 of this EIAR. Table 7-1 below provides a list of the organisations consulted with regard to ornithology during the scoping process and notes where scoping responses were received.

Copies of all scoping responses are included in Appendix 3 of this EIAR. The recommendations of the consultees have informed the EIAR preparation process and the contents of this chapter; Chapter 2 describes where the comments raised in the scoping responses received have been addressed.

Table 7-1 Consultation Responses

	Consultee	Response
01	An Taisce	No response to date
02	BirdWatch Ireland	Response received on 14 April 2021. Recommendations to address potential direct, indirect and cumulative impacts on wintering whooper swan at Ballynagare Bridge, Lixnaw and Ballyouneen, on breeding hen harrier, buzzard, kestrel and barn owl and on wintering golden plover and curlew in area of the wind farm study area.
03	Department of Agriculture, Food and the Marine	No response to date
04	Department of Tourism, Culture, Arts, Gaeltacht, Sport and Media	Response received on 26 January 2021. No ornithological issues were raised.
05	Irish Peatland Conservation Council	No response to date
06	Irish Red Grouse Association	No response to date
07	Irish Raptor Study Group	No response to date

	Consultee	Response
08	Irish Wildlife Trust	No response to date
09	Kerry County Council	No response to date
10	The Heritage Council	No response to date
11	National Parks and Wildlife Service	Response received on 04 June 2021. Information received on hen harrier breeding sites from the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA, breeding barn owl sites and curlew breeding in the wider area of the wind farm study area.

7.2.3 Identification of Target Species and Key Ornithological Receptors

This section describes the criteria used for the selection of "target species" and KORs. Following a comprehensive desk study, initial site visits and consultation, a list of target species likely to occur in the ZOI of the Proposed Development was compiled. Bird surveys conducted on the site were then specifically designed to survey for these target species, in accordance with SNH (2017). The target species list was drawn from:

- Species listed on Annex I of the EU Birds Directive.
- Special Conservation Interests (SCI) of Special Protection Areas (SPA) within the zone of likely significant effects.
- Red listed Birds of Conservation Concern in Ireland (BoCCI).
- Species listed on Schedule 4 of the Wildlife Acts 1976-2021.

Following analysis of the collated field survey data (described below), a precautionary screening approach was followed to identify KORs. The list of target species observed during surveys (see Appendix 7-1) was refined to KORs, excluding those for which pathways for a significant effect could not be identified.

7.2.4 Field Surveys

Field surveys were undertaken during the survey period April 2019 – March 2021, consisting of two breeding seasons (April – September) and two non-breeding seasons (October – March), in compliance with NatureScot guidance on surveys for onshore windfarms (SNH, 2017). Based on the results of the desk study, consultation and reconnaissance site visits described in the previous sections (Section 7.2.1-7.2.3), the assemblage of bird species in the study area and the likely importance of the study area for these species was ascertained. Then, adopting a precautionary approach, a site-specific scope for ornithological surveys was devised. The data provided in the field surveys is robust and allows clear, precise and definitive conclusions to be made on the avian receptors identified within the study area.

7.2.4.1 Survey Methodologies

The survey work that was undertaken between April 2019 and March 2021 forms the core dataset for the assessment of impacts on ornithology. In the absence of specific national bird survey guidelines, the ornithological surveys were designed and undertaken in full accordance with the guidance document 'Recommended bird survey methods to inform impact assessment of onshore wind farms' (SNH, 2017). The various ornithological surveys undertaken at the wind farm study area and hinterland are described in detail below. The proposed cable routes were surveyed as part of a multidisciplinary walkover (details in Chapter 6 of this EIAR).

7.2.4.1.1 *Vantage Point Surveys*

Vantage point surveys were undertaken in accordance with SNH (2017) from April 2019 to March 2021. These surveys aimed to monitor flight activity on the wind farm study area to a 500m radius of the proposed turbines. Surveys were conducted monthly throughout this period from one fixed point vantage point with comprehensive coverage of the study area (Figure 7-1). The vantage point location was selected by undertaking a viewshed analysis (described below) and confirmed by a recce visit and initial field surveys to ensure that the proposed turbine layout is entirely covered. Initially, three vantage points were surveyed from the commencement of surveys (April 2019) until December 2019 (Figure 7-2). However, surveys at these two additional vantage points were discontinued from January 2020 because the wind farm study area area was reduced and turbines were no longer proposed within their viewsheds. Data from surveys at the two additional vantage points is included as supplementary information in Appendix 7-4.

Viewshed analysis was carried out to inform coverage of the study area from the fixed vantage point location. A 500m buffer was applied to the outermost proposed turbines, in line with SNH (2017). Viewsheds were calculated using Resoft Wind Farm ZTV (Zone of Theoretical Visibility) software in combination with Mapinfo Professional (Version 10.0) using a notional layer suspended at 15m, which is representative of the minimum height considered for the Potential Collision Risk Area based on a worst-case scenario turbine model at the time the vantage point locations were selected. Note that while the relevance of being able to view as much of the site to ground level is acknowledged, the NatureScot guidance emphasises the importance of visibility of the 'collision risk volume' when the data is to be used to estimate the risk of collision with turbines by birds.

The viewshed analysis aims to identify the most suitable locations to site vantage points such that the airspace of the turbine rotor swept area is in view. The analysis aims to achieve this using the fewest possible number of vantage points. The vantage point location was tested for visibility coverage by creating a viewshed point 1.5 meters in height (to represent the height of observer) on a map using 10 metre contours terrain data. The relative height of any surrounding forestry and its effects on visibility is also accounted for in the analysis. Using the ZTV software, a viewshed of 360 degrees was produced calculating an area 15m from ground level up to a 2km radius. The resulting viewshed image was then cropped to 180 degrees to give the viewshed, in line with SNH (2017). The visible view shed at 15m is presented in Figure 7-3.

Data on bird observations and flight activity was collected from a scanning arc of 180° and a 2km radius by an observer at the fixed vantage point location for two 3-hour watches separated by a minimum 30 minute break (ie. 6 hours total) per month. Surveys were scheduled to provide a spread over the full daylight period, including dawn and dusk watches to coincide with the highest periods of bird activity. Along with target species, any additional (non-target) species observed were recorded to inform the evaluation of supporting habitat. The survey effort is presented in Appendix 7-2, including full details of dates, times and weather conditions. Table 7-2 below provides a brief summary of the survey effort.

Table 7-2 Vantage Point Survey Effort

Survey Season	Months	Effort per Vantage Point
2019 Breeding Season (1VP and 2 supplementary VPs)	Apr-Sep	36 hours per VP
2019/2020 Winter Season (1VP and 2 supplementary VPs)	Oct-Dec	18 hours per VP
2019/2020 Winter Season (1VP)	Jan-Mar	18 hours per VP
2019 Breeding Season (1VP)	Apr-Sep	36 hours per VP
2020/2021 Winter Season (1VP)	Oct-Mar	36 hours per VP

Each flight observation was assigned a unique identifier when mapped in the field and subsequently digitised using QGIS software. Observed flight activity was recorded as per defined flight bands which were chosen in relation to the dimensions of potential turbine models for the site. Bands were split into 0-10m, 10-25m, 25-175m and >175m for surveys between April 2019 and December 2019. From January 2020 to the end of the survey period (March 2021), bands were split into 0-15m, 15-25m, 25-200m and >200m. All flight activity within a height band 10-200m (ie. all activity in survey bands 10-25m and 25-175m from April to December 2019, and in bands 15-25m and 25-200m from January 2020 to March 2021) is considered to be within the Potential Collision Height (PCH) with regard to the turbine swept area, based on a worst-case scenario for turbine modelling.

7.2.4.1.2 Breeding Walkover Surveys

Breeding walkover surveys were undertaken to determine possible, probable or confirmed breeding bird activity within the wind farm study area to a 500m radius. The methodology was based on Brown and Shepherd (Brown and Shepherd, 1993; Calladine et al. 2009), combined with Common Bird Census methods (British Trust for Ornithology, 2021) for dense habitat, as per SNH (2017) recommendations. Transect routes were walked across different habitat complexes where access allowed[1]. The surveyor regularly scanned with their binoculars the wider surroundings of each transect for target species. Along with target species, all additional (non-target) species observed were recorded to inform the evaluation of supporting habitat.

Breeding walkover surveys were conducted in daylight hours (08:00-18:00) over four visits during the core breeding season months April to July. All four visits were successfully conducted in 2019. However, due the COVID-19 restrictions, three visits were conducted in May, June and July in 2020. Survey effort is presented in Appendix 7-2, including full details of dates, times and weather conditions for each survey. Figure 7-4 shows the transect routes.

7.2.4.1.3 Winter Walkover Surveys

Winter walkover surveys were undertaken to record the presence of bird species within the wind farm study area to a 500m radius. The methodology was adapted from the breeding walkover surveys outlined above. Transect routes were walked across different habitat complexes within the study area where access allowed. Along with target species, all additional (non-target) species observed were recorded to inform the evaluation of supporting habitat.

Winter walkover surveys were conducted in daylight hours over four visits between October and March (ie. four visits in winter 2019/2020 and four visits in winter 2020/2021). All target species observations were mapped. Survey effort is presented in Appendix 7-2, including full details of dates, times and weather conditions for each survey. Figure 7-4 shows the transect routes.

7.2.4.1.4 Breeding Raptor Surveys

Raptors include all harrier, falcon, buzzard, eagle, hawk, owl, kite and osprey species. Breeding raptor surveys were undertaken within the wind farm study area and within a 2km radius. Survey methodology followed Hardy *et al.* (2013), as per SNH (2017) recommendations. All raptor species were recorded during these surveys to identify occupied raptor territories and monitor their breeding success within the study area.

Breeding raptor watches of 3 hours (supplemented by transects if necessary) were conducted at four breeding raptor vantage point (BRVP) locations during daylight hours. Each BRVP was surveyed once per month during the core breeding season between April and July. All four visits were successfully

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[1] *the onsite areas were boggy and quite treacherous under foot, which limited access to some areas.*

conducted in 2019. However, due the COVID-19 restrictions, three visits were conducted in May, June and July in 2020. Survey effort is presented in Appendix 7-2, including full details of dates, times and weather conditions. Figure 7-5 shows the BRVPs.

7.2.4.1.5 *Hen Harrier Winter Roost Surveys*

Hen harrier roost surveys were undertaken within the wind farm study area and within a 2km radius. Survey methodology followed SNH (2017) and Gilbert *et al.* (1998) recommendations. These surveys aimed to identify active winter hen harrier roosts within the study area. Roost watches of 2-3 hours were conducted at two hen harrier vantage point (HHVP) locations from dusk until last visible light during which all hen harrier observations were mapped. Each HHVP was surveyed once per month during the winter season between October and March (in winter 2019/2020 and 2020/2021). Survey effort is presented in Appendix 7-2, including full details of dates, times and weather conditions. Figure 7-6 shows the HHVPs.

7.2.4.1.6 *Waterbird Distribution Surveys*

Waterbirds include: swans, geese and ducks; cormorant, shag, divers and grebes; auks and seabirds; gulls, terns and skuas; herons, egrets and crane; rails and crakes; waders; and kingfisher. Significant wetlands and waterbodies within 5km of the wind farm study area were surveyed for waterbirds during the 2019/2020 and 2020/2021 winter and passage seasons (September to May inclusive). The area surveyed exceeds the 500m for foraging waterbirds and 1km for roosting waterbirds requirements of SNH (2017) and follows the recommendations of SNH (2016).

Survey methodology follows Gilbert *et al.* (1998) and the Irish Wetland Bird Survey (BirdWatch Ireland, 2021), as recommended by SNH (2017). Surveys were undertaken during daylight hours from suitable vantage points at wetlands and waterbodies. Target waterbird species observed were mapped. Survey effort, including details of survey duration and weather conditions, is presented in Appendix 7-2. Figure 7-7 shows the surveyed area.

7.2.4.1.7 *Multidisciplinary Walkover Survey*

The grid connection route options were surveyed in June 2021 through a multidisciplinary walkover survey. The site was systematically walked, while the surveyor recorded a range of protected species, including birds. Further details on this survey are available in the Biodiversity Chapter (Chapter 6)

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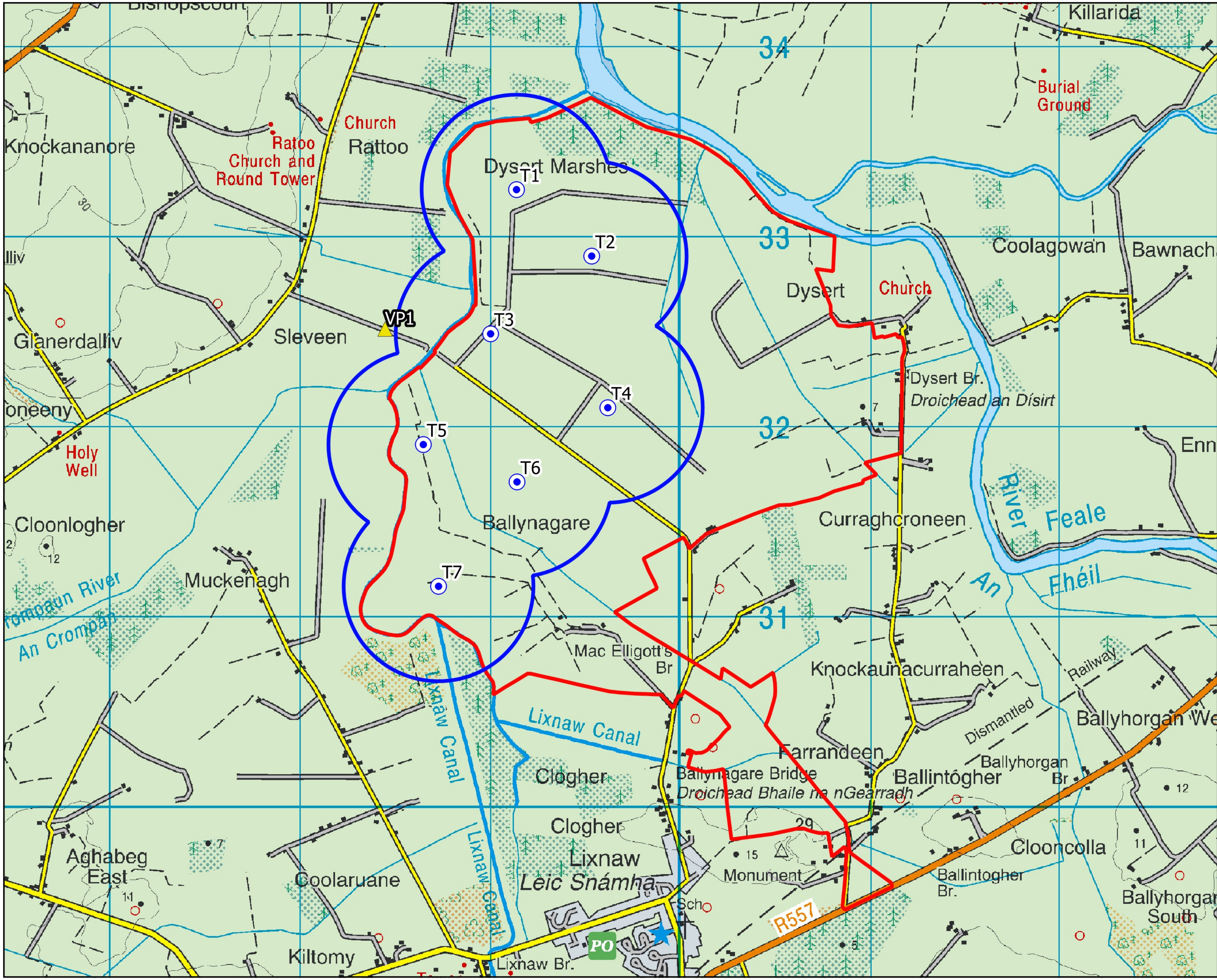

Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Vantage Point

Drawing Title	Vantage Point Location
Project Title	Ballynagare Wind Farm
Drawn By: S Doyle	Checked By: P Cregg
Project No.: 200512	Drawing No.: Fig 7-1
Scale: 1:26000	Date: 05.07.21

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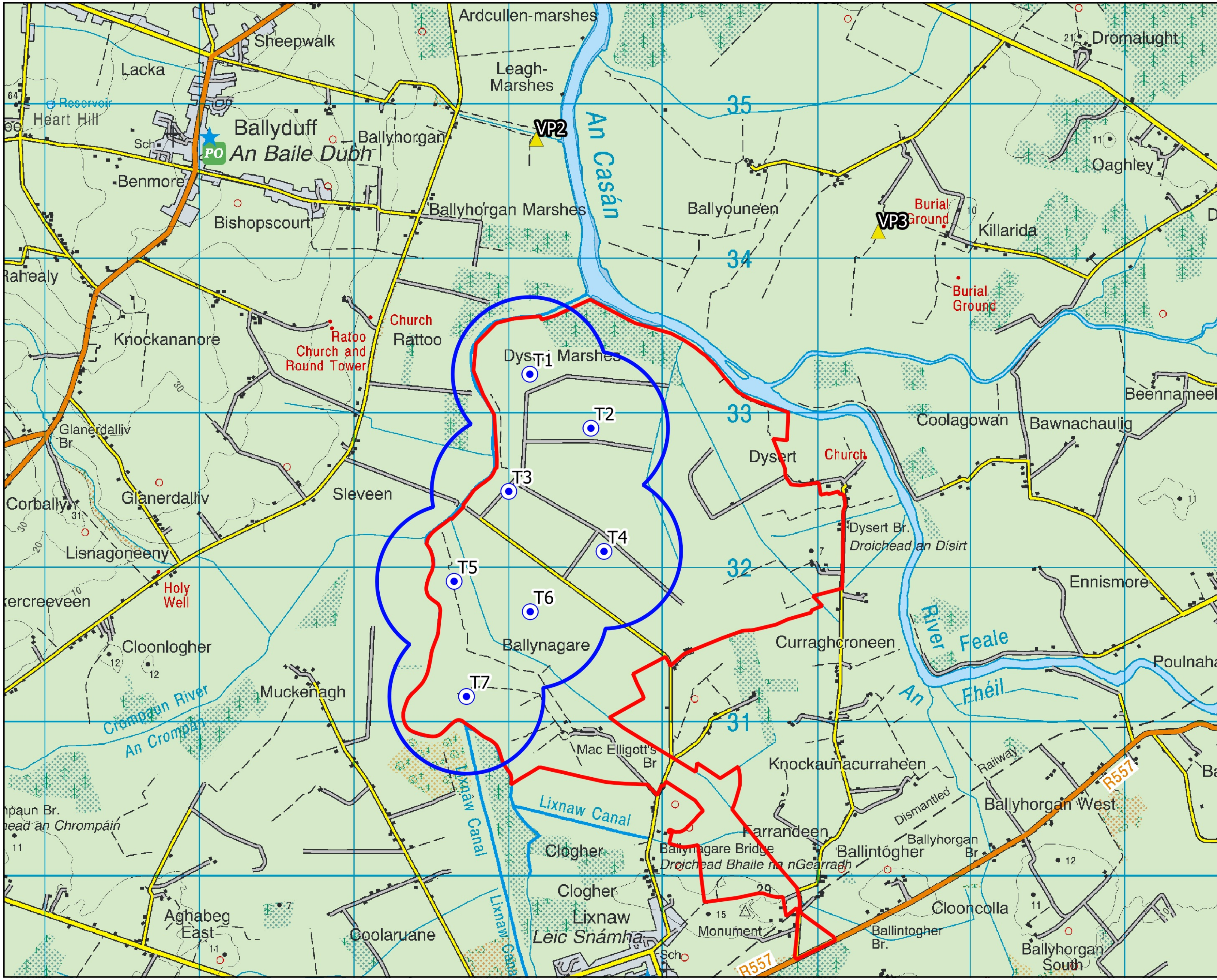

Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Supplementary Vantage Point

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Drawing Title	
Supplementary Vantage Point Location	
Project Title	
Ballynagare Wind Farm	
Drawn By: S Doyle	Checked By: P Cregg
Project No.: 200512	Drawing No.: Fig 7-2
Scale: 1:32000	Date: 05.07.21

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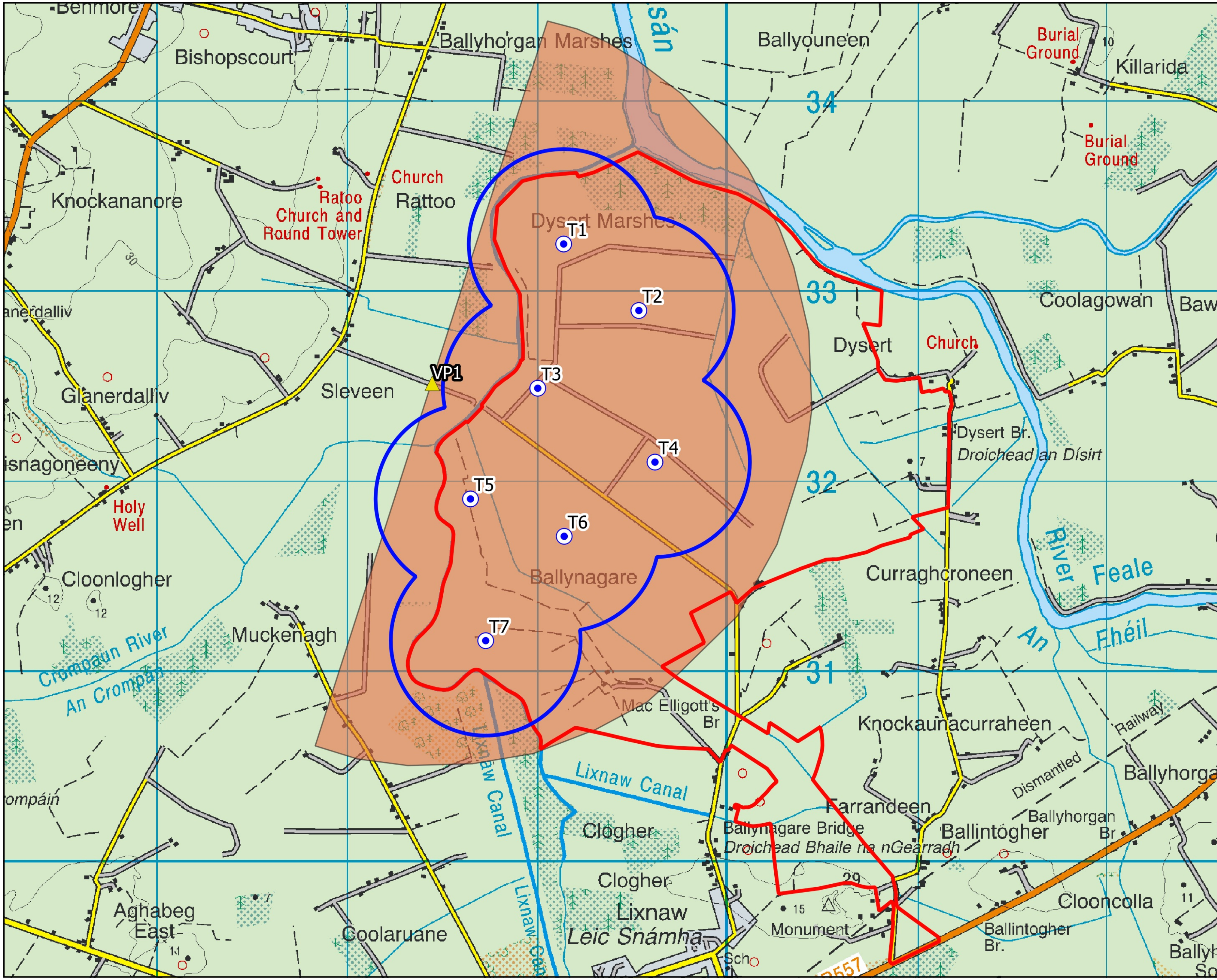

Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Vantage Point
- Viewshed Coverage

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Drawing Title	Viewshed Coverage
Project Title	Ballynagare Wind Farm
Drawn By: S Doyle	Checked By: P Cregg
Project No.: 200512	Drawing No.: Fig 7-3
Scale: 1:26000	Date: 05.07.21

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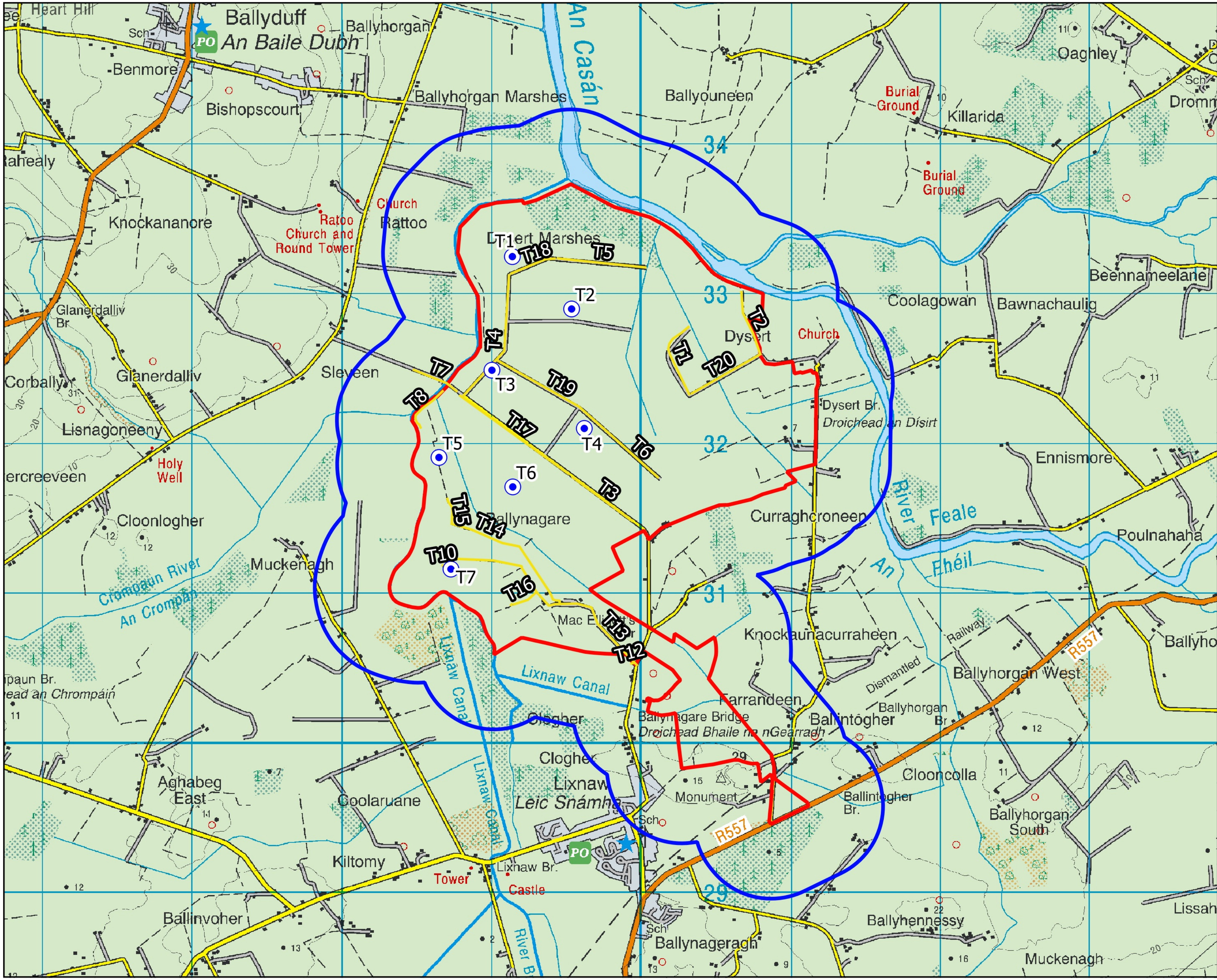

Drawing Title	Walkover Transect Routes
Project Title	Ballynagare Wind Farm
Drawn By: S Doyle	Checked By: P Cregg
Project No.: 200512	Drawing No.: Fig 7-4
Scale: 1:33000	Date: 07.10.21

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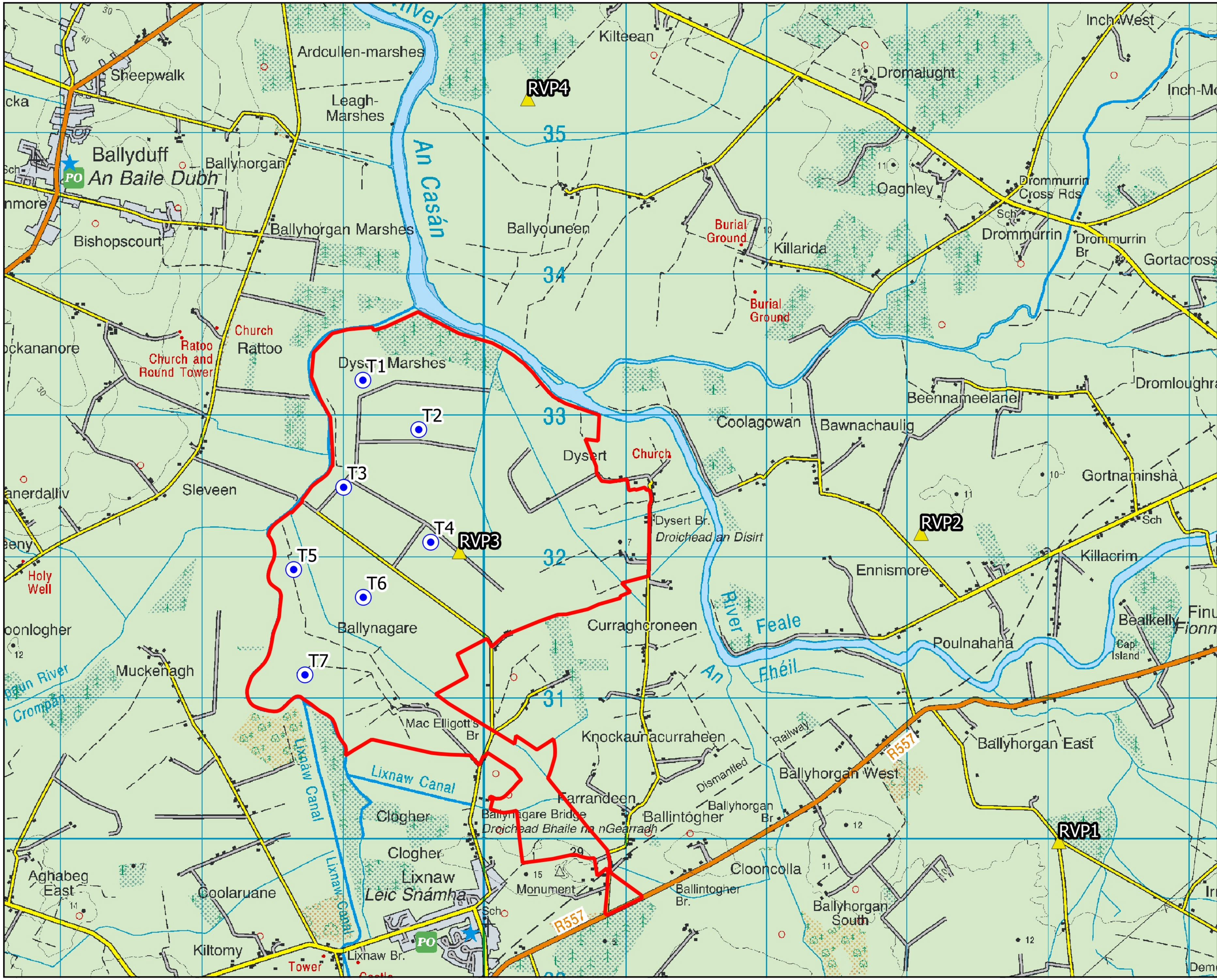

Drawing Title	
Breeding Raptor Vantage Point Location	
Project Title	
Ballynagare Wind Farm	
Drawn By: S Doyle	Checked By: P Cregg
Project No.: 200512	Drawing No.: Fig 7-5
Scale: 1:35000	Date: 05.07.21

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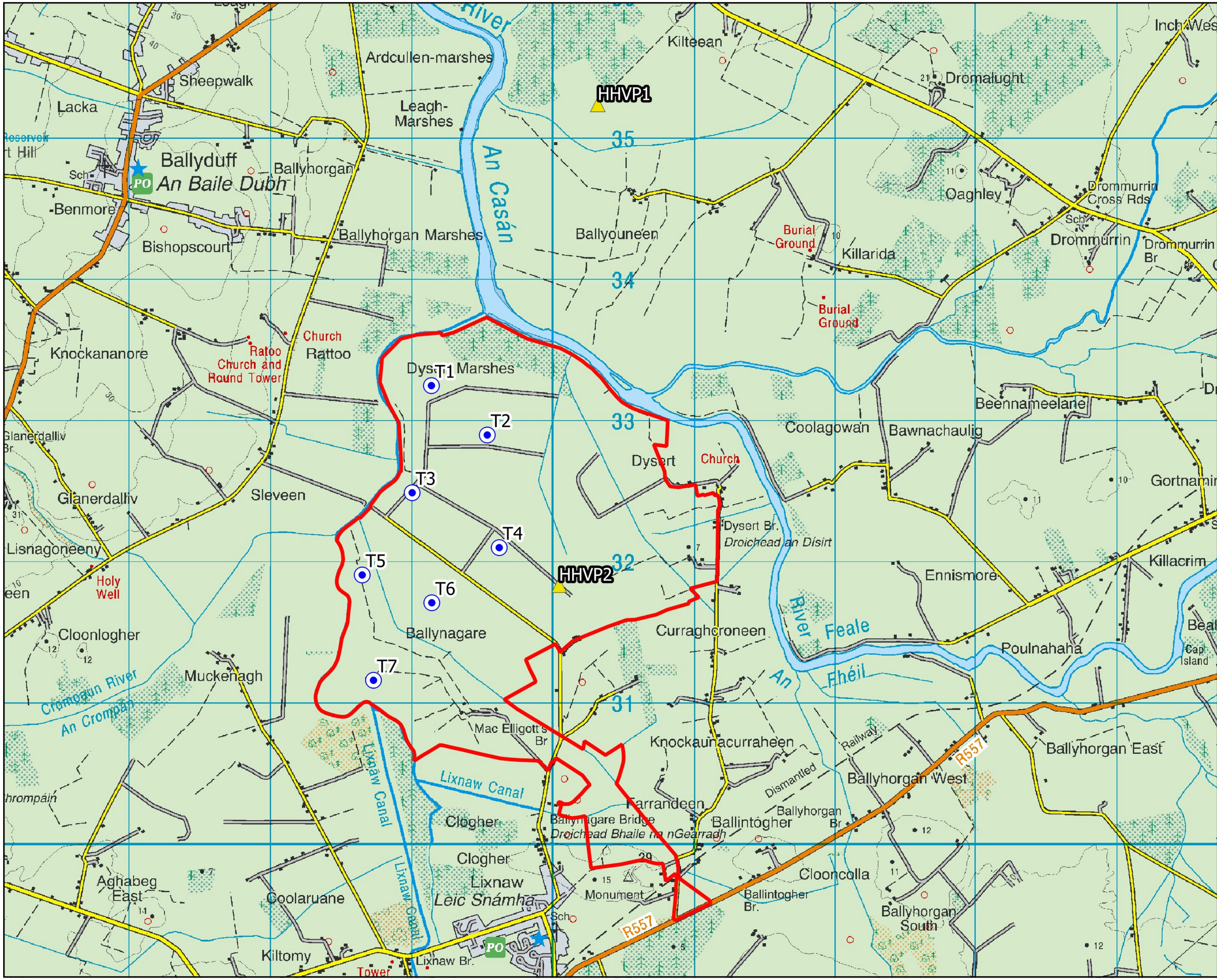

Map Legend

- Wind Farm Site
- Turbine Location
- Hen Harrier Vantage Point

Drawing Title	Hen Harrier Vantage Point Location
Project Title	Ballynagare Wind Farm
Drawn By: S Doyle	Checked By: P Cregg
Project No.: 200512	Drawing No.: Fig 7-6
Scale: 1:35000	Date: 05.07.21

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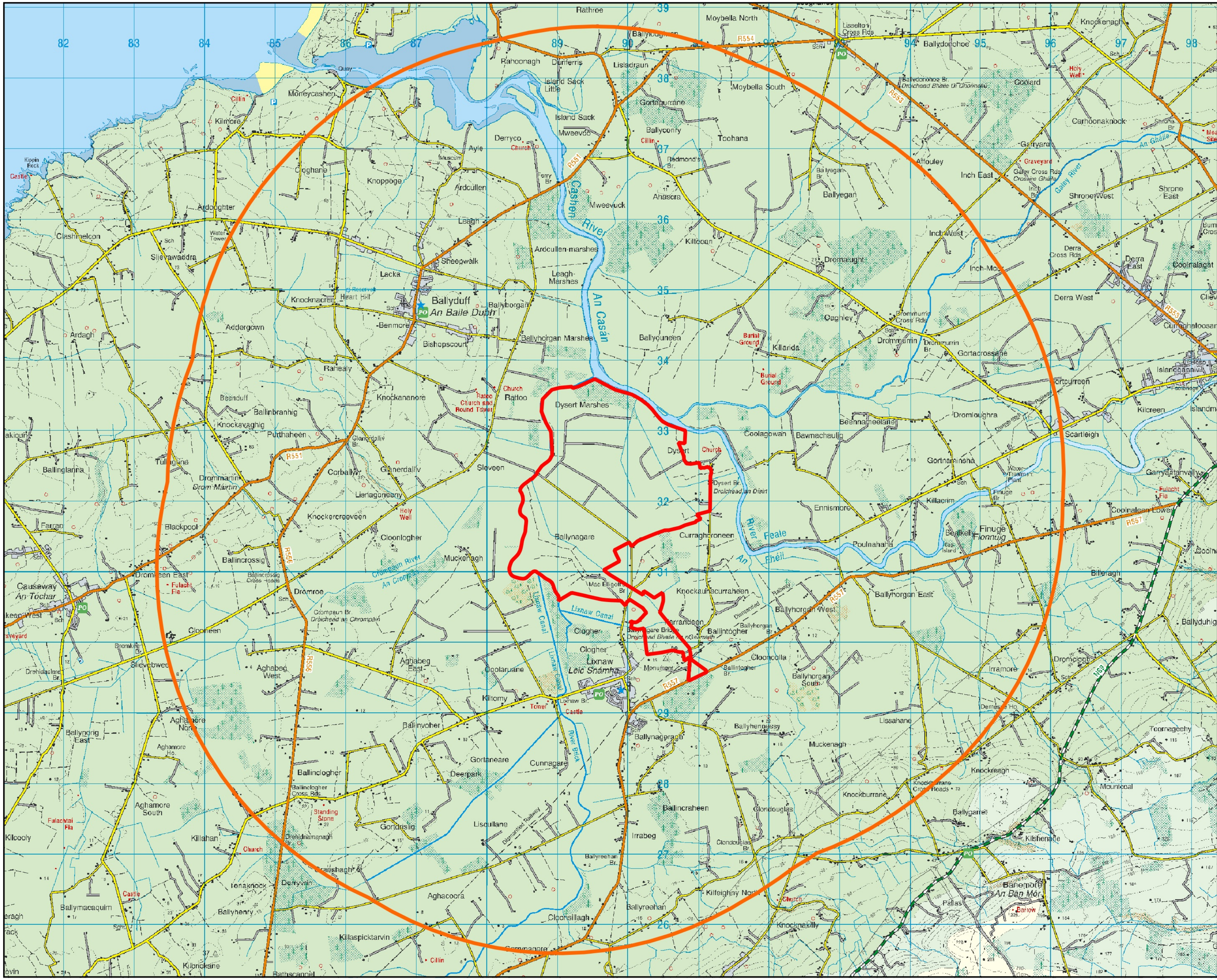

Map Legend

- Wind Farm Site
- 5km Waterbird Distribution Survey Radius

Drawing Title	Waterbird Distribution Survey
Project Title	Ballynagare Wind Farm
Drawn By: S Doyle	Checked By: P Cregg
Project No.: 200512	Drawing No.: Fig 7-7
Scale: 1:70000	Date: 05.07.21

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7.2.5 Receptor Evaluation and Impact Assessment

7.2.5.1 Potential Impacts Associated with Proposed Development

Wind farms present three potential risks to birds (Drewitt and Langston 2006, 2008; Band et al. 2007):

- **Direct habitat loss** through the construction of wind farm infrastructure.
- **Displacement** (sometimes called indirect habitat loss) if birds avoid the wind farm and its surrounding area due to turbine construction and operation. Displacement may also include barrier effects in which birds are deterred from using normal routes to feeding or roosting grounds.
- Death through **collision** or interaction with turbine blades and other infrastructure.

For each of these three risks, the detailed knowledge of bird distribution and flight activity within and surrounding the wind farm study area has been used to predict potential impacts of the Proposed Development on birds. These impacts are assessed with regard to the construction phase, operational phase and decommissioning phase. They are also assessed cumulatively with other projects.

7.2.5.2 Geographical Framework

Guidance on Ecological Impact Assessment (CIEEM, 2019) recommends categories of ornithological value that relate to a geographical framework (e.g. international through to local). This EIAR utilises the geographical framework described in 'Guidelines for Assessment of Ecological Impact of National Road Schemes' (NRA, 2009). The following geographic frame of reference should be used when determining value:

- International
- National
- County
- Local Importance (Higher Value)
- Local Importance (Lower Value)

Locally Important (Lower Value) receptors are habitats and species that are widespread and of low ecological significance and important only in the local area. In comparison, Internationally Important sites are designated for conservation as part of the Natura 2000 Network (Special Area of Conservation or Special Protection Area) or provide the best examples of habitats or internationally important populations of protected flora and fauna.

7.2.5.3 Description of Impacts

The sensitivity, magnitude and significance of impacts on local avian communities resulting from the Proposed Development was quantified according to two assessment criteria: Percival (2003) and the Environmental Protection Agency (EPA). The two assessment criteria have been used to independently characterise impacts to inform a robust assessment of potential impacts. EPA impact assessment criteria has been used for consistency between the Biodiversity and Ornithology chapters of this EIAR, while Percival (2003) has also been followed given its specific focus on birds.

Percival (2003) criteria

The Percival (2003) methodology quantifies the sensitivity of a given species to the development type, the magnitude of the effect and the significance of the potential impact. Table 7-3 (Sensitivity), Table 7-4 (Magnitude of effect) and Table 7-5 (Determination of significance) outline the assessment criteria for each stage.

Table 7-3 Evaluation of Sensitivity for Birds (from Percival, 2003)

Sensitivity	Determining Factor
Very High	Species that form the cited interest of SPAs and other statutorily protected nature conservation areas. Cited means mentioned in the citation text for the site as a species for which the site is designated.
High	Species that contribute to the integrity of a SPA but which are not cited as a species for which the site is designated. Ecologically sensitive species including the following: divers, common scoter, hen harrier, golden eagle, red necked phalarope, roseate tern and chough. Species present in nationally important numbers (>1% of the Irish population)
Medium	Species listed on Annex 1 of the EU Birds Directive. Species present in regionally important numbers (>1% county population). Other species on BirdWatch Ireland's Red List of Birds of Conservation Concern
Low	Any other species of conservation interest, including species on BirdWatch Ireland's Amber List of Birds of Conservation Concern, not covered above.

Table 7-4 Determination of Magnitude of Effects (from Percival, 2003)

Sensitivity	Description
Very High	Total loss or very major alteration to key elements/ features of the baseline conditions, such that the post development character/composition/attributes will be fundamentally changed and may be lost from the site altogether. Guide: < 20% of population / habitat remains
High	Major loss or major alteration to key elements/features of the baseline (pre-development) conditions such that post development character/composition/attributes will be fundamentally changed. Guide: 20-80% of population/ habitat lost
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/composition/attributes of baseline will be partially changed. Guide: 5-20% of population/ habitat lost

Sensitivity	Description
Low	Minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible but underlying character/composition/attributes of baseline condition will be similar to pre-development circumstances/patterns. Guide: 1-5% of population/ habitat lost
Negligible	Very slight change from baseline condition. Change barely distinguishable, approximating to the “no change” situation. Guide: < 1% population/ habitat lost

Table 7-5 Significance Matrix combining magnitude and sensitivity to assess significance (from Percival, 2003)

Significance		Sensitivity			
		Very High	High	Medium	Low
Magnitude	Very High	Very High	Very High	High	Medium
	High	Very High	Very High	Medium	Low
	Medium	Very High	High	Low	Very Low
	Low	Medium	Low	Low	Very Low
	Negligible	Low	Very Low	Very Low	Very Low

EPA (2017) Criteria

EPA criteria use the following terms to describe the quality of the impact:

- **Positive** - a change which improves the quality of the environment (for example, by increasing species diversity; or the improving reproductive capacity of an ecosystem, or by removing nuisances or improving amenities).
- **Neutral** - no effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.
- **Negative** - a change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).

The significance of the impact is quantified as:

- **Imperceptible** - an effect capable of measurement but without significant consequences.
- **Not Significant** – an effect which causes noticeable changes in the character of the environment but without significant consequences.
- **Slight** - an effect which causes noticeable changes in the character of the environment without affecting its sensitivities.

- **Moderate** - an effect that alters the character of the environment that is consistent with existing and emerging baseline trends.
- **Significant** - an effect which, by its character, magnitude, duration or intensity significantly alters a sensitive aspect of the environment.
- **Very Significant**– an effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
- **Profound** - an effect which obliterates sensitive characteristics.

The duration of impacts can be:

- **Momentary** – effects lasting from seconds to minutes
- **Brief** – effects lasting less than a day
- **Temporary** – effects lasting less than a year
- **Short-term** – effects lasting 1 to 7 years
- **Medium term** – effects lasting 7 to 15 years
- **Long term** – effects lasting 15 to 60 years
- **Permanent** – effects lasting over 60 years
- **Reversible** – effects that can be undone (eg. through remediation or restoration)

The frequency of impacts (ie. how often the impact will occur) can be:

- **Once, rarely, occasionally, frequently** or **constantly**
- **Hourly, daily, weekly, monthly** or **annually**

Finally, the probability of the impact may be:

- **Likely** – the effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented
- **Unlikley** – the effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented

The impacts may also be described in relation to their extent and context. Extent describes the population affected by an impact, while context relates the impact to the established baseline conditions.

7.2.5.4 Collision Risk Assessment

Collision risk is calculated using a mathematical model to predict the number of individual birds of a particular species that may be killed by collision with moving wind turbine rotor blades. The modelling method used in this collision risk calculation follows the Band Model (Band *et al.,* 2007), as recommended by NatureScot guidance. The Band Model first determines the number of birds transits through the air space swept by the rotor blades of the wind turbines. Then it calculates the collision risk for the birds. The product of the transits multiplied by the collision risk provides a collision rate. An avoidance factor is applied to this to account for birds actively avoiding turbines, providing a final “real world” annual collision rate for each species. See Appendix 7-5 for full details on the collision risk modelling method.

7.2.6 Assessment Justification

7.2.6.1 Survey Data

A comprehensive suite of bird surveys was undertaken at the Proposed Development site between April 2019 and March 2021. Results derived from a continuous two years of surveying at the wind farm study area and hinterland, undertaken in line with NatureScot guidance, are analysed to inform this assessment. As such, the surveys undertaken provide the information necessary to allow a complete, comprehensive and robust assessment of the potential impacts of the Proposed Development on avian receptors.

7.2.6.2 Mitigation

The development has been designed to specifically avoid, reduce and minimise impacts on all avian receptors. Where potential impacts on KORs are predicted, mitigation has been prescribed to avoid, reduce and remove such impacts. Proposed best practice design and mitigation measures are specifically set out and are realistic in terms of cost and practicality. They have been subject to detailed design and will effectively address the effects on the identified KORs. As such, the potential impacts of the Proposed Development have been considered and assessed to ensure that all impacts on KORs are adequately addressed and no significant residual effects are likely to remain following the implementation of mitigation measures and best practices (refer to Section 7.6 for further details).

7.2.6.3 Limitations

The information provided in this EIAR chapter accurately and comprehensively describes the baseline environment and provides an informed prediction of the likely impacts of the Proposed Development. It also prescribes mitigation as necessary and describes the predicted residual effects. Furthermore, the specialist studies, analysis and reporting have been undertaken in accordance with the appropriate guidelines. Therefore, no significant limitations in the scope, scale or context of the assessment have been identified.

7.3 Baseline Ornithological Conditions

7.3.1 Designated Sites within the Likely ZOI of the Development

A screening assessment and Natura Impact Statement (NIS) were prepared to provide the competent authority with the information necessary to complete an Appropriate Assessment for the Proposed Development in compliance with Article 6(3) of the EU Habitats Directive (92/43/EEC). According to EPA (2017) "*A biodiversity section of an EIAR … should not repeat the detailed assessment of potential effects on European sites contained in a NIS, but it should refer to the findings of that separate assessment*" and should "*incorporate their key findings as available and appropriate*". Therefore, this section provides a summary of the key screening assessment findings regarding SPAs and nationally designated sites, while a summary of findings regarding Special Areas of Conservation is provided in Chapter 6 of this EIAR. In addition, any potential impacts for SPAs are assessed in detail in the Appropriate Assessment and NIS associated with Chapter 6 of this EIAR.

Sites designated for nature conservation within the potential ZOI of the Proposed Development were identified using GIS software. The ZOI is derived utilising a precautionary approach. Initially, sites within a 15km radius of the proposed works are identified. Then designated sites located outside the 15km buffer zone are accounted for and assessed for pathways for impacts. In this case, no potential for direct or indirect impacts for species listed as SCIs of SPAs more than 15km from the Proposed Development was identified.

In addition (and in the absence of any specific European or Irish guidance), the guidance document 'Assessing Connectivity with Special Protection Areas' (SNH, 2016) was consulted. This document provides guidance on identifying of connectivity between the Proposed Development and SPAs. It considers the distances some species may travel beyond the boundary of their SPAs and outlines dispersal and foraging ranges. Potential effects on wetlands and supporting habitats associated with SPAs and potential indirect pathways in the form of surface water pollution are considered in the Appropriate Assessment and NIS and summarised briefly below.

Four SPAs were located within 15km of the Proposed Development. There are listed and summarised in Table 7-6.

Table 7-6 Designated Sites in the Zone of Influence

European Site	Distance from proposed works	Special Conservation Interests for which the European Site has been designated	Conservation Objectives	Zone of Influence Determination and Identification of Pathways for Effect
Special Protection Area				
Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA	6km south-east of the wind farm study area One of the grid connection routes lies partly within the SPA	- Hen Harrier (*Circus cyaneus*) [A082]	This site has the generic conservation objective "to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA." From: NPWS (2021) Conservation objectives for Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA [004161]. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage.	The wind farm study area is located entirely outside of this European Site. However, a section of one of the proposed grid connection routes is located within the SPA. All works associated with this grid connection route will be confined to the existing public road corridor. **This SPA is within the Likely Zone of Impact and further assessment will be provided in the NIS.**
Kerry Head SPA	6.8km north-west of the wind farm study area 8.8km north-west of the grid connection route	- Fulmar (*Fulmarus glacialis*) [A009] - Chough (*Pyrrhocorax pyrrhocorax*) [A346]	This site has the generic conservation objective "to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA."	The wind farm study area is located entirely outside of this European Site. Of the SCIs, fulmar are pelagic and do not forage or commute over terrestrial habitats. Similarly, chough are typically sedentary

European Site	Distance from proposed works	Special Conservation Interests for which the European Site has been designated	Conservation Objectives	Zone of Influence Determination and Identification of Pathways for Effect
Special Protection Area				
			From: NPWS (2021) Conservation objectives for Kerry Head SPA [004189]. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage.	and forage along coasts. Therefore, the potential for direct and indirect impacts on populations of SCI species associated with the SPA can be discounted. The development site has no hydrological connectivity with the SPA. Therefore, there is no potential for indirect effects in relation to surface water pollution or deterioration of supporting habitat for SCI within or outside the SPA. **This site is not within the Likely Zone of Impact and no further assessment is required.**
Tralee Bay Complex SPA	12.9km from south-west of the wind farm study area	- Whooper Swan (*Cygnus cygnus*) [A038] - Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]	The objective of this site is to maintain the favourable conservation condition of all SCI species. This is defined as a long-term stable or increasing population trend and no significant	The wind farm study area is located entirely outside of this European Site. The development site has no hydrological connectivity with

European Site	Distance from proposed works	Special Conservation Interests for which the European Site has been designated	Conservation Objectives	Zone of Influence Determination and Identification of Pathways for Effect
Special Protection Area				
	14.4km west of the grid connection route	- Shelduck (*Tadorna tadorna*) [A048] - Wigeon (*Anas penelope*) [A050] - Teal (*Anas crecca*) [A052] - Mallard (*Anas platyrhynchos*) [A053] - Pintail (*Anas acuta*) [A054] - Scaup (*Aythya marila*) [A062] - Oystercatcher (*Haematopus ostralegus*) [A130] - Ringed Plover (*Charadrius hiaticula*) [A137] - Golden Plover (*Pluvialis apricaria*) [A140] - Grey Plover (*Pluvialis squatarola*) [A141] - Lapwing (*Vanellus vanellus*) [A142] - Sanderling (*Calidris alba*) [A144] - Dunlin (*Calidris alpina*) [A149] - Black-tailed Godwit (*Limosa limosa*) [A156] - Bar-tailed Godwit (*Limosa lapponica*) [A157]	decrease in the range, timing and intensity of use of areas by the SCI species, other than that occurring from natural patterns of variation. In addition, the objective of this site is to maintain the favourable conservation condition of the wetland habitat in this site as a resource for the regularly-occurring migratory waterbirds that utilise it. This is achieved by maintaining the permanent area occupied by the wetland. The area should be stable and not significantly less than 3,657ha, aside from variation occurring from natural patterns. From: NPWS (2014) Conservation Objectives: Tralee Bay Complex SPA 004188. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.	the SPA. Therefore, there is no potential for indirect effects in relation to surface water pollution or deterioration of supporting habitat for SCIs within or outside the SPA. Of the SCIs, the majority have a core foraging range that is not within range of the wind farm study area. However, common gull may forage up to 25km from an SPA, which is within range of the wind farm study area. This species is known to utilise agricultural fields such as those that are characteristic of the landscape around the wind farm study area. **This SPA is within the Likely Zone of Impact and further assessment will be provided in the NIS.**

European Site	Distance from proposed works	Special Conservation Interests for which the European Site has been designated	Conservation Objectives	Zone of Influence Determination and Identification of Pathways for Effect
Special Protection Area				
		- Curlew (*Numenius arquata*) [A160] - Redshank (*Tringa totanus*) [A162] - Turnstone (*Arenaria interpres*) [A169] - Black-headed Gull (*Chroicocephalus ridibundus*) [A179] - Common Gull (*Larus canus*) [A182] - Wetland and Waterbirds [A999]		
River Shannon and River Fergus Estuaries SPA	14.9km north-east of the wind farm study area 12.2km north of the grid connection route	- Cormorant (*Phalacrocorax carbo*) [A017] - Whooper Swan (*Cygnus cygnus*) [A038] - Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] - Shelduck (*Tadorna tadorna*) [A048] - Wigeon (*Anas penelope*) [A050] - Teal (*Anas crecca*) [A052] - Pintail (*Anas acuta*) [A054] - Shoveler (*Anas clypeata*) [A056] - Scaup (*Aythya marila*) [A062]	The first objective of this site is to maintain the favourable conservation conditions of breeding SCI species (cormorant). This is defined as a long-term stable or increasing population trend. There should be no significant decline in: breeding population number; mean productivity rate; weight of available prey biomass; or the number, location and area of breeding colonies. There should be no significant increase in the number, location, shape and area of barriers to	The wind farm study area is located entirely outside of this European Site. The development site has no hydrological connectivity with the SPA. Therefore, there is no potential for indirect effects in relation to surface water pollution or deterioration of supporting habitat for SCIs within or outside the SPA.

European Site	Distance from proposed works	Special Conservation Interests for which the European Site has been designated	Conservation Objectives	Zone of Influence Determination and Identification of Pathways for Effect
Special Protection Area				
		- Ringed Plover (*Charadrius hiaticula*) [A137] - Golden Plover (*Pluvialis apricaria*) [A140] - Grey Plover (*Pluvialis squatarola*) [A141] - Lapwing (*Vanellus vanellus*) [A142] - Knot (*Calidris canutus*) [A143] - Dunlin (*Calidris alpina*) [A149] - Black-tailed Godwit (*Limosa limosa*) [A156] - Bar-tailed Godwit (*Limosa lapponica*) [A157] - Curlew (*Numenius arquata*) [A160] - Redshank (*Tringa totanus*) [A162] - Greenshank (*Tringa nebularia*) [A164] - Black-headed Gull (*Chroicocephalus ridibundus*) [A179] - Wetland and Waterbirds [A999]	connectivity. Furthermore, human activities should occur at levels that do not adversely affect the breeding population. The second objective of this site is to maintain the favourable conservation condition of the non-breeding SCI species in the site(all species listed). There should be no significant decrease in the range, timing or intensity of use of areas by SCI species other than that occurring from natural patterns of variation. The long-term population trend should be stable or increasing. In addition, the third objective of this site is to maintain the favourable conservation condition of the wetland habitat as a resource for the regularly-occurring migratory waterbirds that utilise it. This is achieved by maintaining the permanent area occupied by the wetland. The area	Of the SCIs, none have a core foraging range that is within range of the wind farm study area. **This site is not within the Likely Zone of Impact and no further assessment is required.**

European Site	Distance from proposed works	Special Conservation Interests for which the European Site has been designated	Conservation Objectives	Zone of Influence Determination and Identification of Pathways for Effect
Special Protection Area				
			should be stable and not significantly less than 32,261ha, aside from variation occurring from natural patterns. From: NPWS (2012) Conservation Objectives: River Shannon and River Fergus Estuaries SPA 004077. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.	
Nationally Designated Sites				
Other than sites which are encompassed by the above list of SPAs, no nationally designated sites of ornithological significance occur within the potential ZOI.				

7.3.2 Breeding and Wintering Bird Atlas Records

"Bird Atlas 2007-11: The breeding and wintering birds of Britain and Ireland' (Balmer *et al.*, 2013) is the most recent comprehensive work on wintering and breeding birds in Ireland. Previous Bird Atlases have been the primary source of information on the distribution and abundance of British and Irish birds prior to Bird Atlas 2007–11. The three previously published atlases were:

- The atlas of breeding birds in Britain and Ireland (Sharrock, 1976)
- The atlas of wintering birds in Britain and Ireland (Lack, 1986)
- The new atlas of breeding birds in Britain and Ireland: 1988-1991. (Gibbons *et al.,* 1993)

The wind farm study area lies within hectads Q83 and Q93, while the cable route also extends into hectads Q92 and R03. Tables 7-7 and 7-8 present a list of species of conservation interest recorded from the relevant hectads, with regard to breeding and wintering respectively.

Table 7-7 Breeding Bird Atlas Data. The following applies to conservation status: Section19 and Schedule 4 of the Wildlife Acts 1976-2021, Annex I of the Birds Directive, Red List species on the BoCCI

Species Name	Breeding Atlas 1968-1972		Breeding Atlas 1988-1991		Breeding Atlas 2007-2011		Conservation Status
	Q83	Q93	Q83	Q93	Q83	Q93	
Mute Swan	-	-	breeding	-	probable breeding	probable breeding	Section 19
Shelduck	breeding	-	seen	-	probable breeding	-	Section 19
Mallard	breeding	breeding	-	breeding	breeding	breeding	Section 19
Red-breasted Merganser	confirmed breeding	-	-	-	-	-	Section 19
Fulmar	confirmed breeding	-	breeding	-	confirmed breeding	-	Section 19
Gannet	-	-	-	-	non-breeding	-	Section 19
Cormorant	probable breeding	-	seen	seen	confirmed breeding	non-breeding	Section 19
Shag	confirmed breeding	-	breeding	-	confirmed breeding	-	Section 19
Little Egret	-	-	-	-	non-breeding	-	Annex I & Section 19
Grey Heron	confirmed breeding	possible breeding	seen	seen	probable breeding	possible breeding	Section 19
Hen Harrier	-	-	-	-	possible breeding	-	Annex I & Schedule 4 and Section 19
Sparrowhawk	confirmed breeding	confirmed breeding	breeding	seen	possible breeding	possible breeding	Schedule 4 and Section 19
Water Rail	probable breeding	-	breeding	-			Section 19
Moorhen	confirmed breeding	confirmed breeding	breeding	breeding	possible breeding	-	Section 19
Coot	-	-	-	breeding			Section 19

Species Name	Breeding Atlas 1968-1972		Breeding Atlas 1988-1991		Breeding Atlas 2007-2011		Conservation Status
	Q83	Q93	Q83	Q93	Q83	Q93	
Oystercatcher	confirmed breeding	-	seen	-	non-breeding	-	Red List & Section 19
Golden Plover	-	-	-	-	non-breeding	-	Annex I & Red List & Section 19
Lapwing	confirmed breeding	confirmed breeding	seen	seen	-	-	Red List & Section 19
Ringed Plover	confirmed breeding	-	seen	-	confirmed breeding	-	Section 19
Whimbrel	-	-	-	-	non-breeding	non-breeding	Section 19
Curlew	confirmed breeding	confirmed breeding	seen	-	non-breeding	possible breeding	Red List & Section 19
Turnstone	-	-	-	-	non-breeding	-	Section 19
Sanderling	-	-	-	-	non-breeding	-	Section 19
Dunlin	-	-	-	-	non-breeding	-	Annex I & Red List & Section 19
Common Sandpiper	-	-	-	-	probable breeding	possible breeding	Section 19
Redshank	-	-	-	-	non-breeding	-	Red List & Section 19
Woodcock	-	probable breeding	-	breeding	-	-	Red List & Section 19
Snipe	confirmed breeding	confirmed breeding	breeding	-	-	-	Red List & Section 19
Black Guillemot	-	-	-	-	probable breeding	-	Section 19
Guillemot	confirmed breeding	-	breeding	-	-	-	Section 19
Sandwich Tern	-	-	seen	-	non-breeding	-	Annex I & Section 19
Common Tern	-	-	-	-	non-breeding	-	Annex I & Section 19
Black-headed Gull	-	-	-	seen	non-breeding		Section 19
Common Gull	-	-	seen	-	non-breeding	-	Section 19
Lesser Black-backed Gull	-	-	-	-	non-breeding	non-breeding	Section 19
Herring Gull	confirmed breeding	-	seen	-	non-breeding	non-breeding	Section 19
Great Black-backed Gull	confirmed breeding	-	seen	-	non-breeding	-	
Barn Owl	confirmed breeding	confirmed breeding	-	breeding	confirmed breeding	probable breeding	Red List & Schedule 4 and Section 19

Species Name	Breeding Atlas 1968-1972		Breeding Atlas 1988-1991		Breeding Atlas 2007-2011		Conservation Status
	Q83	Q93	Q83	Q93	Q83	Q93	
Long-eared Owl	confirmed breeding	confirmed breeding	-	breeding	-	-	Schedule 4 and Section 19
Kingfisher	-	possible breeding	breeding	breeding	-	confirmed breeding	Annex I & Section 19
Kestrel	confirmed breeding	confirmed breeding	breeding	breeding	possible breeding	possible breeding	Red List & Schedule 4 and Section 19
Peregrine Falcon	-	-	-	-	confirmed breeding	possible breeding	Annex I & Schedule 4 and Section 19
Chough	confirmed breeding	-	-	-	probable breeding	-	Annex I & Section 19
Swift	confirmed breeding	confirmed breeding	seen	breeding	-	confirmed breeding	Red List & Section 19
Grey Wagtail	confirmed breeding	confirmed breeding	breeding	breeding	possible breeding	probable breeding	Red List & Section 19
Meadow Pipit	confirmed breeding	confirmed breeding	breeding	breeding	confirmed breeding	confirmed breeding	Red List & Section 19
Yellowhammer	confirmed breeding	confirmed breeding	-	-	-	-	Red List & Section 19

Table 7-8 Wintering Bird Atlas Data.The following applies to conservation status: Section19 and Schedule 4 of the Wildlife Acts 1976-2021, Annex I of the Birds Directive, Red List species on the BoCCI.

Species Name	Wintering Atlas 1981-1984		Wintering Atlas 2007-2011		Conservation Status
	Q83	Q93	Q83	Q93	
Mute Swan	-	-	present	present	Section 19
Whooper Swan	present	present	present	present	Annex I & Section 19
Barnacle Goose	-	-	-	present	Annex I & Section 19
Light-bellied Brent Goose	-	-	present	-	Section 19
Shelduck	present	-	-	-	Section 19
Wigeon	present	-	present	-	Section 19
Teal	-	-	present	present	Section 19
Mallard	present	-	present	present	Section 19
Red-breasted Merganser	present	-	-	-	Section 19
Great Northern Diver	-	-	present	-	Annex I & Section 19
Fulmar	-	-	present	-	Section 19
Cormorant	present	present	present	present	Section 19
Shag	-	-	present	-	Section 19

Species Name	Wintering Atlas 1981-1984		Wintering Atlas 2007-2011		Conservation Status
	Q83	Q93	Q83	Q93	
Little Egret	-	-	present	-	Annex I & Section 19
Grey Heron	present	-	present	present	Section 19
Hen Harrier	-	-	present	present	Annex I & Schedule 4 and Section 19
Sparrowhawk	-	present	present	present	Schedule 4 and Section 19
Moorhen	present	present	present	present	Section 19
Oystercatcher	present	-	present	-	Red List & Section 19
Golden Plover	present	present	present	present	Annex I & Red List & Section 19
Grey Plover	present	-	present	-	Red List & Section 19
Lapwing	present	present	present	present	Red List & Section 19
Ringed Plover	present	-	present	-	Section 19
Curlew	present	present	present	present	Red List & Section 19
Bar-tailed Godwit	present	-	-	-	Annex I & Red List & Section 19
Black-tailed Godwit	present	-	present	-	Red List & Section 19
Turnstone	present	-	present	-	Section 19
Knot	present	-	-	-	Red List & Section 19
Sanderling	-	-	present	-	Section 19
Dunlin	present	-	present	-	Annex I & Red List & Section 19
Greenshank	present	-	present	-	Section 19
Redshank	present	-	present	present	Red List & Section 19
Woodcock	-	-	-	present	Red List & Section 19
Snipe	present	present	present	present	Red List & Section 19
Kittiwake	-	-	present	-	Red List & Section 19
Black-headed Gull	present	present	present	present	Section 19
Mediterranean Gull	-	-	present	-	Annex I & Section 19
Common Gull	present	present	present	-	Section 19
Lesser Black-backed Gull	-	-	present	-	Section 19

Species Name	Wintering Atlas 1981-1984		Wintering Atlas 2007-2011		Conservation Status
	Q83	Q93	Q83	Q93	
Herring Gull	present	present	present	present	Section 19
Iceland Gull	-	-	present	-	Section 19
Glaucous Gull	-	-	-	present	Section 19
Great Black-backed Gull	present	present	present	-	
Barn Owl	-	-	present	-	Red List & Schedule 4 and Section 19
Peregrine Falcon	-	-	present	-	Annex I & Schedule 4 and Section 19
Chough	present	-	present	-	Annex I & Section 19
Redwing	present	present	present	present	Red List & Section 19
Grey Wagtail	-	present	present	present	Red List & Section 19
Meadow Pipit	present	present	present	present	Red List & Section 19

7.3.3 Bird Sensitivity Mapping Tool

A Bird Sensitivity Mapping Tool for wind energy development was developed by BirdWatch Ireland to provide a measured spatial indication of where protected birds are likely to be sensitive to wind energy developments. The tool can be accessed via the National Biodiversity Data Centre Website (www.biodiversityireland.ie) and is accompanied by a guidance document (McGuiness *et al.*, 2015). The criteria for estimating a zone of sensitivity (i.e. 'low', 'medium', 'high' and 'highest') is based on a review of the behavioural, ecological and distributional data available for each species.

The wind farm study area is located within areas of **medium** and **low** bird sensitivity to wind energy developments. The wind farm study area boundary is 1.2km from the nearest area of high sensitivity (Cashen River estuary). The grid connection is also within areas of medium and low sensitivity and is 2.3km from the nearest area of high sensitivity (Duagh).

7.3.4 National Biodiversity Data Centre Records

The National Biodiversity Data Centre (NBDC) Biodiversity Maps provide records of flora and fauna within 10km hectads across Ireland. Data is available from the map viewer on the NBDC website (https://maps.biodiversityireland.ie/Map). The wind farm study area lies within hectad Q83 and Q93. Table 7-9 lists the bird species have been recorded in these 10km Grids.

Table 7-9 National Biodiversity Data Centre records

Common Name	Scientific Names	NBDC Dataset
American Golden Plover	*Pluvialis dominica*	Rare birds of Ireland
Baird's Sandpiper	*Calidris bairdii*	Rare birds of Ireland
Barn Owl	*Tyto alba*	Bird Atlas 2007 - 2011
Barnacle Goose	*Branta leucopsis*	Bird Atlas 2007 - 2011
Bar-tailed Godwit	*Limosa lapponica*	Bird Atlas 2007 - 2011

Common Name	Scientific Names	NBDC Dataset
Black Guillemot	*Cepphus grylle*	Birds of Ireland
Black Swan	*Cygnus atratus*	Irish Wetland Birds Survey (I-WeBS) 1994-2001
Black-headed Gull	*Larus ridibundus*	Birds of Ireland & Bird Atlas 2007 - 2011
Black-legged Kittiwake	*Rissa tridactyla*	Bird Atlas 2007 - 2011
Black-tailed Godwit	*Limosa limosa*	The First Atlas of Wintering Birds in Britain and Ireland: 1981/82-1983/84.
Brent Goose	*Branta bernicla spp.*	Birds of Ireland & Bird Atlas 2007 - 2011
Canada Goose	*Branta canadensis*	Rare birds of Ireland
Cattle Egret	*Bubulcus ibis*	Rare birds of Ireland
Buzzard	*Buteo buteo*	Birds of Ireland
Coot	*Fulica atra*	The Second Atlas of Breeding Birds in Britain and Ireland: 1988-1991
Greenshank	*Tringa nebularia*	Bird Atlas 2007 - 2011
Guillemot	*Uria aalge*	The Second Atlas of Breeding Birds in Britain and Ireland: 1988-1991
Kestrel	*Falco tinnunculus*	Bird Atlas 2007 - 2011 & Birds of Ireland
Kingfisher	*Alcedo atthis*	Birds of Ireland
Moorhen	*Gallinula chloropus*	Birds of Ireland & Bird Atlas 2007 - 2011
Redshank	*Tringa totanus*	Birds of Ireland & Bird Atlas 2007 - 2011
Sandpiper	*Actitis hypoleucos*	Bird Atlas 2007 - 2011
Shelduck	*Tadorna tadorna*	Bird Atlas 2007 - 2011
Snipe	*Gallinago gallinago*	Birds of Ireland
Swift	*Apus apus*	The Second Atlas of Breeding Birds in Britain and Ireland: 1988-1991 & Birds of Ireland
Corncrake	*Crex crex*	The First Atlas of Breeding Birds in Britain and Ireland: 1968-1972.
Dunlin	*Calidris alpina*	Birds of Ireland
Curlew	*Numenius arquata*	Birds of Ireland & Bird Atlas 2007 - 2011
Oystercatcher	*Haematopus ostralegus*	Birds of Ireland
Sparrowhawk	*Accipiter nisus*	Bird Atlas 2007 - 2011
Teal	*Anas crecca*	Bird Atlas 2007 - 2011
Wigeon	*Anas penelope*	Birds of Ireland
Woodcock	*Scolopax rusticola*	Bird Atlas 2007 - 2011
Golden Plover	*Pluvialis apricaria*	Birds of Ireland
Shag	*Phalacrocorax aristotelis*	Birds of Ireland
Glaucous Gull	*Larus hyperboreus*	The First Atlas of Wintering Birds in Britain and Ireland: 1981/82-1983/84.
Great Black-backed Gull	*Larus marinus*	The First Atlas of Wintering Birds in Britain and Ireland: 1981/82-1983/84 & Birds of Ireland
Cormorant	*Phalacrocorax carbo*	Birds of Ireland & Bird Atlas 2007 - 2011
Great Northern Diver	*Gavia immer*	Birds of Ireland
Greater White-fronted Goose	*Anser albifrons*	Irish Wetland Birds Survey (I-WeBS) 1994-2001.
Grey Heron	*Ardea cinerea*	Birds of Ireland
Grey Plover	*Pluvialis squatarola*	Bird Atlas 2007 - 2011
Greylag Goose	*Anser anser*	Irish Wetland Birds Survey (I-WeBS) 1994-2001.
Hen Harrier	*Circus cyaneus*	Bird Atlas 2007 - 2011 & Birds of Ireland

Common Name	Scientific Names	NBDC Dataset
Herring Gull	*Larus argentatus*	Birds of Ireland & Bird Atlas 2007 - 2011
Iceland Gull	*Larus glaucoides*	Bird Atlas 2007 - 2011
Kumlien's Iceland Gull	*Larus glaucoides kumlieni*	Rare birds of Ireland
Lesser Black-backed Gull	*Larus fuscus*	Birds of Ireland
Little Bustard	*Tetrax tetrax*	Rare birds of Ireland
Little Egret	*Egretta garzetta*	Birds of Ireland
Little Grebe	*Tachybaptus ruficollis*	Birds of Ireland
Little Gull	*Larus minutus*	Bird Atlas 2007 - 2011
Long-eared Owl	*Asio otus*	The First Atlas of Breeding Birds in Britain and Ireland: 1968-1972 & Birds of Ireland
Mallard	*Anas platyrhynchos*	Birds of Ireland & Bird Atlas 2007 - 2011
Meadow Pipit	*Anthus pratensis*	Birds of Ireland & Bird Atlas 2007 - 2011
Mediterranean Gull	*Larus melanocephalus*	Birds of Ireland
Mew Gull	*Larus canus*	The First Atlas of Wintering Birds in Britain and Ireland: 1981/82-1983/84 & Birds of Ireland
Mute Swan	*Cygnus olor*	Bird Atlas 2007 - 2011
Fulmar	*Fulmarus glacialis*	Birds of Ireland
Lapwing	*Vanellus vanellus*	Birds of Ireland
Peregrine Falcon	*Falco peregrinus*	Bird Atlas 2007 - 2011
Red Knot	*Calidris canutus*	Irish Wetland Birds Survey (I-WeBS) 1994-2001.
Chough	*Pyrrhocorax pyrrhocorax*	Birds of Ireland
Red-breasted Merganser	*Mergus serrator*	Irish Wetland Birds Survey (I-WeBS) 1994-2001.
Redwing	*Turdus iliacus*	Birds of Ireland
Ringed Plover	*Charadrius hiaticula*	Birds of Ireland
Turnstone	*Arenaria interpres*	Birds of Ireland
Ruff	*Philomachus pugnax*	Birds of Ireland
Sanderling	*Calidris alba*	Birds of Ireland
Sandwich Tern	*Sterna sandvicensis*	The Second Atlas of Breeding Birds in Britain and Ireland: 1988-1991
Semipalmated Sandpiper	*Calidris pusilla*	Rare birds of Ireland
Spotted Sandpiper	*Actitis macularius*	Rare birds of Ireland
Water Rail	*Rallus aquaticus*	The Second Atlas of Breeding Birds in Britain and Ireland: 1988-1991 & Birds of Ireland
Whooper Swan	*Cygnus cygnus*	Bird Atlas 2007 - 2011 & Birds of Ireland
Yellowhammer	*Emberiza citrinella*	The First Atlas of Breeding Birds in Britain and Ireland: 1968-1972.

7.3.5 Irish Wetland Bird Survey Records

IWeBS, coordinated by BirdWatch Ireland, monitors wintering waterbird populations at their wetland sites across Ireland. IWeBS site locations are available at https://birdwatchireland.ie/our-work/. The nearest IWeBS subsites to the study area are 0KS05 Ballynagare Bridge, 0KS03 Lixnaw and 0KS02 Ballyouneen. Data from IWeBS sites in County Kerry have been used to estimate county populations of wintering waterbirds identified as KORs. Datasets for the following 12 sites were downloaded from www.birdwatchireland.ie and reviewed:

- An Trá Beg
- Brandon Bay - Inner Brandon Bay
- Cashen River & Estuary

- Castlemaine Harbour & Rossbehy
- Castlemaine Outer: Inch offshore
- Dingle Harbour
- Lough Caragh
- Lough Leane & Killarney Valley
- Magharees Islands
- Smerwick Harbour
- Tralee Bay, Lough Gill & Akeragh Lough
- Ventry Harbour

7.3.6 Rare and Protected Species Dataset

An information request was sent to NPWS requesting records from the Rare and Protected Species Database. The following records were obtained from the NPWS on the 4th of June 2021:

Barn Owl

Barn owl was recorded in hectads Q83 (Casheen) and Q93 (Castlequarter and Shrone East) during the Barn Owl Project 2009 (the hectads within which the wind farm study area lies). Barn owl was also recorded in the adjacent hectads R03 (Duagh) and Q82 (Abbeydorney).

Hen Harrier

Hen harrier was recorded in the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA during the National Hen Harrier Surveys in 2005, 2010 and 2015 (there was no survey conducted in 2020). In 2005, there was one confirmed hen harrier breeding site between 0-3km from the wind farm study area and one confirmed breeding site between 3-5km from the wind farm study area. In 2010, there was one confirmed hen harrier breeding site and one additional hen harrier sighting between 0-3km from the wind farm study area and one confirmed breeding site and one additional sighting between 3-5km from the wind farm study area. In 2015, there were no hen harrier records between 0-3km from the wind farm study area, but there was one confirmed and one possible breeding site between 3-5km from the wind farm study area.

Curlew

Curlew was recorded in the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA. In 2015, a pair of breeding curlew were recorded between 3-5km from the wind farm study area. Similarly, in 2018, a pair of breeding curlew were recorded between 3-5km from the wind farm study area.

7.3.7 Field Survey Results

A list of all bird species recorded during surveys is provided in Appendix 7-1. The target species listed in Table 7-10 below were recorded within the potential ZOI of the Proposed Development during field surveys. The list is ordered in accordance with conservation significance: Annex I species, SCIs of SPAs within 15km, Red listed BoCCI species and Schedule 4 species.

Table 7-10 Target Species Recorded in the Potential ZOI of the Prooposed Development

Species	Conservation Significance
Bar-tailed Godwit	Annex I of Birds Directive, SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA and Red List with respect to wintering population

Species	Conservation Significance
Dunlin	Annex I of Birds Directive, SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA and Red List with respect to breeding and wintering populations
Golden Plover	Annex I of Birds Directive, SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA and Red List with respect to breeding and wintering populations
Hen Harrier	Annex I of Birds Directive, SCI of Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA and Schedule 4 of the Wildlife Acts
Kingfisher	Annex I of Birds Directive
Little Egret	Annex I of Birds Directive
Peregrine Falcon	Annex I of Birds Directive and Schedule 4 of Wildlife Acts
Short-eared Owl	Annex I of Birds Directive and Schedule 4 of Wildlife Acts
Whooper Swan	Annex I of Birds Directive, SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA
Black-headed Gull	SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA
Brent Goose	SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA
Common Gull	SCI of Tralee Bay Complex SPA
Cormorant	SCI of River Shannon and River Fergus Estuaries SPA
Curlew	SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA and Red List with respect to breeding and wintering populations
Grey Plover	SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA and Red List with respect to wintering population
Lapwing	SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA and Red List with respect to breeding and wintering populations
Mallard	SCI of Tralee Bay Complex SPA
Oystercatcher	SCI of Tralee Bay Complex SPA and Red List with respect to breeding and wintering populations
Redshank	SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA and Red List with respect to breeding and wintering populations
Shoveler	SCI of River Shannon and River Fergus Estuaries SPA and Red List with respect to breeding and wintering populations
Teal	SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA
Wigeon	SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA
Barn Owl	Red List with respect to breeding population and Schedule 4 of the Wildlife Acts
Grey Wagtail	Red List with respect to breeding population
Kestrel	Red List with respect to breeding population and Schedule 4 of the Wildlife Acts

Species	Conservation Significance
Meadow Pipit	Red List with respect to breeding population
Snipe	Red List with respect to breeding and wintering populations
Buzzard	Schedule 4 of the Wildlife Acts
Sparrowhawk	Schedule 4 of the Wildlife Acts

The following sections describe the records of each target species under the individual survey headings. Survey data and mapping for each target species is provided in Appendix 7-4, while Appendix 7-3 presents results summary tables including:

- Non-target species observed during Vantage Point and Walkover Surveys
- Distribution of activity for target species during Vantage Point Surveys
- Target species observed during breeding and winter walkover surveys
- Target species observed during waterbird distribution surveys
- Monthly abundance of raptors during Breeding Raptors Surveys
- Monthly abundance of hen harrier during Hen Harrier Roost Surveys

7.3.7.1 Bar-tailed Godwit

Bar-tailed godwit were observed in the passage and winter season. Raw survey data and maps are provided in Appendix 7-4.

Vantage Point Survey

Bar-tailed godwit was recorded twice during vantage point surveys. Both records were non-flight observations of 1-2 birds foraging along the River Brick on the wind farm study area north-western boundary.

Waterbird Distribution Survey

Bar-tailed godwit was recorded 5 times during waterbird distribution surveys, within 2km north of the wind farm study area boundary. Small flocks of up to 3 birds were observed flying along the Cashen River. Flocks of up to 70 birds were observed foraging in agricultural fields around the Cashen River.

7.3.7.2 Dunlin

Dunlin was recorded during the winter season. Raw survey data and maps are provided in Appendix 7-4.

Waterbird Distribution Survey

Dunlin was observed once during waterbird distribution surveys. A flock of 59 birds was recorded in the Cashen River estuary, approximately 5km north-west of the wind farm study area boundary.

7.3.7.3 Golden Plover

Golden plover was recorded during the winter season. Raw survey data and maps are provided in Appendix 7-4.

Waterbird Distribution Survey

Golden plover was observed 4 times during waterbird distribution surveys. A flock of 400 birds was recorded roosting adjacent to the wind farm study area north-eastern boundary (approximately 100m across the river channel) in November 2020 and a flock of 600 was recorded at the Cashen River estuary, approximately 5km north-west of the wind farm study area in December 2019. Flocks of 50 and 30 birds were recorded in fields within 2km of the wind farm study area boundary in December 2019.

7.3.7.4 Hen Harrier

Hen Harrier was recorded during the breeding and winter season. Raw survey data and maps are provided in Appendix 7-4. Survey maps relating to the hen harrier roost are contained in a Confidential Appendix 7-8. Note that hen harrier was not recorded during breeding raptor surveys.

Vantage Point Survey

Hen harrier was observed twice during vantage point surveys in September 2020 (both on the same day). Individuals were observed hunting, including 30 seconds (s) at PCH. Both flights were partly within the wind farm study area boundary, in the north-western area.

Walkover Survey

Hen harrier was observed once during walkover surveys in October 2019. A female was being mobbed by other birds at the Ballyhorgan Marshes, 600m north of the wind farm study area boundary.

Hen Harrier Winter Roost Survey

There were 30 records of hen harrier during hen harrier winter roost surveys. Up to 3 birds were observed at once (2 females/juveniles and 1 male) using the wider area. A confirmed roost is located in Ballyouneen bog, approximately 1.4km north of the wind farm study area boundary (Confidential Appendix 7-8). Birds were observed landing within the wind farm study area on the eastern side in Ballynagare bog at dusk in January 2020. However, these birds were subsequently observed flying again 10 minutes before sunset and their final roosting location is uncertain. A male was also observed flying in this area close to dusk in January 2021. No further hen harrier observations were made in the same area during winter roost or any other surveys.

Incidental Records

There were 4 incidental records of hen harrier over the survey period. Of these, 2 were individual birds on Ballynagare bog within western side of the wind farm study area, observed during the day in November and December 2020. The remaining records were further than 500m north of the wind farm study area boundary.

Supplementary Data

There are 10 hen harrier records in the supplementary data. All are records of individuals in flight and hunting outside the wind farm study area boundary, to the north-east. These birds were observed in the post-breeding and winter season, between August and December 2020. A total of 3 flights were within 500m of the wind farm study area boundary. Both a male and female were observed.

7.3.7.5 Kingfisher

Kingfisher was recorded during the breeding and winter season. Raw survey data and maps are provided in Appendix 7-4.

Waterbird Distribution Survey

Kingfisher was observed once during waterbird distribution surveys in August 2019. An individual was recorded flying along the Cashen River, approximately 900m north of the wind farm study area boundary.

Supplementary Data

There are 6 kingfisher records in the supplementary data. All are non-flight records of birds along a tributary of the River Brick at Ballyhorgan, 1km north of the wind farm study area boundary in April, August, September, October, November and December 2019. Up to 3 observations were made in one day in August.

7.3.7.6 Little Egret

Little egret was recorded during the breeding and wintering season. Raw survey data and maps are provided in Appendix 7-4.

Vantage Point Survey

Little egret was observed 29 times during vantage point surveys throughout the winter and breeding seasons. Individuals were observed in flight, involving 370s at PCH. The majority of flight activity was within or partially within the wind farm study area boundary, particularly in the northern part of the study area around the Dysert Marshes and Sleveen.

Walkover Survey

Little egret was observed 11 times during walkover surveys throughout the winter and breeding seasons. Individuals were observed in flight or feeding along watercourses and drainage streams (10 within or within 500m of the wind farm study area, 1 further than 500m from the wind farm study area boundary).

Waterbird Distribution Survey

During the migratory/wintering period, little egret was observed 26 times during waterbird distribution surveys. Of these observations, 3 were within the wind farm study area along the River Brick western boundary. A further 5 were within 500m of the boundary. The remaining observations were further than 500m from the wind farm study area boundary, along the Cashen River, at Ballyouneen and Farandeen. The maximum count was 6 birds, at the Ardcullen Marshes and Ballyouneen.

Supplementary Data

There are 16 records of little egret in the supplementary data during the breeding and winter season 2019. Of these, 2 were located within 500m of the wind farm study area boundary (in October and November 2019) on the Cashen River to the north. The remaining records were further than 500m north of the wind farm study area boundary.

7.3.7.7 Peregrine Falcon

Peregrine falcon was recorded during the winter season. Raw survey data and maps are provided in Appendix 7-4.

Incidental Records

There was 1 incidental observation of a peregrine falcon perched on a fence post during a hen harrier winter roost survey in October 2020. The bird was within the wind farm study area boundary, in the eastern side.

Supplementary Data

There is 1 record of peregrine falcon in the supplementary data. An individual landed on a fencepost, approximately 1.2km north-east of the wind farm study area boundary in Killarida in October 2019.

7.3.7.8 Short-eared Owl

A short-eared owl was recorded in April. Raw survey data and maps are provided in Appendix 7-4.

Supplementary Data

There is 1 record of short-eared owl in the supplementary data. An individual was recorded flying in Ballyhorgan in April 2019, approximately 400m north of the wind farm study area boundary, landing briefly on a fencepost.

7.3.7.9 Whooper Swan

Whooper swan was recorded in the winter and passage season. Raw survey data and maps for whooper swan is provided in Appendix 7-4. Survey data relating to whooper swan roosts (waterbird distribution survey) is contained in Confidential Appendix 7-8.

Vantage Point Survey

Whooper swan was observed 52 times during vantage point surveys during September to March each winter. Of these, 45 were flight and 7 were non-flight observations. Flight observations were generally of birds flying in and out of agricultural fields along the River Brick and Dysert Marshes in the north and north-east of the study area (involving 1,168s at PCH). All flight observations were within 500m of the wind farm study area boundary; the majority were fully or partially within the wind farm study area itself. Non-flight observations were generally flocks foraging in agricultural fields along the River Brick at Ballynagare on the western study area boundary. Of these, 4 were within the wind farm study area and the remaining 3 were within 200m of the wind farm study area boundary. The maximum flock size observed in flight was 27 birds, while the maximum foraging flock size was 57 birds.

Walkover Survey

Whooper swan was observed 14 times during winter walkover surveys between October and March. Of these, 8 observations were within the wind farm study area boundary, on agricultural fields along the River Brick at Ballynagare on the western side and at MacElligott's Bridge in the south side. A further 2 observations were within 500m of the wind farm study area boundary, in agricultural fields at Ballyouneen (east) and Sleveen (north-west). The remaining 4 flocks were further than 500m from the boundary, at Ballyouneen. Observations were of flocks foraging. The maximum flock size observed within the wind farm study area was 42 birds, and within 500m of the wind farm study area boundary was 119 birds (at Ballyouneen).

Waterbird Distribution Survey

Whooper swan were observed 199 times during waterbird distribution surveys. Of these, 24 were within the wind farm study area and a further 67 were within 500m of the wind farm study area boundary. Within the wind farm study area, the largest flock size was 46 birds and the majority of observations were on agricultural fields along the River Brick at Ballynagare on the western side. Within 500m of the wind farm study area, the largest flock size was 265 birds and the majority of observations were in agricultural fields along the Cashen River at Ballyouneen (adjacent to the wind farm study area to the north-east) and along the Lixnaw Canal, south of the study area. The remaining 108 observations were between 500m-5km from the wind farm study area boundary, at Ballincrossig, Farrandeen, Finuge, Ballyouneen, Ballyhorgan Marshes and the Cashen River estuary. The largest flock observed in the 500m-5km wider area was 88 birds. The surveys indicate that Ballyouneen is a key site for whooper swan: birds were resident here throughout both winter 2019/2020 and 2020/2021 and the largest flocks were recorded here. Ballyouneen was also the only place where whooper swan roosts were recorded (see supplementary data below).

Incidental Records

There were 9 incidental records of whooper swan over the survey period. Of these, 8 were within the wind farm study area in the western part and 1 was within 250m of the wind farm study area boundary. The final observation was further than 500m from the wind farm study area boundary at Ballyouneen, to the the north-east.

Supplementary Data

There are 96 records of whooper swan in the supplementary data, including 91 flight and 5 non-flight observations. Of these, 1 flight was within the wind farm study area boundary (a flock of 3 birds flying low in the northernmost part). Many of the remaining flights were within 500m of the wind farm study area north-eastern boundary and associated with whooper swans going to roost in Ballyouneen. A total of 94 birds were recorded using the roost in Ballyouneen in November 2019 and 25 birds were recorded flying in the direction of the roost at dusk in February 2021. The roosting area was within 150m of the wind farm study area boundary but further than 800m from the nearest proposed turbine.

7.3.7.10 Black-headed Gull

Black-headed gull was recorded during the winter and passage season. Raw survey data and maps are provided Appendix 7-4.

Vantage Point Survey

Black-headed gull was observed 5 times during vantage point surveys in February, November and December 2020. Of these, 4 were flights and 1 was a non-flight observation. All 4 flights were within 500m of the north-eastern wind farm study area boundary (involving 80s at PCH). Of the flights, 3 were partially within the wind farm itself, with a maximum flock size of 35 birds, and the final was a flock of 300 birds approximately 250m from the boundary. The non-flight observation was of 27 birds in agricultural fields within 300m of the wind farm study area boundary.

Waterbird Distribution Survey

Black-headed gull was observed 13 times during waterbird distribution surveys throughout the winter months. Of these observations, 5 were within the wind farm study area, with a maximum flock size of 52 birds, particularly around the west side of Ballynagare. A further 3 were within 500m of the wind farm study area boundary, with a maximum flock size of 150 birds, at Ballynagare bridge (to the west) and the Lixnaw canal (to the south). Finally, 5 observations were further than 500m from the wind farm study area boundary, with a maximum flock size of 250 birds, at the Ballyhorgan Marshes (to the north) and Ballyouneen (to the north-east).

Incidental Records

There was one incidental record of black-headed gull during surveys. A flock of approximately 300 birds was foraging in agricultural fields within 150m of the western wind farm study area boundary in December 2020.

Supplementary Data

There is one record of black-headed gull in the supplementary data. A single bird was observed in flight approximately 1.1km north of the wind farm study area boundary in August 2019.

7.3.7.11 Brent Goose

Brent goose was observed during the winter season. Raw survey data and maps are provided in Appendix 7-4.

Waterbird Distribution Survey

Brent goose was observed 9 times during waterbird distribution surveys throughout the winter months. All observations were between 100m-1.2km west of the wind farm study area boundary, comprising birds foraging at Ballyouneen. The maximum flock size was 5 birds.

Supplementary Data

There are 3 records of brent goose in the supplementary data in November and December 2019. These are records of 3 flights of up to 7 birds, within 500m of the north-eastern wind farm study area boundary, at Ballyouneen.

7.3.7.12 Common Gull

Common gull was recorded during the winter and passage season. Raw survey data and maps for common gull is provided in Appendix 7-4.

Vantage Point Survey

Common gull was observed once during vantage point surveys in October 2019. A flock of 13 birds flew partially within the wind farm study area boundary on the west side, involving 20s at PCH.

Walkover Survey

Common gull was observed once during winter walkover surveys in October 2019. A flock of 6 birds were foraging with other gulls on agricultural farmland at Ballyouneen, 1km north-east of the wind farm study area boundary.

Waterbird Distribution Survey

Common gull was observed 8 times during waterbird distribution surveys in the months of August, September, October, December 2019 and January 2021. Of these, 2 were within 500m of the northern wind farm study area boundary, comprising individual birds. All observations were around the Cashen River and estuary and the largest flock size in the wider area was 86 birds.

Incidental Records

There were 2 incidental records of common gull over the survey period, in April and September 2019. In both cases, the surveyor observed large mixed flocks of gulls, including common gull, flying in the dark. Both records were within 500m of the wind farm study area to the north-east, at Ballyouneen.

Supplementary Data

There are 9 records of common gull in the supplementary data from the months of April, August, September and October 2019. Of these records, 2 are flights within 500m north of the north-eastern wind farm study area boundary, along the Cashen River.

7.3.7.13 Cormorant

Cormorant was recorded in the winter and breeding season. Raw survey data and maps are provided in Appendix 7-4.

Vantage Point Survey

Cormorant was observed 15 times during vantage point surveys throughout the breeding and winter seasons. Of these, 14 were flight and 1 was a non-flight observation. Of the flight observations, 13 were along the western wind farm study area boundary (along the River Brick) and 1 was within 250m of the boundary. All were individual birds. The non-flight observation was a single bird feeding in the River Brick, adjacent to the wind farm study area.

Walkover Survey

Cormorant was observed twice during walkover surveys in May 2020 and January 2021. Both observations were individuals in flight along the River Brick, adjacent to the western wind farm study area boundary.

Waterbird Distribution Survey

Cormorant was observed 8 times during waterbird distribution surveys. Of these, 1 was within the wind farm study area (a single bird flying across the river and over fields in the west side) and 1 was on the western wind farm study area boundary (flying along the River Brick). A further 3 were within 500m of the northern wind farm study area boundary, including up to 7 birds on sediment along the river. The remaining 3 were along the Cashen River, further than 700m north of the wind farm study area boundary.

Incidental Records

There were 2 incidental records of cormorant during hen harrier roost surveys at Kilteen, 1.5km north-east of the wind farm study area.

Supplementary Data

There are 16 records of cormorant in the supplementary data throughout April to December 2019. Of these, 1 record was of an individual cormorant flying within 500m of the northern wind farm study area boundary. The remaining 15 were further than 500m north and east of the wind farm study area boundary, particularly along the Cashen River.

7.3.7.14 Curlew

Curlew was observed in the breeding and winter season. Raw survey data and maps are provided in Appendix 7-4.

Vantage Point Survey

Curlew was observed 54 times during vantage point surveys. The majority of observations were within the winter season, though some were also in the breeding season. Of the total observations, 48 were flight and 6 were non-flight observations. All flights were within 500m of the wind farm study area boundary, concentrated along the River Brick (ie. the western study area boundary) and involved 670s at PCH. The average flying flock size was 7 birds, with a minimum of 1 and a maximum of 47. Of the non-flight observations, 3 were on the western study area boundary and included two instances of roosting flocks of 35 and 5 birds on the River Brick. Two further non-flight observations were up to 290m from the wind farm study area boundary and involved up to 6 birds foraging. The remaining non-flight observation was 1km north of the wind farm study area boundary, comprising 1 bird calling.

Walkover Survey

Curlew was observed 14 times during walkover surveys during the winter and breeding seasons. This species was recorded throughout the winter season and in June and July of the breeding season. Of the observations, 9 were all or partially within the wind farm study area boundary. These observations included birds flying, with a maximum flock size of 60 birds flushed by the surveyor (in January 2020). These observations also included two instances of roosting flocks (of 13 and 19 birds) on the Cashen River along the north-eastern boundary of the wind farm study area. A further 4 observations were within 500m of the wind farm study area boundary, with a maximum flock size of 13 birds roosting at the Cashen River. The final observation comprised 15 birds foraging 650m from the western wind farm study area boundary.

Waterbird Distribution Survey

Curlew was observed 60 times during waterbird distribution surveys. Of these, 17 observations were within or on the wind farm study area boundary to the west and north side, and a further 17 were within 500m of the wind farm study area boundary. The remaining 26 observations were further than 500m north of the wind farm study area boundary, along the Cashen River channel and estuary. The largest flocks recorded were between 231-550 birds (all other flocks were less than 100 birds). These were observed to the north-east at Ballyouneen; the nearest to the wind farm study area was the flock of 231 birds, roosting in fields 120m from the boundary. A second flock of 18 birds were observed roosting in the same area on another occasion. The largest flock within or on the wind farm study area boundary was 45 birds on the boundary at Ballyouneen, followed by 12 birds foraging at Ballynagare. The remaining observations within or on the boundary were of singletons or less than 8 birds.

Incidental Records

There were 6 incidental records of curlew over the survey period. Flocks of up to 85 birds were observed foraging in agricultural fields, flying or heard calling. Curlew feathers were also found on the embankment. Of these records, 3 were within 500m or on the wind farm study area boundary in the northern portion. The remaining 3 were further than 500m from the wind farm study area boundary in Sleveen and the Leagh Marshes to the north-west.

Supplementary Data

There are 35 records of curlew in the supplementary data. Curlew were observed in flight 32 times, between 150m-1.3km north of the wind farm study area boundary. The maximum flock size was 175 birds, 950m north of the wind farm study area boundary. However, the second largest flock was 70 birds and the third largest was 35 birds. The remaining 29 flight observations were of flocks of less than 30 birds. Curlew was also recorded as a non-flight record 3 times. Of these, 2 records comprised singletons and the third comprised a flock of 61 birds in fields 350m from the wind farm study area boundary.

7.3.7.15 Grey Plover

Grey plover was recorded during the winter season. Raw survey data and maps are provided in Appendix 7-4.

Waterbird Distribution Survey

Grey plover was observed twice during waterbird distribution surveys. In October 2019, a flock of 656 was observed at the Cashen River estuary, 5km north of the wind farm study area boundary. In December 2019, a flock of 141 was observed at the mouth of the Cashen River, also 5km north of the wind farm study area boundary.

7.3.7.16 Lapwing

Lapwing was observed during the winter and passage season. Raw survey data and maps are provided in Appendix 7-4.

Vantage Point Survey

Lapwing was observed 8 times during vantage point surveys in the months of August, September, October, November, December and February over the 2 year survey period. Of these, 7 were flight and 1 was a non-flight observation. Of the 7 flights, 3 were all or partially within the wind farm study area boundary in the northern portion; flock size was between 8-38 birds and involved 80s at PCH. The remaining 4 of the 7 flights were within 500m of the north and north-western wind farm study area boundary; flock size was between 54-500 birds (involving 106s at PCH). Flocks were flying through, moving position or circling. The non-flight observation comprised a flock of 68 birds roosting in fields 170m west of the wind farm study area boundary at Ballynagare.

Walkover Survey

Lapwing was observed twice during walkover surveys. Both observations were within 500m of the north-eastern wind farm study area boundary at Dysert: a flock of 110 were flying in October 2019 and a flock of 9 was flushed by the surveyor in January 2020.

Waterbird Distribution Survey

Lapwing was observed 21 times during waterbird distribution surveys throughout the autumn passage and winter seasons. Of these observations, 2 were within the wind farm study area. These comprised a flock of 43 roosting and a flock of 38 circling in fields at Ballynagare in the west side. A further 6 were within 500m of the north-western wind farm study area boundary. These comprised flocks between 9-235 birds foraging and roosting in agricultural fields. The remaining 13 observations were further than 500m north and west of the wind farm study area boundary. These comprised flocks between 8-400 birds (average of 107) foraging and roosting, predominantly on land around the Cashen River channel and estuary.

Incidental Records

There was 1 incidental record of lapwing during vantage point surveys. A flock of approximately 500 lapwing, along with other bird species, was observed in fields in Ballynagare, 150m west of the wind farm study area boundary.

Supplementary Data

There are 6 records of lapwing in the supplementary data in November 2019. Flock between 11-46 birds were observed flying around the Cashen River, further than 500m north of the wind farm study area boundary.

7.3.7.17 Mallard

Mallard was observed during the winter and breeding season. Raw survey data and maps are provided in Appendix 7-4.

Vantage Point Survey

Mallard was observed 16 times during vantage point surveys. All observations were flights within the wind farm study area or within 500m of the boundary, involving 326s at PCH. The maximum count was 24 birds. Flights were predominantly around the River Brick on the western boundary.

Walkover Survey

Mallard was observed 13 times during walkover surveys. Of these, 4 were within the wind farm study area, comprising pairs or singletons flying in the bog. A further 7 were on or within 500m of the north-eastern wind farm study area boundary, comprising between 2-38 birds foraging or flushed by the surveyor. The remaining 2 flights were further than 500m from the wind farm study area boundary, to the north-east.

Waterbird Distribution Survey

Mallard was observed 25 times during waterbird distribution surveys. Of these, 5 were within the wind farm study area boundary, comprising flocks between 2-55 birds foraging or flushed by the surveyor in agricultural fields in Ballynagare in the west side. A further 10 were within 500m of the wind farm study area boundary, comprising singletons up to flocks of 44 birds foraging or flying around the River Cashen (to the east), Dysert (to the east), the Lixnaw Canal (to the south) and Ballyouneen (to the north-east). The remaining 10 were further than 500m from the north-eastern wind farm study area boundary, in Killarida and Ballyouneen.

Incidental Records

There were 3 incidental records of mallard during breeding raptor surveys. Pairs or singletons were observed further than 500m to the east of the wind farm study area boundary.

Supplementary Data

There are 10 records of mallard in the supplementary data. Of these, 3 are partially within 500m of the north-eastern wind farm study area boundary, comprising between 1-5 mallard in flight around the Cashen River. The remaining supplementary records comprise between 1-10 mallard in flight further than 500m from the wind farm study area boundary around the Cashen River to the north and Ballyouneen to the north-east.

7.3.7.18 Oystercatcher

Oystercatcher was recorded in the months of August-November. Raw survey data and maps are provided in Appendix 7-4.

Waterbird Distribution Survey

Oystercatcher was observed 12 times during waterbird distribution surveys in August-October 2019 and November 2020. Of these, 5 were within 500m north of the wind farm study area boundary. These comprised between 2-5 oystercatcher feeding in the estuary and at the river's edge near Ballyouneen. The remaining observations were further than 500m north of the wind farm study area boundary, comprising between 1-10 oystercatchers feeding on the Cashen River and tributaries at the Ardcullen Marshes and flying on the coast at Rahoonagh.

7.3.7.19 Redshank

Redshank was recorded during the winter and passage season. Raw survey data and maps are provided in Appendix 7-4.

Vantage Point Survey

Redshank was observed once during vantage point surveys. An individual was observed landing and starting to forage on the River Brick on the western wind farm study area boundary at Ballynagare in March 2021.

Walkover Survey

Redshank was observed once during walkover surveys. A flock of 5 birds were flushed by the surveyor, on the north-eastern wind farm study area boundary along the Cashen River at Dysert in January 2020.

Waterbird Distribution Survey

Redshank was observed 6 times during waterbird distribution surveys in the months of August, October and December 2019. Of these, 3 observations were within 350m of the northern wind farm study area boundary on the Rivers Cashen and Brick; flocks between 3-29 birds were feeding and roosting on the river. The 3 other observations were at the Cashen River estuary 5km north of the wind farm study area; flocks between 4-12 birds were foraging in the estuary.

Supplementary Data

There are 10 records of redshank in the supplementary data during the winter season. Of these, 9 are flight records of flocks between 1-37 redshank 1km north of the wind farm study area boundary. The final record is an auditory record of a redshank calling 1km north of the wind farm study area boundary.

7.3.7.20 Shoveler

Shoveler was recorded during the winter season. Raw survey data and maps are provided in Appendix 7-4.

Waterbird Distribution Survey

Shoveler was recorded once during waterbird distribution surveys at the Lixnaw Canal, 300m south from the wind farm study area boundary. A single bird was observed foraging in agricultural grassland in March 2020.

7.3.7.21 Teal

Teal was observed during the winter season. Raw survey data and maps are provided in Appendix 7-4.

Vantage Point Survey

Teal were observed once during vantage point surveys in February 2020. A flock of 5 birds were foraging in agricultural fields approximately 250m west of the wind farm study area boundary at Ballynagare.

Waterbird Distribution Survey

Teal was observed twice during waterbird distribution surveys. A group of 3 teal were observed foraging on agricultural fields at the Lixnaw Canal, approximately 110m south of the wind farm study area boundary in March 2020, and a pair were observed at Killacrim, 3km east of the wind farm in November 2019.

Incidental Records

There was 1 incidental record of teal during vantage point surveys in December 2020. A flock of 300 were recorded in agricultural fields with other bird species approximately 150m west of the wind farm study area boundary at Ballynagare.

7.3.7.22 Wigeon

Wigeon was observed during the winter season. Raw survey data and maps are provided in Appendix 7-4.

Waterbird Distribution Survey

Wigeon was observed twice during waterbird distribution surveys on the water in the Cashen River estuary, 5km north of the wind farm study area. A flock of at least 200 birds were observed in November 2019 and a flock of 269 in December 2019.

7.3.7.23 Barn Owl

Barn owl was observed during the winter season. Raw survey data and maps for barn owl is provided in Appendix 7-4.

Incidental Records

There was an incidental record of barn owl during vantage point surveys. An individual landed on a fence post in February 2020, 400m from the western wind farm study area boundary at Sleveen. Subsequently, a nearby round tower (Ratoo tower) that could potentially provide a suitable nest site for barn owl was investigated for the presence of owls during the breeding season. However, the surveyor found that the tower had recently been refurbished and is now unlikely to host breeding barn owl.

7.3.7.24 Kestrel

Kestrel was recorded during the winter and breeding season. Raw survey data and maps are provided in Appendix 7-4.

Vantage Point Survey

Kestrel was observed 16 times during vantage point surveys. All were flights in the Ballynagare area in the west side of the study area, involving 591s at PCH. Of the total, 12 were all or partially within the wind farm study area boundary and the remaining 4 were within 300m of the boundary. All observations were of individual birds (including an adult male) hunting or flying over a bog, agricultural fields or conifer plantations.

Walkover Survey

Kestrel was observed 4 times during walkover surveys. Of the observations, 2 were of individuals (including an adult female) hunting in bog or flying low in agricultural fields within the wind farm study area. The other 2 observations were individuals hunting or flying low in fields within 500m of the west and east wind farm study area boundary. Breeding activity was not recorded during walkover surveys, although 1 kestrel was observed in suitable breeding habitat during the breeding season.

Breeding Raptor Survey

Kestrel was observed 9 times during breeding raptor surveys. In May 2019, a pair were seen in the bog 4km north-east of the wind farm study area, indicating probable breeding. In June 2020 an adult male was observed hunting in a bog within the wind farm study area and, in July 2020, an adult female was also seen hunting in a bog within the wind farm study area. The other 6 observations in breeding seasons 2019 and 2020 were individuals in suitable breeding habitat hunting at least 2km east of the wind farm study area.

Incidental Records

There were 7 incidental records of kestrel over the survey period, all involving individuals hunting, flying or perched. Males, females and juveniles were observed. The juvenile was observed alone in Ballyouneen to the north-east and the location of a breeding site is not known. Of the other records, 2 were of individual kestrels within the wind farm study area boundary. The remainder were individuals outside the boundary.

Supplementary Data

There are 6 records of kestrel in the supplementary data. Each of these comprises an individual bird flying and hunting. Of the records, 2 are within 500m of the north-eastern wind farm study area boundary, at Ballyouneen, while the remaining 4 are further than 500m from the northern wind farm study area boundary, at Ballyouneen and Ballyhorgan.

7.3.7.25 Snipe

Snipe was recorded during the winter and breeding season. Raw survey data and maps are provided in Appendix 7-4.

Vantage Point Survey

Snipe was observed 4 times during vantage point surveys in the months of August and October. Of these, 3 were flight and 1 was a non-flight record. Flight observations comprised between 1-6 snipe flying, involving 27s at PCH. All flights were in the Ballynagare area in the west side; 1 flight was partially within the wind farm study area and the remaining 2 were within 400m of the western boundary. The non-flight record was of a snipe calling after dark 250m from the wind farm study area boundary.

Walkover Survey

Snipe was observed 4 times during walkover surveys in the Dysert Marshes area in the north side of the wind farm study area. Snipe were recorded drumming (courtship display) twice in June 2020 in this area, indicating probable breeding in the site. Snipe were flushed by the surveyor twice during the winter season walkover surveys.

Waterbird Distribution Survey

Snipe was observed 6 times in farmland during waterbird distribution surveys. Of these, 1 observation was within the wind farm study area; an individual snipe was recorded in Ballynagare in the west side. A further observation was within 300m of the north-easterm wind farm study area boundary; 2 snipe were flushed by the surveyor at Ballyouneen. The remaining 4 observations were between 1-6 snipe in fields further than 500m north-east of the wind farm study area boundary, in Ballyouneen and Rahoonagh.

Incidental Records

There were 2 incidental records of snipe during the survey period, in August and October 2019. A snipe was heard calling at Sleveen (within 500m of the western wind farm study area boundary) and Ballynagare (further than 500m from the north-eastern wind farm study area boundary.

Supplementary Data

There is 1 record of snipe in the supplementary data in October 2019. A count of 7 snipe was made at Ballyouneen, 900m from the north-easternwind farm study area boundary.

7.3.7.26 Buzzard

Buzzard was recorded during the winter and breeding season. Raw survey data and maps are provided in Appendix 7-4. Note that buzzard was not recorded during breeding raptor surveys.

Vantage Point Survey

Buzzard was observed 3 times during vantage point surveys. In September 2020, 2 birds were observed circling in the Ballynagare area in the west side of the wind farm study area. In September 2019, 1 bird was observed flying through Ratoo, partially within the northern portion of the wind farm study area. Finally, in June 2019, 2 birds were observed circling on thermals in Ratoo, 100m from the northern wind farm study area boundary.

Incidental Records

There were 4 incidental records of buzzard during the survey period during the winter months. Of these, 2 were within the southern portion of the wind farm study area, at MacElligot's Bridge. The remaining 2 records were further than 500m north of the wind farm study area boundary, near Ballyouneen and Ballyhorgan. A maximum count of 5 buzzard was made.

7.3.7.27 Sparrowhawk

Sparrowhawk was recorded in the winter and breeding season. Raw survey data and maps are provided in Appendix 7-4.

Vantage Point Survey

Sparrowhawk was observed once during vantage point surveys. In June 2019, an individual was flying into the west side of wind farm study area at Ballyngare, involving 193s at PCH.

Walkover Survey

Sparrowhawk was observed once during walkover surveys. In April 2019, a sparrowhawk was flushed from trees by the surveyor in the west side of the wind farm study area at Ballynagare and flew away.

Breeding Raptor Survey

Sparrowhawk was observed once during breeding raptor surveys in Ennismore, 1.8km west of the wind farm study area. An individual was flying across the bog in April, in suitable breeding habitat, indicating possible breeding.

Incidental Records

There was 1 incidental record of sparrowhawk during hen harrier roost surveys in February 2020. An individual was observed in flight at Ballyouneen, 1.5km north-east of the wind farm study area boundary.

Supplementary Data

There is 1 record of sparrowhawk in the supplementary data in August 2019. An individual was in flight at the Ballyhorgan Marshes, 800m north of the wind farm study area boundary.

7.3.7.28 Meadow Pipit

Meadow pipit was observed during the breeding and winter seasons. Raw survey data and maps are provided in Appendix 7-4.

Vantage Point Survey

Meadow pipit was recorded during vantage point surveys 13 times during the survey period April 2019 to March 2021. A maximum count of 8 birds was made.

Walkover Survey

Meadow pipit was recorded 27 times during walkover surveys in both the breeding and winter season between April 2019 and March 2021. A maximum count of 5 birds was made. Breeding displays were observed in July 2019.

Supplementary Data

There are 7 records of meadow pipit in the supplementary data from April to December 2019. A maximum count of 4 birds was made.

7.3.7.29 Grey Wagtail

Grey wagtail was observed in December. Raw survey data and maps are provided in Appendix 7-4.

Supplementary Data

There is 1 record of grey wagtail in the supplementary data. A single bird was observed in December 2019.

7.4 Receptor Evaluation

7.4.1 Determination of Population Importance

A determination of population importance for birds within the likely ZOI is provided below, following criteria described in Section 7.2.5. Estimates of national population sizes were obtained from the most recent species specific national survey, Burke *et al.* (2018) or NPWS Article 12 Reporting (2008-2012), depending on what literature was available. Similarly, estimates for mean county population sizes were obtained from species specific surveys, a review of I-WeBS sites in County Kerry or from NPWS Article 12 Reporting, according to what literature was available.

Following NRA (2009), a population of National Importance is a regularly occurring population that exceeds 1% of the national population. Similarly, a population of County Importance is a regularly occurring population that exceedings 1% of the county population.

7.4.1.1 Bar-tailed godwit

Bar-tailed godwit is listed on Annex I and Red Listed with respect to wintering populations. It is an SCI of River Shannon and River Fergus Estuaries SPA (located 14.9km north-east of the wind farm study area) and Tralee Bay Complex SPA (located 12.9km from south-west of the wind farm study area).

As per the latest national wintering estimates provided in Burke *et al.* (2018), the national wintering population of bar-tailed godwit in the Republic of Ireland is 13,385. The county population was estimated as the most recent 5-year mean (2013/14-2017/18) count at Kerry I-WeBS sites:

- An Trá Beg - 2
- Brandon Bay - Inner Brandon Bay - 10
- Cashen River & Estuary - 376
- Castlemaine Harbour & Rossbehy - 301
- Dingle Harbour - 2
- Magharees Islands - 0
- Smerwick Harbour - 2
- Tralee Bay, Lough Gill & Akeragh Lough - 214
- Ventry Harbour - 1

Therefore, as per NRA (2009), a regularly occurring population of 133 birds is required for classification as Nationally Important and of 9 birds for classification as County Importance.

This species was recorded 5 times within 2km of the wind farm study area, including flocks of 70 birds (County Importance). However, it was only recorded on 2 occasions along the wind farm study area boundary, with a maximum count of 2 birds, which is below the threshold for County Importance. As such, there is no regularly occurring population within 500m of the wind farm study area and the proposed development has no potential to result in direct habitat loss, displacement or barrier effects for this species. No pathways for direct or indirect effects exist. Therefore, bar-tailed godwit is not considered further in this assessment and the wind farm study area is not of significance to this species.

7.4.1.2 Dunlin

Dunlin is listed on Annex I and Red Listed with respect to breeding and wintering populations. It is an SCI of River Shannon and River Fergus Estuaries SPA (located 14.9km north-east of the wind farm study area) and Tralee Bay Complex SPA (located 12.9km from south-west of the wind farm study area).

As per the latest national wintering estimates provided in Burke *et al.* (2018), the national wintering population of dunlin in the Republic of Ireland is 37,409. The county population was estimated as the most recent 5-year mean (2013/14-2017/18) count at Kerry I-WeBS sites:

- An Trá Beg - 4
- Brandon Bay - Inner Brandon Bay - 380
- Cashen River & Estuary - 58
- Castlemaine Harbour & Rossbehy - 515
- Castlemaine Outer: Inch offshore - 0
- Dingle Harbour - 0
- Lough Leane & Killarney Valley - 0
- Magharees Islands - 0
- Smerwick Harbour - 22
- Tralee Bay, Lough Gill & Akeragh Lough - 714
- Ventry Harbour - 16

Therefore, as per NRA (2009), a regularly occurring population of 374 birds is required for classification as Nationally Important and of 18 birds for classification as County Importance.

This species was recorded once within 5km of the wind farm study area, comprising a flock of 59 birds (County Importance). It was not recorded within 500m of the wind farm study area. As such, there is no regularly occurring population within 500m of the wind farm study area and the proposed development has no potential to result in direct habitat loss, displacement or barrier effects for this species. No pathways for direct or indirect effects exist. Therefore, dunlin is not considered further in this assessment and the wind farm study area is not of significance to this species.

7.4.1.3 Golden Plover

Golden plover is listed on Annex I and Red Listed with respect to breeding and wintering populations. It is an SCI of River Shannon and River Fergus Estuaries SPA (located 14.9km north-east of the wind farm study area) and Tralee Bay Complex SPA (located 12.9km from south-west of the wind farm study area). Foraging golden plover favour lowland grasslands away from the coast during the winter. In the present case, when recorded during hinterland surveys at Ballynagare, observations included foraging and roosting. The birds recorded during surveys are therefore likely to be locally wintering birds.

As per the latest national wintering estimates provided in Burke *et al.* (2018), the national wintering population of golden plover in the Republic of Ireland is 80,707. The county population was estimated as the most recent 5-year mean (2013/14-2017/18) count at Kerry I-WeBS sites:

- An Trá Beg - 14
- Cashen River & Estuary - 670
- Castlemaine Harbour & Rossbehy - 2
- Dingle Harbour - 0
- Smerwick Harbour - 44
- Tralee Bay, Lough Gill & Akeragh Lough - 1579
- Ventry Harbour - 42

Therefore, as per NRA (2009), a regularly occurring population of 807 birds is required for classification as Nationally Important and of 24 birds for classification as County Importance.

This species was recorded 3 times within 2km of wind farm study area boundary, with a maximum count of 600 birds (County Importance). On one occasion, a flock of 400 birds (County Importance) was recorded roosting adjacent to the wind farm study area boundary (on the other side of the river boundary). Although this was not a regularly occurring population (1 record), on a highly precautionary basis, golden plover is considered to be a population of **County Importance**.

7.4.1.4 Hen Harrier

Hen harrier is listed on Annex I and Schedule 4. It is an SCI of Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (6km south-east of the wind farm study area). The core foraging range of hen harrier is 2km, which is less than the distance from the SPA to the wind farm study area. Furthermore, the presence of a roost in Ballyouneen suggests that it is unlikely that the birds around the wind farm study area are associated with the SPA.

Based on Ruddock (2016), the Republic of Ireland national breeding hen harrier population is in the range of 108-157 pairs. Therefore, a single breeding pair (ie. 1% of the national total) is of National Importance, as per NRA (2009) criteria. Hen harrier was recorded once, in the wider area outside the wind farm study area, during the breeding season. Therefore, this species is not dependent on the wind farm study area for breeding.

As per NPWS Article 12 Reporting, the estimated national wintering population of hen harrier is 269-349 birds. As such, following NRA (2009), a regularly occurring winter population of 2-3 birds is Nationally Important. During roost surveys, up to 3 hen harriers (National Importance) were observed in the wider area (further than 500m from the wind farm study area boundary) and a regularly used roost site was located in Ballyouneen, 1.4km north of the wind farm study area boundary. Hen harrier were observed within the wind farm study area at Ballynagare at dusk on 1 occasion, but no roost was confirmed. This species was also recorded in flight 7 times within the wind farm study area to a 500m radius and 9 times further than 500m from the wind farm study area boundary. Taking a precautionary approach, hen harrier recorded in the wind farm during surveys are therefore considered to be associated with a population of **National Importance** from the wider surroundings.

7.4.1.5 Kingfisher

Kingfisher is listed on Annex I. It is not an SCI of an SPA within 15km of the wind farm study area.

There are no available estimates of the size of the national kingfisher population in Ireland due to survey constraints, although this species is believed to be widely distributed (Cummins *et al.,* 2010). Similarly, counts at I-WeBS sites are generally too limited to provide a county population (kingfisher has been record once in An Trá Beg and Dingle Harbour I-WeBS sites in the 2013/14-2017/18 period). Therefore, following the precautionary principle, any records of kingfisher are treated as County Importance.

This species was recorded 4 times during the winter season and 3 times during the breeding season (County Importance). It was not recorded within 500m of the wind farm study area. As such, there is no regularly occurring population within 500m of the wind farm study area and the proposed development has no potential to result in direct habitat loss, displacement or barrier effects for this species. No pathways for direct or indirect effects exist. Therefore, kingfisher is not considered further in this assessment and the wind farm study area is not of significance to this species.

7.4.1.6 Little Egret

Little egret is listed on Annex I. It is not an SCI of an SPA within 15km of the wind farm study area.

As per the latest national wintering estimates provided in Burke *et al.* (2018), the national wintering population of little egret in the Republic of Ireland is 1,274. The county population was estimated as the most recent 5-year mean (2013/14-2017/18) count at Kerry I-WeBS sites:

- An Trá Beg - 8
- Brandon Bay - Inner Brandon Bay - 3
- Cashen River & Estuary - 3
- Castlemaine Harbour & Rossbehy - 34
- Dingle Harbour - 10

- Lough Leane & Killarney Valley - 3
- Smerwick Harbour - 2
- Tralee Bay, Lough Gill & Akeragh Lough - 17
- Ventry Harbour - 1

Therefore, as per NRA (2009), a regularly occurring population of 12 birds is required for classification as Nationally Important and of 1 bird for classification as County Importance.

This species was regularly recorded in flight and foraging within the wind farm study area, with a maximum count of 2 birds (County Importance). This species was also recorded foraging in the wider area, further than 500m from the wind farm study area, with a maximum count of 6 birds (County Importance). Thus, little egret recorded during surveys are considered to be a population of **County Importance**.

7.4.1.7 Peregrine Falcon

Peregrine falcon is listed on Annex I and Schedule 4. It is not an SCI of an SPA within 15km of the wind farm study area.

The estimated national breeding population of peregrine falcon in Ireland is 425 breeding pairs as per the National Breeding Peregrine Survey 2017. Therefore, 4 breeding pairs (ie. 1% of the national total) is of National Importance, as per NRA (2009) criteria.

This species was not observed during the breeding season. However, there were 2 observations of individuals during the winter season (County Importance). The first observation was within the wind farm study area, while the second observation was in the wider area, further than 500m from the wind farm study area. Given the low number of records over the 2 year survey period, there is not a regularly occurring population within 500m of the wind farm study area and the proposed development has no potential to result in direct habitat loss, displacement or barrier effects for this species. No pathways for direct or indirect effects exist. Therefore, peregrine falcon is not considered further in this assessment and the wind farm study area is not of significance to this species.

7.4.1.8 Short-eared Owl

Short-eared owl is listed on Annex I and Schedule 4. It is not an SCI of an SPA within 15km of the wind farm study area.

There are no available estimates of the size of the national short-eared owl population in Ireland because it is an infrequent winter visitor, although it is believed to be widespread. Therefore, following the precautionary principle, any records are treated as County Importance.

Short-eared owl was observed once during the survey period (County Importance), in the wider area, further than 500m from the wind farm study area. Because this species was not observed within 500m of the wind farm study area, the wind farm study area is not considered to be of significance to this species. The proposed development has no potential to result in direct habitat loss, displacement or barrier effects for this species. No pathways for direct or indirect effects exist. Therefore, short-eared owl is not considered further in this assessment and the wind farm study area is not of significance to this species.

7.4.1.9 Whooper Swan

Whooper swan is listed on Annex I. It is an SCI of River Shannon and River Fergus Estuaries SPA (located 14.9km north-east of the wind farm study area) and Tralee Bay Complex SPA (located 12.9km from south-west of the wind farm study area). The whooper swan that were recorded during the surveys, were likely resident locally rather than associated with either SPA. The rationale for this was that throughout the winter months the birds were recorded foraging and roosting in the same locations within

5km of the wind farms site. Furthermore, no regular commuting/migratory flights were recorded that would constitute evidence of connectivity between the SPAs and the proposed development area. In addition, the distance between these SPAs and the wind farm study area is greater than the core foraging range of whooper swan, 5km (SNH, 2016).

As per the latest national wintering estimates provided in the 2020 International Swan Census (Burke *et al.,* 2021), the national wintering population of whooper swan in the Republic of Ireland is 19,111. The county population of Kerry is 419 (Burke *et al.,* 2021). Therefore, as per NRA (2009), a regularly occurring population of 191 birds is required for classification as Nationally Important (1% of the national population) and of 4 birds (1% of the county population) for classification as County Importance.

This species was recorded 371 times during the survey period. Flocks up to 57 birds were recorded foraging within the wind farm study area (County Importance) and flocks up to 265 birds were recorded foraging and roosting within 500m of the wind farm study area boundary (National Importance). Roosts were identified in Ballyouneen, adjacent to the wind farm study area. Whooper swan recorded in the wind farm study area during surveys are therefore considered to be associated with a population of **National Importance** from the wider surroundings.

7.4.1.10 Black-headed Gull

Black-headed gull is an SCI of River Shannon and River Fergus Estuaries SPA (located 14.9km north-east of the wind farm study area) and Tralee Bay Complex SPA (located 12.9km from south-west of the wind farm study area). The distance between these SPAs and the wind farm study area is greater than the core foraging range of black-headed gull, mean 11.4±6.7km (Thaxter *et al.,* 2012).

As per the NPWS Article 12 Reporting, the national population of black-headed gull is estimated at 50,181. The county population was estimated as the most recent 5-year mean (2013/14-2017/18) count at Kerry I-WeBS sites:

- An Trá Beg - 29
- Brandon Bay - Inner Brandon Bay – 2
- Cashen River & Estuary - 104
- Castlemaine Harbour & Rossbehy - 248
- Castlemaine Outer: Inch offshore - 1
- Dingle Harbour - 100
- Lough Leane & Killarney Valley - 2215
- Magharees Islands - 0
- Smerwick Harbour - 47
- Tralee Bay, Lough Gill & Akeragh Lough - 131
- Ventry Harbour - 8

Therefore, as per NRA (2009), a regularly occurring population of 502 is required for classification as Nationally Important and of 29 birds for classification as County Importance.

This species was recorded 20 times during the survey period during winter and passage seasons. It was not recorded during the breeding season. A maximum flock size of 52 birds (County Importance) was recorded within the wind farm study area. Black-headed gull recorded in the wind farm study area during surveys are therefore considered to be of **County Importance.**

7.4.1.11 Brent Goose

Brent goose is an SCI of River Shannon and River Fergus Estuaries SPA (located 14.9km north-east of the wind farm study area) and Tralee Bay Complex SPA (located 12.9km from south-west of the wind farm study area). The distance between these SPAs and the wind farm study area is greater than the core foraging range of brent goose, 6.1km (Summers and Critchley, 1990).

As per the latest national wintering estimates provided in Burke *et al.* (2018), the national wintering population brent goose (light-bellied) on the island of Ireland is 35,150. The county population was estimated as the most recent 5-year mean (2013/14-017/18) count at Kerry I-WeBS sites:

- An Trá Beg - 0
- Brandon Bay - Inner Brandon Bay - 300
- Cashen River & Estuary - 117
- Castlemaine Harbour & Rossbehy - 1107
- Castlemaine Outer: Inch offshore - 0
- Dingle Harbour - 37
- Smerwick Harbour - 59
- Tralee Bay, Lough Gill & Akeragh Lough - 1720
- Ventry Harbour - 93

Therefore, as per NRA (2009), a regularly occurring population of 352 birds is required for classification as Nationally Important and of 34 birds for classification as County Importance.

This species was recorded 12 times during the survey period, outside the wind farm study area boundary. A maximum flock size of 7 birds was recorded within 500m of the wind farm study area. Given the low number of observations, the distance from the wind farm and the low number of individuals, the proposed development is not considered to have the potential to result in direct habitat loss, displacement or barrier effects on this species. No pathways for direct or indirect effects exist. Therefore, brent goose is not considered further in this assessment and the wind farm study area is not of significance to this species.

7.4.1.12 Common Gull

Common gull is an SCI of Tralee Bay Complex SPA (located 12.9km from south-west of the wind farm study area). The distance between this SPA and the wind farm study area is within the core foraging range of common gull, mean 25km (Thaxter *et al.,* 2012).

As per NPWS Article 12 reporting, the national population common gull in the Republic of Ireland is estimated at 18,415 birds. The county population was estimated as the most recent 5-year mean (2013/14-017/18) count at Kerry I-WeBS sites:

- An Trá Beg - 22
- Brandon Bay - Inner Brandon Bay - 24
- Cashen River & Estuary - 0
- Castlemaine Harbour & Rossbehy - 4
- Castlemaine Outer: Inch offshore - 2
- Dingle Harbour - 54
- Magharees Islands - 25
- Smerwick Harbour - 74
- Tralee Bay, Lough Gill & Akeragh Lough - 231
- Ventry Harbour - 44

Therefore, as per NRA (2009), a regularly occurring population of 184 birds is required for classification as Nationally Important and of 5 birds for classification as County Importance.

This species was recorded 21 times during the survey period. Flocks up to 13 birds (County Importance) were recorded in the wind farm study area. Flocks up to 230 birds (National Importance) were recorded in the wider area. The species is not dependent on the wind farm study area for breeding. However, taking a precautionary approach, common gull recorded in the wind farm study area during winter and passage season surveys are considered to be of **County Importance.**

7.4.1.13 Cormorant

Cormorant is an SCI of River Shannon and River Fergus Estuaries SPA (located 14.9km north-east of the wind farm study area). The distance between this SPA and the wind farm study area is greater than the core foraging range for cormorant, mean 5.2±1.5km (Thaxter *et al.,* 2012).

As per the latest national wintering estimates provided in Burke *et al.* (2018), the national wintering population of cormorant in the Republic of Ireland is 7,967. The county population was estimated as the most recent 5-year mean (2013/14-017/18) count at Kerry I-WeBS sites:

- An Trá Beg - 3
- Brandon Bay - Inner Brandon Bay - 14
- Cashen River & Estuary - 14
- Castlemaine Harbour & Rossbehy - 37
- Castlemaine Outer: Inch offshore - 4
- Dingle Harbour - 39
- Lough Caragh - 0
- Lough Leane & Killarney Valley - 64
- Magharees Islands - 1
- Smerwick Harbour - 4
- Tralee Bay, Lough Gill & Akeragh Lough - 46
- Ventry Harbour - 11

Therefore, as per NRA (2009), a regularly occurring population of 80 birds is required for classification as Nationally Important and of 2 birds for classification as County Importance.

This species was recorded 43 times during the survey period. Individual birds were observed within the wind farm (below threshold for County Importance), but a maximum count of 7 birds (County Importance) was made within 500m of the wind farm study area. The species is not dependent on the wind farm study area for breeding. However, taking a precautionary approach, cormorant recorded in the wind farm study area during surveys are considered to be of **County Importance.**

7.4.1.14 Curlew

Curlew is Red Listed with respect to breeding and wintering populations. It is also an SCI of River Shannon and River Fergus Estuaries SPA (located 14.9km north-east of the wind farm study area) and Tralee Bay Complex SPA (located 12.9km from south-west of the wind farm study area). Curlew recorded at Ballynagare were largely resident (i.e. foraging and roosting) in the wider area around the wind farm study area throughout the winter season. As such, the population around the wind farm study area is likely to be locally wintering, rather than associated with these SPAs.

As per the latest national wintering estimates provided in Burke *et al.* (2018), the national wintering population of curlew in the Republic of Ireland is 28,300. The county population was estimated as the most recent 5-year mean (2013/14-017/18) count at Kerry I-WeBS sites:

- An Trá Beg - 29
- Brandon Bay - Inner Brandon Bay - 41
- Cashen River & Estuary - 45
- Castlemaine Harbour & Rossbehy - 324
- Castlemaine Outer: Inch offshore - 0
- Dingle Harbour - 26
- Lough Leane & Killarney Valley - 13
- Magharees Islands - 8
- Smerwick Harbour - 87
- Tralee Bay, Lough Gill & Akeragh Lough - 337

- Ventry Harbour - 34

Therefore, as per NRA (2009), a regularly occurring population of 283 birds is required for classification as Nationally Important and of 9 birds for classification as County Importance.

This species was recorded 169 times during the survey period, foraging, roosting and flying. Flocks of County Importance were recorded within the wind farm study area and flocks of National Importance were recorded within 500m of the wind farm study area during the winter and passage season. Flocks of County Importance were also recorded within the wind farm study area and surrounds during the breeding season, although, based on the survey data, the species is not using the wind farm study area for breeding. In conclusion, curlew recorded in the wind farm study area during the winter and passage season are considered to be associated with a population of **National Importance** from the wider surroundings, while curlew recorded in the wind farm study area during the late summer are considered to be of **County Importance**.

7.4.1.15 Grey Plover

Grey plover is Red Listed with respect to wintering populations. It is also an SCI of River Shannon and River Fergus Estuaries SPA (located 14.9km north-east of the wind farm study area) and Tralee Bay Complex SPA (located 12.9km from south-west of the wind farm study area).

As per the latest national wintering estimates provided in Burke *et al.* (2018), the national wintering population of grey plover in the Republic of Ireland is 2,812. The county population was estimated as the most recent 5-year mean (2013/14-017/18) count at Kerry I-WeBS sites:

- Brandon Bay - Inner Brandon Bay - 18
- Cashen River & Estuary - 0
- Castlemaine Harbour & Rossbehy - 24
- Dingle Harbour - 0
- Smerwick Harbour - 4
- Tralee Bay, Lough Gill & Akeragh Lough - 70
- Ventry Harbour - 2

Therefore, as per NRA (2009), a regularly occurring population of 28 birds is required for classification as Nationally Important and of 1 bird for classification as County Importance.

This species was recorded 2 times during the survey period. A flock of 656 and 141 (National Importance) was recorded 5km north of the wind farm study area. As such, there is no regularly occurring population within 5km of the wind farm study area and the proposed development has no potential to result in direct habitat loss, displacement or barrier effects for this species. No pathways for direct or indirect effects exist.. Therefore, grey plover is not considered further in this assessment and the wind farm study area is not of significance to this species.

7.4.1.16 Lapwing

Lapwing is Red Listed with respect to breeding and wintering populations. It is also an SCI of River Shannon and River Fergus Estuaries SPA (located 14.9km north-east of the wind farm study area) and Tralee Bay Complex SPA (located 12.9km from south-west of the wind farm study area). Foraging lapwing favour lowland grasslands away from the coast during winter and, based on survey data, were largely resident (i.e. foraging and roosting) in the wider area around the wind farm study area throughout the winter season. As such, the population around the wind farm study area is unlikely to be associated with these SPAs.

As per the latest national wintering estimates provided in Burke *et al.* (2018), the national wintering population of lapwing in the Republic of Ireland is 69,823. The county population was estimated as the most recent 5-year mean (2013/14-017/18) count at Kerry I-WeBS sites:

- An Trá Beg - 47
- Brandon Bay - Inner Brandon Bay - 0
- Cashen River & Estuary - 539
- Castlemaine Harbour & Rossbehy - 379
- Castlemaine Outer: Inch offshore - 0
- Dingle Harbour - 39
- Lough Leane & Killarney Valley - 0
- Smerwick Harbour - 43
- Tralee Bay, Lough Gill & Akeragh Lough - 208
- Ventry Harbour - 47

Therefore, as per NRA (2009), a regularly occurring population of 698 birds is required for classification as Nationally Important and of 13 birds for classification as County Importance.

This species was recorded 38 times over the survey period. Roosting, foraging and flying was observed in the wind farm study area and wider area during winter and passage season. Flocks up to 500 birds (County Importance) were observed flying within the wind farm study area to a radius of 500m. Flocks of County Importance were also observed in the wider area, further than 500m from the wind farm study area boundary. However, the species is not dependent on the wind farm study area for breeding. Thus, lapwing recorded during surveys in winter and passage season are considered to be a population of **County Importance**.

7.4.1.17 Mallard

Mallard is an SCI of Tralee Bay Complex SPA (located 12.9km from south-west of the wind farm study area). The distance between the SPA and the wind farm study area is greater than the mean foraging range for mallard, 2.5km (Johnson *et al.,* 2014).

As per the latest national wintering estimates provided in Burke *et al.* (2018), the national wintering population of mallard in the Republic of Ireland is 18,810. The county population was estimated as the most recent 5-year mean (2013/14-017/18) count at Kerry I-WeBS sites:

- An Trá Beg - 16
- Brandon Bay - Inner Brandon Bay – 9
- Cashen River & Estuary - 2
- Castlemaine Harbour & Rossbehy - 287
- Castlemaine Outer: Inch offshore - 0
- Dingle Harbour - 33
- Lough Caragh - 0
- Lough Leane & Killarney Valley - 238
- Smerwick Harbour - 17
- Tralee Bay, Lough Gill & Akeragh Lough - 82
- Ventry Harbour - 21

Therefore, as per NRA (2009), a regularly occurring population of 188 birds is required for classification as Nationally Important and of 7 birds for classification as County Importance.

This species was recorded 67 times over the survey period. Flocks up to 55 birds (County Importance) were observed within the wind farm study area to a radius of 500m. Thus, mallard recorded during surveys in winter and passage season are considered to be a population of **County Importance**.

7.4.1.18 Oystercatcher

Oystercatcher is Red Listed with respect to breeding and wintering populations. It is also an SCI of Tralee Bay Complex SPA (located 12.9km from south-west of the wind farm study area). Oystercatcher tends to use estuarine habitats and, based on the locations of records during surveys, it is likely that oystercatcher around the wind farm study area are associated with the nearby Cashen River estuary 5km to the north.

As per the latest national wintering estimates provided in Burke *et al.* (2018), the national wintering population of oystercatcher in the Republic of Ireland is 42,875. The county population was estimated as the most recent 5-year mean (2013/14-017/18) count at Kerry I-WeBS sites:

- An Trá Beg - 21
- Brandon Bay - Inner Brandon Bay - 177
- Cashen River & Estuary - 51
- Castlemaine Harbour & Rossbehy - 646
- Castlemaine Outer: Inch offshore - 15
- Dingle Harbour - 110
- Magharees Islands - 10
- Smerwick Harbour - 78
- Tralee Bay, Lough Gill & Akeragh Lough - 581
- Ventry Harbour - 36

Therefore, as per NRA (2009), a regularly occurring population of 429 birds is required for classification as Nationally Important and of 17 birds for classification as County Importance.

This species was recorded 12 times over the survey period. Flocks up to 5 birds were observed foraging within the wind farm study area to a radius of 500m, while flocks up to 10 birds were observed in the wider area. Observations were occasional and all flocks were below the threshold for County Importance. The species is also not dependent on the wind farm study area for breeding. However, taking a precautionary approach, oystercatcher recorded in the wind farm study area during surveys are considered to be of **Local Importance (Higher Value).**

7.4.1.19 Redshank

Redshank is Red Listed with respect to breeding and wintering populations. It is also an SCI of River Shannon and River Fergus Estuaries SPA (located 14.9km north-east of the wind farm study area) and Tralee Bay Complex SPA (located 12.9km from south-west of the wind farm study area). Redshank tends to use estuarine habitats and, based on the locations of records during surveys, it is likely that redshank around the wind farm study area are associated with the nearby Cashen River estuary 5km to the north.

As per the latest national wintering estimates provided in Burke *et al.* (2018), the national wintering population of redshank in the Republic of Ireland is 16,812. The county population was estimated as the most recent 5-year mean (2013/14-017/18) count at Kerry I-WeBS sites:

- An Trá Beg - 23
- Brandon Bay - Inner Brandon Bay - 41
- Cashen River & Estuary - 37
- Castlemaine Harbour & Rossbehy - 683
- Castlemaine Outer: Inch offshore - 0
- Dingle Harbour - 28
- Smerwick Harbour - 3
- Tralee Bay, Lough Gill & Akeragh Lough - 238
- Ventry Harbour - 9

Therefore, as per NRA (2009), a regularly occurring population of 167 birds is required for classification as Nationally Important and of 11 birds for classification as County Importance.

This species was recorded 18 times over the survey period during the winter and passage season. Flocks up to 29 birds (County Importance) were observed foraging and roosting within the wind farm study area to a radius of 500m, while flocks up to 37 birds (County Importance) were observed in the wider area, including the Cashen River estuary. The species is not dependent on the wind farm study area for breeding. Thus, redshank recorded during surveys are considered to be of **County Importance.**

7.4.1.20 Shoveler

Shoveler is Red Listed with respect to breeding and wintering populations. It is also an SCI of River Shannon and River Fergus Estuaries SPA (located 14.9km north-east of the wind farm study area). The distance from these SPAs to the wind farm study area is significantly greater than the mean foraging range of shoveler, 2.5km (Johnson *et al.,* 2014).

As per the latest national wintering estimates provided in Burke *et al.* (2018), the national wintering population of shoveler in the Republic of Ireland is 1,865. The county population was estimated as the most recent 5-year mean (2013/14-017/18) count at Kerry I-WeBS sites:

- Cashen River & Estuary - 0
- Castlemaine Harbour & Rossbehy - 0
- Lough Leane & Killarney Valley - 3
- Smerwick Harbour - 0
- Tralee Bay, Lough Gill & Akeragh Lough - 2

Therefore, as per NRA (2009), a regularly occurring population of 19 birds is required for classification as Nationally Important and of 1 bird for classification as County Importance.

This species was recorded 1 time over the survey period. A single bird was foraging within 500m of the wind farm study area boundary. As such, there is no regularly occurring population in the area and the proposed development has no potential to result in direct habitat loss, displacement or barrier effects for this species. No pathways for direct or indirect effects exist. The species is also not dependent on the wind farm study area for breeding. Therefore, shoveler is not considered further in this assessment and the wind farm study area is not of significance to this species.

7.4.1.21 Teal

Teal is an SCI of River Shannon and River Fergus Estuaries SPA (located 14.9km north-east of the wind farm study area) and Tralee Bay Complex SPA (located 12.9km from south-west of the wind farm study area). The distance from these SPAs to the wind farm study area is greater than the mean foraging range of teal, 8.4km (Johnson *et al.,* 2014).

As per the latest national wintering estimates provided in Burke *et al.* (2018), the national wintering population of teal in the Republic of Ireland is 27,644. The county population was estimated as the most recent 5-year mean (2013/14-017/18) count at Kerry I-WeBS sites:

- An Trá Beg - 12
- Brandon Bay - Inner Brandon Bay - 0
- Cashen River & Estuary - 30
- Castlemaine Harbour & Rossbehy - 179
- Castlemaine Outer: Inch offshore - 0
- Dingle Harbour - 7
- Lough Caragh - 4
- Lough Leane & Killarney Valley - 191

- Smerwick Harbour - 19
- Tralee Bay, Lough Gill & Akeragh Lough - 144
- Ventry Harbour - 10

Therefore, as per NRA (2009), a regularly occurring population of 276 birds is required for classification as Nationally Important and of 6 birds for classification as County Importance.

This species was recorded 4 times over the survey period. On 3 occasions, flocks of 5 birds or less were observed (below the threshold for County Importance). However, on 1 occasion, a flock of 300 birds were observed within 500m of the wind farm study area boundary. Therefore, taking a precautionary approach, teal recorded during surveys are considered to be of **County Importance.**

7.4.1.22 Wigeon

Wigeon is an SCI of River Shannon and River Fergus Estuaries SPA (located 14.9km north-east of the wind farm study area) and Tralee Bay Complex SPA (located 12.9km from south-west of the wind farm study area). The distance from these SPAs to the wind farm study area is greater than the mean foraging range of wigeon, 2.8km (Johnson *et al..,* 2014).

As per the latest national wintering estimates provided in Burke *et al.* (2018), the national wintering population of wigeon in the Republic of Ireland is 50,452. The county population was estimated as the most recent 5-year mean (2013/14-017/18) count at Kerry I-WeBS sites:

- An Trá Beg - 46
- Brandon Bay - Inner Brandon Bay - 57
- Cashen River & Estuary - 248
- Castlemaine Harbour & Rossbehy - 4338
- Castlemaine Outer: Inch offshore - 0
- Dingle Harbour - 51
- Lough Leane & Killarney Valley - 16
- Smerwick Harbour - 2
- Tralee Bay, Lough Gill & Akeragh Lough - 1601
- Ventry Harbour - 15

Therefore, as per NRA (2009), a regularly occurring population of 504 birds is required for classification as Nationally Important and of 64 birds for classification as County Importance.

This species was recorded 2 times over the survey period. A flock of 200 and 269 (County Importance) was recorded 5km north of the wind farm study area at the Cashen River estuary. As such, there is no regularly occurring population within 500m of the wind farm study area and the proposed development has no potential to result in direct habitat loss, displacement or barrier effects for this species. No pathways for direct or indirect effects exist. The species is also not dependent on the wind farm study area for breeding. Therefore, wigeon is not considered further in this assessment and the wind farm study area is not of significance to this species.

7.4.1.23 Barn Owl

Barn owl is Red Listed with respect to breeding populations and listed on Schedule 4. It is not an SCI of an SPA within 15km of the wind farm study area.

As per NPWS Article 12 Reporting, the national population of breeding barn owl is estimated at 400-500 pairs. From this, a rough estimate of 15 pairs per county can be estimated. Therefore, as per NRA (2009), a regularly occurring population of 5 breeding pairs is required for classification as National Importance and of 1 pair is required for classification as County Importance.

Barn owl was recorded once during the survey period. An individual was observed within 500m of the wind farm study area in February 2020. As outlined in Section 7.3.7.23, the nearby Ratoo tower was considered to provide suitable nesting habitat for this species, however this is no longer the case following its refurbishment. Given the difficulty to observe this nocturnal species, and on a highly precautionary basis, the population was assigned **Local Importance (Higher Value)**.

7.4.1.24 Kestrel

Kestrel is Red Listed with respect to breeding populations and listed on Schedule 4. It is not an SCI of an SPA within 15km of the wind farm study area.

As per Lewis *et al.* (2019), the national population of kestrel is estimated at 13,500 birds. From this, a rough estimate of a minimum 519 birds per county can be estimated. Therefore, as per NRA (2009), a regularly occurring population of 135 birds is required for classification as National Importance and of 5 birds is required for classification as County Importance.

Kestrel was recorded 42 times during the survey period. This species is using the wind farm study area for hunting, with at least 2 separate individuals recorded. A pair were also recorded 4km north-east of the wind farm study area, indicating probable breeding in the wider area. As such, kestrel recorded during surveys are considered to be of **Local Importance (Higher Value)**.

7.4.1.25 Snipe

Snipe is Red Listed with respect to breeding and wintering populations. It is not an SCI of an SPA within 15km of the wind farm study area.

It is important to note that snipe is an elusive species with a secretive nature, therefore national and county populations are difficult to estimate. As per the NPWS Article 12 Reporting, the national breeding population of snipe is 4,275 pairs. With this, a rough population of 164 pairs per county is estimated. Therefore, as per NRA (2009), a regularly occurring population of 43 pairs is required for classification as National Importance and of 2 pairs for classification as County Importance.

This species was recorded 17 times during the survey period. Up to 6 snipe were recorded within the wind farm study area. Drumming (courtship display) was also observed within the wind farm study area, indicating probable breeding. As such, snipe recorded during surveys are considered to be of **County Importance**.

7.4.1.26 Buzzard

Buzzard was recorded 7 times during the survey period. This species was observed in the wind farm study area, with at least 2 separate individuals present. Up to 5 individuals were present in the wider area. However, no breeding activity was recorded.

Buzzard is not an SCI of an SPA within 15km of the wind farm study area and it is not listed on Annex I of the Birds Directive. It is Green Listed with respect to breeding and wintering populations. Therefore, on the basis of a regularly occurring population assessed to be important at the local level, buzzard recorded during surveys are considered to be of **Local Importance (Higher Value)**.

7.4.1.27 Sparrowhawk

Sparrowhawk was recorded 5 times during the survey period. This species was observed in the wind farm study area and wider area; an individual was observed each time. A bird was observed in suitable breeding habitat during the breeding season, 1.8km from the wind farm study area boundary, indicating possible breeding in the wider area.

Sparrowhawk is not an SCI of an SPA within 15km of the wind farm study area and it is not listed on Annex I of the Birds Directive. It is Green Listed with respect to breeding and wintering populations. Therefore, on the basis of a regularly occurring population assessed to be important at the local level, sparrowhawk recorded during surveys are considered to be of **Local Importance (Higher Value)**.

7.4.1.28 Meadow Pipit

Meadow pipit is Red Listed with regard to breeding season populations. The national breeding population is 1,351,995 (Lewis *et al.,* 2019). Meadow pipit was frequently encountered within the wind farm study area and, due to their presence onsite, were deemed to be of **Local Importance (Lower Value)**.

7.4.1.29 Grey Wagtail

Grey wagtail is Red Listed with regard to breeding season populations. The national breeding population is 50,768 (Lewis *et al.,* 2019). Grey wagtail was observed on 1 occasion further than 500m from the wind farm study area boundary and, due to the low frequency of occurrence, are not considered further in this assessment, as the wind farm study area is not of significance to this species.

7.4.2 Identification of Key Ornithological Receptors

Table 7-11 outlines the rationale for including or excluding each target species recorded during field surveys as a KOR. The conservation status, population importance evaluation following NRA (2009) and a detailed explanation for inclusion/exclusion as a KOR is provided. The sensitivity of species included as KORs are then evaluated in the following section.

Table 7-11 Receptor Evaluation and Selection Criteria Rational

Species	Conservation Status	NRA Evaluation	Rationale for inclusion/exclusion as KOR	KOR Yes/No
Bar-tailed godwit	Annex I Birds Directive & Red List & Section 19 Wildlife Acts 1976-2021	**Wintering** No population of ecological significance recorded	This species was not recorded utilising habitats within the wind farm study area for foraging or roosting. It was recorded foraging on the river that forms the wind farm study area boundary on 2 occasions during the extensive suite of surveys, therefore is not considered to be a regularly occurring population. As such, the potential for direct habitat loss and displacement is limited. No flights were recorded over the wind farm study area during surveys, therefore collision risk is unlikely to significantly impact this species. No other pathways for significant effects were identified. In conclusion, there is no evidence to suggest that the development site is of significance to this species.	**No**
Dunlin	Annex I Birds Directive & Red List & Section 19 Wildlife Acts 1976-2021	**Wintering** No population of ecological significance recorded	This species was not recorded utilising habitats within 500m of the wind farm study area for foraging or roosting. Therefore, the proposed development has no potential to result in direct habitat loss, displacement or collision risk and no pathways for significant effects were identified. There is no evidence to suggest that the development site is of significance to this species.	**No**
Golden Plover	Annex I Birds Directive & Red List & Section 19 Wildlife Acts 1976-2021	**Wintering** County Importance	This species was not recorded utilising habitats within the wind farm study area for foraging or roosting. It was recorded roosting on the other side of the river that forms the wind farm study area boundary on 1 occasion during the	**Yes**

Species	Conservation Status	NRA Evaluation	Rationale for inclusion/exclusion as KOR	KOR Yes/No
			extensive suite of surveys. The potential for habitat loss, while minimal, cannot be excluded, therefore an **assessment of direct habitat loss is required** and **potential for displacement exists.** No flights were recorded over the wind farm study area during surveys, therefore collision risk is unlikely to significantly impact this species. A collision risk assessment is not required.	
Hen Harrier	Annex I Birds Directive & Schedule 4 and Section 19 Wildlife Acts 1976-2021	**Wintering** National Importance **Breeding** No population of ecological significance recorded	This species was regularly recorded in the wider area and occasionally in the wind farm study area. The potential for habitat loss, while minimal, cannot be excluded, therefore an **assessment of direct habitat loss is required.** The species was also recorded within the wind farm boundary, therefore the **potential for displacement exists.** Finally, this species was recorded flying over the site within PCH, therefore a **collision risk assessment is required.**	**Yes**
Kingfisher	Annex I Birds Directive & Section 19 Wildlife Acts 1976-2021	**All Seasons** No population of ecological significance recorded	This species was not recorded utilising habitats within 500m of the wind farm study area for foraging. Therefore, the proposed development has no potential to result in direct habitat loss, displacement or collision risk and no pathways for significant effects were identified. There is no evidence to suggest that the development site is of significance to this species.	**No**
Little Egret	Annex I Birds Directive & Section 19 Wildlife Acts 1976-2021	**All Seasons** County Importance	This species was frequently recorded within the wind farm study area, therefore the potential for habitat loss cannot be excluded. As such, an **assessment of direct habitat loss is required** and the **potential for displacement exists.** Finally, this species was recorded flying over the site within PCH, therefore a **collision risk assessment is required.**	**Yes**

Species	Conservation Status	NRA Evaluation	Rationale for inclusion/exclusion as KOR	KOR Yes/No
Peregrine Falcon	Annex I Birds Directive & Schedule 4 and Section 19 Wildlife Acts 1976-2021	**All Seasons** No population of ecological significance recorded	This species was recorded on 2 occasions in the wider area during the extensive suite of surveys. It was not recorded utilising habitats within 500m of the wind farm study area for hunting, roosting or nesting. Therefore, the proposed development is not considered to have the potential to result in direct habitat loss, displacement or collision risk and no pathways for significant effects were identified. There is no evidence to suggest that the development site is of significance to this species.	**No**
Short-eared Owl	Annex I Birds Directive & Schedule 4 and Section 19 Wildlife Acts 1976-2021	**Wintering** No population of ecological significance recorded	This species was recorded on 1 occasion in the wider area during the extensive suite of surveys. It was not recorded utilising habitats within 500m of the wind farm study area for hunting or roosting. Therefore, the proposed development is not considered to have the potential to result in direct habitat loss, displacement or collision risk and no pathways for significant effects were identified. There is no evidence to suggest that the development site is of significance to this species.	**No**
Whooper Swan	Annex I Birds Directive & Section 19 Wildlife Acts 1976-2021	**Wintering** National Importance	This species was frequently recorded within the wind farm study area, therefore the potential for habitat loss cannot be excluded. As such, an **assessment of direct habitat loss is required** and **the potential for displacement exists.** Finally, this species was recorded flying over the site within PCH, therefore a **collision risk assessment is required.**	**Yes**
Black-headed Gull	Section 19 Wildlife Acts 1976-2021	**Wintering** County importance	This species was infrequently recorded flying/feeding within the wind farm study area and within 500m of same during winter months. The potential for habitat loss, while minimal, cannot be excluded. As such, an **assessment of direct habitat loss is required** and **the potential for displacement exists.** Finally, this species was recorded flying over the site within PCH, therefore a **collision risk assessment is required.**	**Yes**

Species	Conservation Status	NRA Evaluation	Rationale for inclusion/exclusion as KOR	KOR Yes/No
Brent Goose	Section 19 Wildlife Acts 1976-2021	**Wintering** No population of ecological significance recorded	This species was infrequently recorded in low numbers within 500m of the wind farm study area and no regularly occurring population was identified. The proposed development is not considered to have the potential to result in direct habitat loss, displacement or collision risk and no pathways for significant effects were identified. There is no evidence to suggest that the development site is of significance to this species.	**No**
Common Gull	Section 19 Wildlife Acts 1976-2021	**Wintering and passage** County importance	This species was frequently recorded within the wind farm study area, therefore the potential for habitat loss cannot be excluded. As such, an **assessment of direct habitat loss is required** and **the potential for displacement exists.** Finally, this species was recorded flying over the site within PCH, therefore a **collision risk assessment is required.**	**Yes**
Cormorant	Section 19 Wildlife Acts 1976-2021	**All Seasons** County Importance	This species was frequently recorded within the wind farm study area, therefore the potential for habitat loss cannot be excluded. As such, an **assessment of direct habitat loss is required.** The species was also recorded within the wind farm boundary, therefore **the potential for displacement exists.** Finally, this species was recorded flying over the site within PCH, therefore a **collision risk assessment is required.**	**Yes**
Curlew	Red List & Section 19 Wildlife Acts 1976-2021	**Wintering and passage** National Importance **Breeding (late summer)** County Importance	This species was frequently recorded within the wind farm study area during the winter and passage season and, to a lesser extent, during the late breeding season. It is utilising the wind farm study area for foraging and roosting. However, no breeding activity was recorded. The potential for habitat loss cannot be excluded. As such, an **assessment of direct habitat loss is required** and the **potential for displacement exists.** Finally, this species was recorded flying over the site within PCH, therefore a **collision risk assessment is required.**	**Yes**

Species	Conservation Status	NRA Evaluation	Rationale for inclusion/exclusion as KOR	KOR Yes/No
Grey Plover	Red List & Section 19 Wildlife Acts 1976-2021	**Wintering** No population of ecological significance recorded	This species was not recorded utilising habitats within the wind farm study area or within 500m of the same for foraging or roosting. The proposed development is not considered to have the potential to result in direct habitat loss, displacement or collision risk and no pathways for significant effects were identified. There is no evidence to suggest that the development site is of significance to this species.	**No**
Lapwing	Red List & Section 19 Wildlife Acts 1976-2021	**Wintering and passage** County Importance	This species was frequently recorded within the wind farm study area during the winter and passage season. It is utilising the wind farm study area for foraging and roosting, therefore the potential for habitat loss cannot be excluded. As such, an **assessment of direct habitat loss is required** and **the potential for displacement exists.** Finally, this species was recorded flying over the site within PCH, therefore a **collision risk assessment is required.**	**Yes**
Mallard	Section 19 Wildlife Acts 1976-2021	**All Seasons** County Importance	This species was frequently recorded within the wind farm study area. It is utilising the wind farm study area for foraging, therefore the potential for habitat loss cannot be excluded. As such, an **assessment of direct habitat loss is required** and **the potential for displacement exists.** Finally, this species was recorded flying over the site within PCH, therefore a **collision risk assessment is required.**	**Yes**
Oystercatcher	Red List & Section 19 Wildlife Acts 1976-2021	**All Seasons** Local Importance (Higher Value)	This species was not recorded within the wind farm study area, therefore the potential for direct habitat loss is limited. However, this species was occasionally recorded within 500m of the wind farm study area in low numbers. Taking a precautionary approach, the **potential for displacement exists.** Because the species was not recorded within the wind farm boundary, a collision risk assessment is not required.	**Yes**

Species	Conservation Status	NRA Evaluation	Rationale for inclusion/exclusion as KOR	KOR Yes/No
Redshank	Red List & Section 19 Wildlife Acts 1976-2021	**Wintering and passage** County Importance	This species was occasionally recorded within the wind farm study area to a 500m radius, utilising the area for foraging and roosting. As such, the potential for habitat loss cannot be excluded and an **assessment of direct habitat loss is required** and **the potential for displacement exists.** However, no flights were recorded at PCH, therefore a collision risk assessment is not required.	**Yes**
Shoveler	Red List & Section 19 Wildlife Acts 1976-2021	**All Seasons** No population of ecological significance recorded	This species was recorded on one occasion during the extensive suite of surveys, therefore is not considered to be a regularly occurring population. As such, the potential for direct habitat loss, displacement and collision risk are limited. No other pathways for significant effects were identified. In conclusion, there is no evidence to suggest that the development site is of significance to this species.	**No**
Teal	Section 19 Wildlife Acts 1976-2021	**Wintering** County Importance	This species was not recorded within the wind farm study area, therefore the potential for direct habitat loss is limited. However, his species was occasionally recorded within 500m of the wind farm study area. Taking a precautionary approach, the **potential for displacement exists.** This species was not recorded flying over the site within PCH, therefore a collision risk assessment is not required.	**Yes**
Wigeon	Section 19 Wildlife Acts 1976-2021	**Wintering** No population of ecological significance recorded	This species was not recorded utilising habitats within the wind farm study area or within 500m of the same for foraging or roosting. The proposed development is not considered to have the potential to result in direct habitat loss, displacement or collision risk and no pathways for significant effects were identified. There is no evidence to suggest that the development site is of significance to this species.	**No**

Species	Conservation Status	NRA Evaluation	Rationale for inclusion/exclusion as KOR	KOR Yes/No
Barn Owl	Red List & Schedule 4 and Section 19 Wildlife Acts 1976-2021	**Wintering** Local Importance (Higher Value) **Breeding** No population of ecological significance recorded	This species was not recorded within the wind farm study area, therefore the potential for direct habitat loss is limited. However, his species was recorded within 500m of the wind farm study area during the winter season. As such, the **potential for displacement exists.** This species was not recorded flying over the site within PCH, therefore a collision risk assessment is not required.	**Yes**
Kestrel	Red List & Schedule 4 and Section 19 Wildlife Acts 1976-2021	**All Seasons** Local Importance (Higher Value)	This species was regularly recorded within the wind farm study area. It is utilising the wind farm study area for hunting, therefore the potential for habitat loss cannot be excluded. As such, an **assessment of direct habitat loss is required** and **the potential for displacement exists.** Finally, this species was recorded flying over the site within PCH, therefore a **collision risk assessment is required.**	**Yes**
Snipe	Red List & Section 19 Wildlife Acts 1976-2021	**All Seasons** County Importance	This species was frequently recorded within the wind farm study area. It is utilising the wind farm study area for foraging and breeding, therefore therefore the potential for habitat loss cannot be excluded. As such, an **assessment of direct habitat loss is required** and **the potential for displacement exists.** Finally, this species was recorded flying over the site within PCH, therefore a **collision risk assessment is required.**	**Yes**
Buzzard	Schedule 4 and Section 19 Wildlife Acts 1976-2021	**All Seasons** Local Importance (Higher Value)	This species was occasionally recorded within the wind farm study area, therefore the potential for habitat loss cannot be excluded. As such, an **assessment of direct habitat loss is required** and **the potential for displacement**	**Yes**

Species	Conservation Status	NRA Evaluation	Rationale for inclusion/exclusion as KOR	KOR Yes/No
			exists. Finally, this species was recorded flying over the site within PCH, therefore a **collision risk assessment is required.**	
Sparrowhawk	Schedule 4 and Section 19 Wildlife Acts 1976-2021	**All Seasons** Local Importance (Higher Value)	This species was occasionally recorded within the wind farm study area, therefore the potential for habitat loss cannot be excluded. As such, an **assessment of direct habitat loss is required** and **the potential for displacement exists.** Finally, this species was recorded flying over the site within PCH, therefore a **collision risk assessment is required.**	**Yes**
Meadow Pipit (Red Listed)	Section 19 Wildlife Acts 1976-2021	**All Seasons** Local Importance (Lower Value)	As per NatureScot guidance, it is generally considered that passerine bird species (including meadow pipit) are not significantly impacted by wind farms due to their ecology.	**No**
Grey Wagtail (Red Listed)	Section 19 Wildlife Acts 1976-2021	**All Seasons** No population of ecological significance recorded	This species was not recorded utilising habitats within 500m of the wind farm study area. Furthermore, as per NatureScot guidance, it is generally considered that passerine bird species (including grey wagtail) are not significantly impacted by wind farms due to their ecology.	**No**

7.4.3 Key Ornithological Receptor Sensitivity Determination

Criteria developed by Percival (2003) for assessing bird sensitivity within the study area is presented in Table 7-3 (Section 7.2.5). The sensitivity of the KORs, as per Percival (2003), are listed below, including the rationale for their respective sensitivity classification.

Very High Sensitivity KORs are:

- Common Gull (SCI of SPAs within foraging range)

High Sensitivity KORs are:

- Hen Harrier (nationally important population)
- Whooper Swan (nationally important population)
- Curlew (nationally important population)

Medium Sensitivity KORs are:

- Golden Plover (Annex I of Birds Directive, BoCCI Red List)
- Little Egret (Annex I Birds Directive)
- Lapwing (BoCCI Red List)
- Oystercatcher (BoCCI Red List)
- Redshank (BoCCI Red List)
- Barn Owl (BoCCI Red List)
- Kestrel (BoCCI Red List)
- Snipe (BoCCI Red List)
- Black-headed Gull (regionally/county important population)
- Cormorant (regionally/county important population)
- Mallard (regionally/county important population)
- Teal (regionally/county important population)

Low Sensitivity KORs are:

- Buzzard
- Sparrowhawk

7.5 Potential Impacts

All elements of the Proposed Development have been considered in assessing impacts on KORs. This section is structured as follows:

- Assessment of 'Do nothing' Effect
- Assessment of impacts in relation to KORs during construction and operation
- Assessment of impacts in relation to KORs during decommissioning
- Assessment of impacts associated with the grid connection route
- Assessment of impacts on designated areas

7.5.1 Do-Nothing Effect

If the proposed development for which this EIAR has been prepared was not to proceed, the site would continue to be managed under the various current management practices. These include turbary activities on the peatland habitats, plantation forestry and agricultural activities (majority dairy farming) in the grassland habitats. It is assumed that the character of the bird community, including the KORs identified, will remain much as it is described in the baseline ornithological conditions.

7.5.2 Effects on Key Ornithological Receptors during Construction and Operation

Table 7-12 – 7-29 describes potential effects on KORs that may occur during the construction and operation of the wind farm. The magnitude and significance of these effects according to Percival (2003) and EPA (2017) are also outlined.

7.5.2.1 Golden Plover (wintering)

Table 7-12 Impact Characterisation for Golden Plover based on Percival (2003) and EPA (2017)

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Construction Phase			
Direct Habitat Loss	This species was recorded roosting within 500m of the wind farm study area boundary on 1 occasion over 2 years of surveys. All other observations were further than 500m from the wind farm study area. No physical loss of habitat will occur in these locations. Given the low number of records within 500m of the wind farm study area, a regularly occurring population is not considered to be dependent on the wind farm study area for roosting or foraging. Furthermore, extensive areas of suitable habitat will remain during construction and there is an abundance of suitable habitats in the surrounding area. Significant effects are not anticipated.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Medium* sensitivity species and *Negligible* impact corresponds to a ***Very Low*** effect significance.	**Likely long-term constant non-significant negative effect**
Displacement & Barrier Effect	Over 2 years of surveys, this species was not observed using habitats within the wind farm study area and was recorded roosting within 500m of the wind farm study area boundary on just 1 occasion. All other observations were further than 500m from the wind farm study area. Given the low number of records within 500m of the wind farm study area, significant displacement and barrier effects are not anticipated.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Medium* sensitivity species and *Negligible* impact corresponds	**Likely short-term frequent non-significant negative effect**

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
		to a ***Very Low*** effect significance	
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	Over 2 years of surveys, this species was not observed using habitats within the wind farm study area and was recorded roosting within 500m of the wind farm study area boundary on just 1 occasion. All other observations were further than 500m from the wind farm study area. Given the low number of records within 500m of the wind farm study area, significant displacement and barrier effects are not anticipated.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Likely long-term constant non-significant negative effect**
Collision	This species was not recorded flying at PCH during the extensive vantage point survey work undertaken. Collision related mortality is not likely to significantly impact this species, based on available data.	**No Effect**	**No Effect**

7.5.2.2 Hen Harrier (wintering)

Table 7-13 Impact Characterisation for Hen Harrier based on Percival (2003) and EPA (2017)

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Construction Phase			
Direct Habitat Loss	Roosting: A regularly used roost site has been identified 1.4km north of the wind farm study area boundary but no roosting was confirmed within 500m of the wind farm study area boundary. As such, there will be no physical loss of roosting habitat. Foraging: This species was recorded hunting within 500m of the wind farm study area on 16 occasions over 2 years of surveys. Extensive areas of suitable foraging habitat will remain during construction and there is an abundance of suitable habitats in the surrounding area. Based on the frequency of hunting hen harrier within 500m of the wind farm study area, a low impact of direct habitat loss is anticipated. No significant effects are anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low.* The cross tablature of a *High* sensitivity species and *Low* impact corresponds to a ***Low*** effect significance.	**Likely long-term constant slight negative effect**
Displacement & Barrier Effect	Roosting: No roosting was recorded within the wind farm study area between April 2019 and March 2021. There is a traditional roost 1.4km north of the wind farm study area boundary. However, no displacement or barrier effect impacts are predicted for this location, based on the 1.4km separation distance. During wind farm construction, displacement has been suggested to potentially occur to 500m around construction works areas, with some impacts occurring up to 1km, depending on the line of visibility (Madders, 2004; Bright *et al.,* 2006). Foraging: In total, there were 16 observations of hen harrier hunting within the proposed development site throughout the 2 years of surveys. Given the frequency with which the proposed development site was visited by this species,	The magnitude of the effect is assessed as *Low.* The cross tablature of a *High* sensitivity species and *Low* impact corresponds to a ***Low*** effect significance	**Likely short-term frequent slight negative effect**

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
	a low displacement and barrier effect is anticipated at the county, national or international scale. A section of 200m of one of the proposed grid connection routes is located within the Stack's to Mullaghareirk Mountains, West Limerick Hills SPA. This is along an existing roadway, therefore is not attractive to hen harrier for roosting or breeding. Significant effects are not anticipated.		
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	Several studies attribute most of the negative effects caused by wind energy developments to the construction phase and the related disturbance and displacement effects (Garvin *et al.,* 2011; Pearce-Higgins *et al.,* 2012; Campedelli *et al.,* 2013; Hull *et al.*, 2013; Stevens *et al.,* 2013). No roosting was recorded within the wind farm study area between April 2019 and March 2021. There is an existing roost 1.4km north of the wind farm study area boundary. However, no displacement or barrier effect impacts are predicted for this location, based on the 1.4km separation distance, as Ruddock and Whitfield (2007) suggest that disturbance related to operating turbines can extend to 500-750m. Pearce-Higgins *et al.* (2009) found that turbine avoidance by hen harriers at a wind farm extended to within 250m of turbines. However, this study found no significant modification in flight height near turbines. In total, there were 16 observations of hen harrier hunting within the proposed development site throughout the two years of surveys. Given the frequency with which the	The magnitude of the effect is assessed as *Low.* The cross tablature of a *High* sensitivity species and *Low* impact corresponds to a ***Low*** effect significance.	**Likely long-term constant slight negative effect**

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
	proposed development site was visited by this species, a low displacement and barrier effect is anticipated during the operational phase. A section of 200m of one of the proposed grid connection routes is located within the Stack's to Mullaghareirk Mountains, West Limerick Hills. This is along an existing roadway, therefore is not attractive to hen harrier for roosting or breeding. Significant effects are not anticipated at the county, national or international scale.		
Collision	The species was recorded flying within PCH during vantage point surveys. A "Random" collision risk analysis has been undertaken (full details provided in Appendix 7-5). The collision risk has been calculated at a ratio of 0.001 collisions per year, or one bird every 913 years. Annual mortality of adult hen harrier has been calculated at 19% per annum (Picazzo, 1984). If 0.001 collisions were to occur per year, it would mean that the losses at the proposed wind farm would increase the annual mortality of the national population (c.269) by 0.002%. The predicted collision risk is negligible. No significant effects are anticipated.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *High* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Likely long-term imperceptible effect**

7.5.2.3 Little Egret (all seasons)

Table 7-14 Impact Characterisation for Little Egret based on Percival (2003) and EPA (2017)

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Construction Phase			
Direct Habitat Loss	This species was regularly recorded commuting and foraging within the wind farm study area, with a maximum count of 2 birds. No evidence of breeding activity was recorded during the comprehensive suite of surveys. Little egret utilise wet areas and water channels for foraging. Direct loss of foraging habitat relative to its availability onsite will be minimal. Furthermore, substantial areas of undisturbed suitable foraging habitat will remain in the surrounding area. Significant effects are not anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low*. The cross tablature of a *Medium* sensitivity species and *Low* impact corresponds to a ***Low*** effect significance.	**Likely long-term constant slight negative effect**
Displacement & Barrier Effect	This species was regularly recorded (in low numbers) foraging within the wind farm study area during the breeding and winter seasons. No evidence of breeding activity was recorded during the comprehensive suite of surveys. Given the low numbers of little egret within the wind farm study area and the abundance of similar suitable foraging habitat for little egret in the surrounding area, a low displacement or barrier effect is anticipated. Significant effects are not anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low*. The cross tablature of a *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance	**Likely short-term frequent slight negative effect**
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Displacement & Barrier Effect	This species was regularly recorded (in low numbers) foraging within the wind farm study area during the breeding and winter seasons. No evidence of breeding activity was recorded during the comprehensive suite of surveys. Given the low numbers of little egret within the wind farm study area and the abundance of similar suitable foraging habitat for little egret in the surrounding area, a low displacement or barrier effect is anticipated. Significant effects are not anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low*. The cross tablature of a *Medium* sensitivity species and *Low* impact corresponds to a ***Low*** effect significance	**Likely long-term constant slight negative effect**
Collision	The species was recorded flying within PCH during vantage point surveys. A "Random" collision risk analysis has been undertaken (full details provided in Appendix 7-5). The collision risk has been calculated at a ratio of 0.07 collisions per year, or one bird every 14 years. Annual mortality of little egret has been calculated at 28.8% per annum (Hafner *et al.,* 1998). If 0.07 collisions were to occur per year, it would mean that the losses at the proposed wind farm would increase the annual mortality of the county population (c.81) by 0.3%. The predicted collision risk is therefore negligible. No significant effects are anticipated.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Likely long-term imperceptible effect**

7.5.2.4 Whooper swan (wintering)

Table 7-15 Impact Characterisation for Whooper Swan based on Percival (2003) and EPA (2017)

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Construction Phase			
Direct Habitat Loss	Whooper swan was regularly recorded foraging and commuting over the wind farm study area and 500m radius. Whooper swan was also recorded foraging and roosting in the wider area, particularly Ballyouneen, which is adjacent to the wind farm study area with flocks up to 265 birds. Based on the two years of data collected both at the wind farm study area and in the wider surroundings, known whooper swan sites within 5km of the wind farm study area (ie. core foraging range) were mapped. Using a combination of swan locations and aerial maps, fields utilised by whooper swan for foraging and roosting were mapped using QGIS. In total, 373ha of land within 5km of the wind farm study area is considered to be regularly used by whooper swan (refer to Appendix 7.7 for further details). Within the wind farm study area, whooper swan foraging activity was not evenly spatially distributed. Foraging flocks ranging from 1-57 birds were recorded on site; the majority of flocks, including the large flocks (>25 birds), were foraging in the vicinity of two proposed turbines, T5 and T7. Physical habitat regularly used by whooper swan that will be lost to the footprint of the proposed development is estimated to be approximately 2.93ha, or 0.7% of the regularly used land in the wider area. The magnitude of this effect is negligible. No significant impacts are anticipated. Furthermore, the turbine layout of the Proposed Development has been specifically designed to avoid direct physical whooper swan habitat loss at their	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *High* sensitivity species and *Negligible* impact corresponds to a ***Very Low*** effect significance.	**Likely long-term constant non-significant negative effect**

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
	key foraging and roost sites at Ballyouneen. Ballyouneen is located to the north-east of the wind farm study area, with the Cashen River separating the swan area from the wind farm study area, and no infrastructure is proposed here.		
Displacement & Barrier Effect	The nearest proposed turbine is located over 750m from key foraging and roosting sites in Ballouneen. The nearest proposed road to be constructed is approximately 500m from Ballyouneen. Displacement in Ballyouneen during construction is expected to be limited due to this separation distance. However, although the wind farm study area is already subject to regular farming and peat extraction activity, there is potential for displacement of foraging whooper swan within the wind farm study area during the construction phase, due to the increased human activity and noise associated with construction works. The magnitude of this effect is assessed as medium.	The magnitude of the effect is assessed as *Medium*. The cross tablature of a *High* sensitivity species and *Medium* Impact corresponds to a ***High*** effect significance.	**Likely short-term frequent moderate negative effect**
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	Percival (2003) states that whooper swan will avoid habitat within 300m of wind turbines. As stated above, the majority of whooper swan foraging within the wind farm study area was within the vicinity of T5 and T7. To estimate the area of suitable regularly used foraging habitat used by whooper swans that is within this disturbance zone, a 300m buffer was applied to T5 and T7 and the area of regularly used whooper swan foraging habitat within was calculated. The area that is expected to become unavailable to foraging whooper swan due to displacement was calculated as 30ha. This amounts to 8% of the total area of regularly used whooper swan foraging habitat within 5km of the wind farm study	The magnitude of the effect is assessed as *Medium*. The cross tablature of a *High* sensitivity species and *Medium* Impact corresponds to a ***High*** effect significance.	**Likely long-term constant moderate negative effect**

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
	area. Please refer to Appendix 7-7 for further details. The magnitude of this effect is assessed as medium. The nearest proposed turbine is (by design) located over 750m from key foraging and roosting sites in Ballouneen. As such, the Proposed Development is not expected to impact the foraging and roosting grounds at Ballyouneen.		
Collision	The species was recorded flying within PCH during vantage point surveys. A "Random" collision risk analysis has been undertaken (full details provided in Appendix 7-5). The collision risk has been calculated at a ratio of 0.3 collisions per year or one bird every 3 years. Because whooper swan were also recorded flying to roost, a "Regular" collision risk analysis has been undertaken (full details provided in Appendix 7-5). The collision risk has been calculated at a ratio of 0.23 collisions per year or one bird every 4 years. Annual mortality of adult whooper swan has been calculated at 20% per annum (Brazil, 2003). If 0.3 or 0.23 collisions were to occur per year, it would mean that the losses at the proposed wind farm would increase the annual mortality of the county population (c.419) by 0.36% and 0.27% respectively. The predicted collision risk is therefore negligible. The actual collision risk is likely to be lower, given the majority of the flights included in the "Regular" collision risk analysis involved birds following/flying along the River Brick at Ballynagare. No turbines are proposed that would overhang this river. Significant effects are not anticipated.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *High* sensitivity species and *Negligible* impact corresponds to a ***Very Low*** effect significance.	**Likely long-term imperceptible effect**

7.5.2.5 Black-headed Gull (wintering)

Table 7-16 Impact Characterisation for Black-headed Gull based on Percival (2003) and EPA (2017)

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Construction Phase			
Direct Habitat Loss	The species was recorded commuting across the proposed development site. The wider landscape contains large areas of agricultural grassland and it is likely that birds were moving between foraging sites. This species was only recorded on 5 occasions utilising habitats within the wind farm study area boundary (the remainder of observations were birds flying over the site). A large proportion of the wind farm study area is dominated by cutover peat that is of limited ecological value for foraging black-headed gull, while suitable habitat is widely available in the surrounding area. As such, significant effects are not anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Likely long-term constant slight negative effect**
Displacement & Barrier Effect	This species was occasionally recorded foraging within the wind farm study area during the winter season. No evidence of breeding activity was recorded during the comprehensive suite of surveys. On a precautionary basis, it is assumed that some temporary displacement may occur around the margins of the site. However, given the extent of similar suitable foraging habitat for black-headed gull in the surrounding area, no significant effects of displacement or barrier effects are anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low.* The cross tablature of a *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance	**Likely short-term frequent slight negative effect**
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Displacement & Barrier Effect	This species was occasionally recorded foraging within the wind farm study area during the winter season. No evidence of breeding activity was recorded during the comprehensive suite of surveys. Given the extent of similar suitable foraging habitat for black-headed gull in the surrounding area, no significant effects of displacement or barrier effects are anticipated. Significant effects are not anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Likely long-term constant slight negative effect**
Collision	The species was recorded flying within PCH during vantage point surveys. A “Random” collision risk analysis has been undertaken (full details provided in Appendix 7-5). The collision risk has been calculated at a ratio of 0.39 collisions per year, or one bird every 3 years. Annual mortality of adult black-headed gull has been calculated at 10% per annum (Prévot-Julliard *et al.,* 1998). If 0.39 collisions were to occur per year, it would mean that the losses at the proposed wind farm would increase the annual mortality of the county population (c. 2,900) by 0.13%. The predicted collision risk is therefore negligible in the context of the county, national and international population. No significant effects are anticipated.	The magnitude of the effect is assessed as *Negligible.* The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Likely long-term imperceptible effect**

7.5.2.6 Common Gull (wintering and passage)

Table 7-17 Impact Characterisation for Common Gull based on Percival (2003) and EPA (2017)

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Construction Phase			
Direct Habitat Loss	The species was recorded once within the wind farm study area boundary. It is not dependent on the wind farm study area for foraging or breeding. Furthermore, suitable habitat for common gull is widely available in the surrounding area. As such, significant effects are not anticipated.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of *Very High* sensitivity species and *Negligible* Impact corresponds to a ***Low*** effect significance.	**Likely long-term constant imperceptible negative effect**
Displacement & Barrier Effect	This species was recorded flying through the wind farm study area once, in winter. Given the very low level of activity within the wind farm study area, no significant effects of displacement or barrier effects are anticipated.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Very High* sensitivity species and *Negligible* Impact corresponds to a ***Low*** effect significance	**Likely short-term frequent imperceptible negative effect**
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	This species was recorded flying through the wind farm study area once, in winter. Given the very low level of activity within the wind farm study area, no significant effects of displacement or barrier effects are anticipated.	The magnitude of the effect is assessed as *Negligible*.	**Likely long-term constant imperceptible negative effect**

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
		The cross tablature of *Very High* sensitivity species and *Negligible* Impact corresponds to a ***Low*** effect significance.	
Collision	The species was recorded flying within PCH during vantage point surveys. A "Random" collision risk analysis has been undertaken (full details provided in Appendix 7-5). The collision risk has been calculated at a ratio of 0.03 collisions per year, or one bird every 34 years. Annual mortality of adult common gull has been calculated at 14% per annum (Buckcicinsqi and Buckcicinsqi, 2003). If 0.03 collisions were to occur per year, it would mean that the losses at the proposed wind farm would increase the annual mortality of the county population (c. 480) by 0.04%. The predicted collision risk is therefore negligible. No significant effects are anticipated.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of *Very High* sensitivity species and *Negligible* Impact corresponds to a ***Low*** effect significance.	**Likely long-term imperceptible effect**

7.5.2.7 Cormorant (all seasons)

Table 7-18 Impact Characterisation for Cormorant based on Percival (2003) and EPA (2017)

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Construction Phase			
Direct Habitat Loss	This species was principally recorded commuting along the river that forms the wind farm study area boundary. However, it is not dependent on the wind farm study area proper for foraging and there are no waterbodies within the development footprint (seasonal flooding may occur). Furthermore, no breeding activity was recorded during the 2 years of surveys. Therefore, significant physical habitat loss effects are not anticipated.	The magnitude of the effect is assessed as *Negligible.* The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Likely long-term constant non-significant negative effect**
Displacement & Barrier Effect	This species was recorded flying along the River Brick that forms the wind farm study area boundary in low numbers (1-2 birds). On a precautionary basis, it is assumed that there may be temporary displacement of cormorant from the watercourse when construction works are taking place nearby. A low effect is anticipated. Construction activity associated with the development has the potential to result in the runoff of silt, nutrients and other pollutants into the River Brick. This gives rise to the potential for an indirect impact on water quality and supporting habitat for cormorant. Following best practice, construction activity will not take place within 50m of a watercourse to avoid the potential for runoff of silt, nutrients and other pollutants into the channel during construction. Significant effects are not anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low.* The cross tablature of a *Medium* sensitivity species and a *Low* Impact corresponds to a ***Low*** effect significance.	**Likely short-term frequent slight negative effect**

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	This species was recorded flying along the river that forms the wind farm study area boundary in small numbers (1-2 birds). There may be temporary displacement of cormorant from the watercourse, however, the birds are expected to habituate to the presence of turbines. Significant effects are not anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low.* The cross tablature of a *Medium* sensitivity species and *Low* impact corresponds to a ***Low*** effect significance.	**Likely long-term constant slight negative effect**
Collision	The species was recorded flying within PCH during vantage point surveys. A “Random” collision risk analysis has been undertaken (full details provided in Appendix 7-5). The collision risk has been calculated at a ratio of 0.05 collisions per year, or one bird every 22 years. Because cormorant were also recorded commuting along the river, a “Regular” collision risk analysis has been undertaken (full details provided in Appendix 7-5). The collision risk has been calculated at a ratio of 0.11 collisions per year, or one bird every 9 years. Annual mortality of adult cormorant has been calculated at 12% per annum (Frederiksen and Bregnballe, 2000). If 0.05 or 0.11 collisions were to occur, it would mean that the losses at the proposed wind farm would increase the annual mortality of the county population (c. 237) by 0.17% or 0.39% respectively. The predicted collision risk is therefore negligible. Significant effects are not anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a M*edium* sensitivity species and *Negligible* impact corresponds to a ***Very Low*** effect significance.	**Likely long-term imperceptible effect**

7.5.2.8 Curlew (all seasons)

Table 7-19 Impact Characterisation for Curlew based on Percival (2003) and EPA (2017)

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Construction Phase			
Direct Habitat Loss	Curlew was observed in the wind farm study area and 500m radius. Birds were recorded travelling over and, to a lesser extent, foraging and roosting. During the winter season, there were 89 records, including 59 above the threshold for County Importance. During the late summer, there were 21 records, including 15 above the threshold for County Importance. No breeding behaviour was observed during the extensive suite of surveys conducted over 2 breeding seasons; curlew recorded during the breeding season were primarily observed in late summer (July to September), therefore are considered to be non-breeding birds. The majority of curlew records in the vicinity of the wind farm study area were concentrated along the River Brick (which forms the site boundary) rather than around the proposed turbines themselves. The river channel habitat will not be reduced as a result of the proposed development and no infrastructure will overhang the river channel. Relatively few of the curlew observations (15 during every survey type over 2 years of surveys) were within other habitat types (agricultural fields and cutover bog) in the wind farm study area. Agricultural fields are extensive in the wider area, and curlew were only recorded flying over cutover bog, rather than utilising it for foraging or roosting. Thus, given that the river channel habitat will not be reduced by the proposed development, a low impact of direct physical habitat loss is anticipated. No significant effects are anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low.* The cross tablature of a *High* sensitivity species and *Low* impact corresponds to a ***Low*** effect significance.	**Likely long-term constant slight negative effect**

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Displacement & Barrier Effect	As stated above, the majority of curlew records in the vicinity of the wind farm study area were concentrated along the River Brick. The nearest proposed turbine is located approximately 150m from the river channel and, following best practise, construction activity will not take place within 50m of a watercourse. This limits the potential for displacement and barrier effects on curlew during the construction phase. This distance also will avoid the potential for runoff of silt, nutrients and other pollutants into the channel during construction that could impact supporting curlew habitat. On a precautionary basis, it is assumed that some temporary displacement of curlew may occur near construction works. However, as effects are expected to be temporary (short-term) and there is abundant similar river channel habitat in the wider area, low displacement and barrier effects are anticipated. No significant effects are anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low.* The cross tablature of a *High* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Likely short-term frequent slight negative effect**
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	Hötker *et al.* (2006) reported a mean disturbance distance from wind turbines of approximately 200m for non-breeding curlew. As stated above, the majority of curlew activity was of birds flying along the River Brick. In comparison, the level of foraging/roosting activity on the River Brick was low. There were just 6 observations of foraging/roosting flocks within 200m of a turbine during all surveys over 2 years. This is a low rate of occurrence given the survey effort. Thus, given the low level of foraging or roosting in the vicinity of the proposed turbines (birds mainly travelled along the river site boundary), a low displacement and barrier effect is anticipated. No significant effects are anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low.* The cross tablature of a *High* sensitivity species and *Low* impact corresponds to a ***Low*** effect significance.	**Likely long-term constant slight negative effect**

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Collision	The species was recorded flying within PCH during vantage point surveys. A "Random" collision risk analysis has been undertaken (full details provided in Appendix 7-5). For the non-breeding/winter season (July to March), the collision risk has been calculated at a ratio of 0.54 collisions per year, or one bird every 1.5 years. Annual mortality of adult curlew has been calculated at 26% per annum (Evans, 1984). If 0.54 collisions were to occur each non-breeding/winter season, it would mean that the losses at the proposed wind farm would increase the annual mortality of the county population (c.900) by 0.23%. The predicted collision risk is therefore negligible in the context of the county population. No significant effects are anticipated.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *High* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Likely long-term slight effect**

7.5.2.9 Lapwing (wintering and passage)

Table 7-20 Impact Characterisation for Lapwing based on Percival (2003) and EPA (2017)

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Construction Phase			
Direct Habitat Loss	This species was occasionally recorded commuting along the river channel that forms the wind farm study area boundary and twice roosting or circling over grassland within the wind farm study area. Given the low frequency of use of grassland within the wind farm study area and the abundance of similar habitat in the surrounding area, significant effects of direct habitat loss are not anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Medium* sensitivity species and *Negligible* impact corresponds to a ***Very Low*** effect significance.	**Likely long-term constant non-significant negative effect**
Displacement & Barrier Effect	As stated above, this species was occasionally recorded commuting along the river channel that forms the wind farm study area boundary and twice roosting or circling over grassland within the wind farm study area. No evidence of breeding activity was recorded during the comprehensive suite of surveys. Given the low frequency records within the wind farm study area and the abundance of suitable habitat in the surrounding area, significant displacement and barrier effects are not anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low*. The cross tablature of a *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance	**Likely short-term frequent non-significant negative effect**
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Displacement & Barrier Effect	As stated above, this species was occasionally recorded commuting along the river channel that forms the wind farm study area boundary and twice roosting or circling over grassland within the wind farm study area, with no evidence of breeding activity. Given the low frequency records within the wind farm study area and the abundance of suitable habitat in the surrounding area, significant displacement and barrier effects are not anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low.* The cross tablature of a *Medium* sensitivity species and *Low* impact corresponds to a ***Low*** effect significance	**Likely long-term constant slight negative effect**
Collision	The species was recorded flying within PCH during vantage point surveys in the winter and passage season. A "Random" collision risk analysis has been undertaken (full details provided in Appendix 7-5). The collision risk has been calculated at a ratio of 1.1 collisions per year, or 1 bird every year. Annual mortality of adult lapwing has been calculated at 29.5% per annum (Peach *et al.*, 1994). If 1.1 collisions were to occur per year, it would mean that the losses at the proposed wind farm would increase the annual mortality of the county population (c.1,300) by 0.29%. The predicted collision risk is therefore negligible. No significant effects are anticipated.	The magnitude of the effect is assessed as *Negligible.* The cross tablature of a *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Likely long-term imperceptible effect**

7.5.2.10 Mallard (all seasons)

Table 7-21 Impact Characterisation for Mallard based on Percival (2003) and EPA (2017)

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Construction Phase			
Direct Habitat Loss	This species was regularly recorded commuting and, to a lesser extent, foraging within the wind farm study area, particularly in agricultural grassland along the River Brick. Mallard preferentially utilise wet areas for foraging and roosting. As such, direct loss of foraging habitat relative to its availability onsite will be minimal. Furthermore, substantial areas of undisturbed agricultural grassland habitat will remain in the surrounding area. Significant effects of direct habitat loss are not anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low*. The cross tablature of a *Medium* sensitivity species and *Low* impact corresponds to a ***Low*** effect significance.	**Likely long-term constant slight negative effect**
Displacement & Barrier Effect	This species was regularly recorded travelling through the wind farm study area and, to a lesser extent, foraging. Given the abundance of similar suitable foraging habitat for mallard in the surrounding area, no significant effects of displacement or barrier effects are anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low*. The cross tablature of a *Medium* sensitivity species and *Low* impact corresponds to a ***Low*** effect significance	**Likely short-term frequent slight negative effect**
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	This species was regularly recorded travelling through the wind farm study area and, to a lesser extent, foraging. Given the abundance of similar suitable	The magnitude of the effect is assessed as *Low*.	**Likely long-term constant slight negative effect**

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
	foraging habitat for mallard in the surrounding area, no significant effects of displacement or barrier effects are anticipated at the county, national or international scale.	The cross tablature of a *Medium* sensitivity species and *Low* impact corresponds to a ***Low*** effect significance	
Collision	The species was recorded flying within PCH during vantage point surveys. A "Random" collision risk analysis has been undertaken (full details provided in Appendix 7-5). The collision risk has been calculated at a ratio of 0.55 collisions per year, or 1 bird every 2 years. Annual mortality of adult mallard has been calculated at an average 32% per annum (range 54%-10%; Gunnarsson *et al.*, 2008). If 0.55 collisions were to occur per year, it would mean that the losses at the proposed wind farm would increase the annual mortality of the county population (c. 700) by 0.25%. The predicted collision risk is therefore negligible. No significant effects are anticipated.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Likely long-term non-significant effect**

7.5.2.11 Oystercatcher (all seasons)

Table 7-22 Impact Characterisation for Oystercatcher based on Percival (2003) and EPA (2017)

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Construction Phase			
Direct Habitat Loss	The species was recorded 5 times on the Cashen River within 500m of the northern wind farm study area boundary, with a maximum count of 5 birds. Given the low number of observations and birds, it is not a regularly occurring population dependent on the wind farm study area for foraging, roosting or breeding. Significant effects are not anticipated.	The magnitude of the effect is assessed as *Negligible.* The cross tablature of a *Medium* sensitivity species and *Negligible* impact corresponds to a ***Very Low*** effect significance.	**Likely long-term constant imperceptible negative effect**
Displacement & Barrier Effect	This species was not recorded within the wind farm study area but was recorded 5 times on the river channel within 500m of the wind farm study area. Given the low frequency of occurrence and that no infrastructure will be located along the river channel, significant effects are not anticipated.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Medium* sensitivity species and *Negligible* impact corresponds to a ***Very Low*** effect significance	**Likely short-term frequent non-significant negative effect**
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Displacement & Barrier Effect	This species was not recorded within the wind farm study area but was recorded 5 times on the river channel within 500m of the wind farm study area. Given the low frequency of occurrence and that no infrastructure will be located along the river channel, significant effects are not anticipated.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Medium* sensitivity species and *Negligible* impact corresponds to a ***Very Low*** effect significance	**Likely long-term constant non-significant negative effect**
Collision	This species was not recorded flying at PCH during the extensive vantage point survey work undertaken. Collision related mortality is not likely to significantly impact this species, based on the results of surveys.	**No Effect**	**No Effect**

7.5.2.12 Redshank (wintering and passage)

Table 7-23 Impact Characterisation for Redshank based on Percival (2003) and EPA (2017)

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Construction Phase			
Direct Habitat Loss	The species was occasionally recorded foraging and roosting along the river channel that forms the wind farm study area boundary. As no development infrastructure is proposed in the river channel, no physical loss of habitat will occur in these locations. Significant effects are not anticipated.	The magnitude of the effect is assessed as *Negligible.* The cross tablature of a *Medium* sensitivity species and *Negligible* impact corresponds to a ***Very Low*** effect significance.	**Likely long-term constant non-significant negative effect**
Displacement & Barrier Effect	This species was recorded 4 times along the river channel that forms the wind farm study area boundary. The nearest turbine is 150m from the watercourse along which this species was recorded. The nearest proposed turbine is located approximately 150m from the river channel and, following best practice, construction activity will not take place within 50m of a watercourse. This limits the potential for displacement and barrier effects on redshank during the construction phase. This distance also will limit the potential for runoff of silt, nutrients and other pollutants into the channel during construction that could impact supporting redshank habitat. On a precautionary basis, it is assumed that some temporary displacement may occur along the river channel near construction works. However, given the low frequency of occurrence and the extent of similar suitable river channel habitat in the surrounding area, no significant effects of displacement or barrier effects are anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low.* The cross tablature of a *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance	**Likely short-term frequent slight negative effect**

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	As stated above, this species was recorded 4 times along the river channel that forms the wind farm study area boundary. Given the low frequency of occurrence and the extent of similar suitable river channel habitat in the surrounding area, no significant effects of displacement or barrier effects are anticipated.	The magnitude of the effect is assessed as *Negligible.* The cross tablature of a *Medium* sensitivity species and *Negligible* impact corresponds to a ***Very Low*** effect significance.	**Likely long-term constant non-significant negative effect**
Collision	This species was not recorded flying at PCH during the extensive vantage point survey work undertaken. Collision related mortality is not likely to significantly impact this species, based on the results of surveys.	**No Effect**	**No Effect**

7.5.2.13 Teal (wintering)

Table 7-24 Impact Characterisation for Teal based on Percival (2003) and EPA (2017)

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Construction Phase			
Direct Habitat Loss	The species was occasionally recorded within 500m of the wind farm study area boundary, including one flock of 500 birds. However, given the low number of observations within 500m of the wind farm study area (3 during every survey type over the 2 year survey period), a regularly occurring population is not considered to be dependent on the wind farm study area for foraging or roosting. Significant effects of direct habitat loss are not anticipated.	The magnitude of the effect is assessed as *Negligible.* The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Likely long-term constant imperceptible negative effect**
Displacement & Barrier Effect	This species was observed 3 times over the 2 year survey period. Given the low frequency of occurrence, no significant effects of displacement or barrier effects are anticipated.	The magnitude of the effect is assessed as *Negligible.* The cross tablature of a *Medium* sensitivity species and *Negligible* impact corresponds to a ***Very Low*** effect significance.	**Likely short-term frequent non-significant negative effect**
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	This species was observed 3 times over the 2 year survey period. Given the low frequency of occurrence, no significant effects of displacement or barrier effects are anticipated.	The magnitude of the effect is assessed as *Negligible.*	**Likely long-term constant non-significant negative effect**

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
		The cross tablature of a *Medium* sensitivity species and *Negligible* impact corresponds to a ***Very Low*** effect significance.	
Collision	This species was not recorded flying at PCH during the extensive vantage point survey work undertaken. Collision related mortality is not likely to significantly impact this species, based on the results of surveys.	**No Effect**	**No Effect**

7.5.2.14 Barn Owl (all seasons)

Table 7-25 Impact Characterisation for Barn Owl based on Percival (2003) and EPA (2017)

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Construction Phase			
Direct Habitat Loss	The species was recorded once, 400m from the wind farm study area boundary, during the 2 year survey period, although it must be noted that the nocturnal nature of this species makes observation difficult. It was observed during the winter season (ie. not breeding), therefore is presumed to have been utilising agricultural grassland habitat near the wind farm study area for hunting. Given the extent of similar agricultural foraging habitat in the wider surroundings and that the majority of the wind farm study area comprises cutover bog, a low impact of direct habitat loss is anticipated. Significant effects are not anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low.* The cross tablature of a *Medium* sensitivity species and *Low* impact corresponds to a ***Low*** effect significance.	**Likely long-term constant slight negative effect**
Displacement & Barrier Effect	A large proportion of the wind farm study area is cutover bog, which is of limited value to hunting barn owl. Furthermore, the agricultural grassland habitat in which the bird was observed is widely available in the surrounding area. As such, significant impacts of displacement and barrier effects are not anticipated. Significant effects are not anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low.* The cross tablature of a *Medium* sensitivity species and *Low* impact corresponds to a ***Low*** effect significance.	**Likely short-term frequent slight negative effect**
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	Barn owl was not observed within the wind farm study area itself. However, McGuinness *et al.* (2015) estimates a zone of sensitivity of 2km for barn owl	The magnitude of the effect is assessed as *Low.*	**Likely long-term constant slight negative effect**

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
	around wind farms. A large proportion of the wind farm study area is cutover bog, which is of limited value to hunting barn owl. Furthermore, the agricultural grassland habitat in which the bird was observed is widely available in the surrounding area. As such, significant impacts of displacement and barrier effects are not anticipated at the county, national or international scale.	The cross tablature of a *Medium* sensitivity species and *Low* impact corresponds to a ***Low*** effect significance.	
Collision	This species was not recorded flying at PCH during the extensive vantage point survey work undertaken. Collision related mortality is not likely to significantly impact this species, based on available data and given the typically low altitude (c. 2m) of hunting flights.	**No Effect**	**No Effect**

7.5.2.15 Kestrel (all seasons)

Table 7-26 Impact Characterisation for Kestrel based on Percival (2003) and EPA (2017)

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Construction Phase			
Direct Habitat Loss	This species was regularly recorded hunting within the wind farm study area. No evidence of breeding activity was recorded during the comprehensive suite of surveys. The proposed infrastructure will be confined to a narrow development footprint, therefore direct loss of hunting habitat relative to its availability onsite will be minimal. Furthermore, substantial areas of undisturbed suitable hunting habitat will remain in the surrounding area. Significant effects are not anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low*. The cross tablature of a *Medium* sensitivity species and *Low* impact corresponds to a ***Low*** effect significance.	**Likely long-term constant slight negative effect**
Displacement & Barrier Effect	This species was regularly recorded hunting within the wind farm study area during the breeding and winter seasons. No evidence of breeding activity was recorded during the comprehensive suite of surveys, including specific breeding raptor surveys. Given the abundance of similar suitable hunting habitat for kestrel in the surrounding area, no significant effects of displacement or barrier effects are anticipated. Significant effects are not anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low*. The cross tablature of a *Medium* sensitivity species and *Low* impact corresponds to a ***Low*** effect significance.	**Likely short-term frequent slight negative effect**
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Displacement & Barrier Effect	This species was regularly recorded hunting within the wind farm study area during the breeding and winter seasons. No evidence of breeding activity was recorded during the comprehensive suite of surveys, including specific breeding raptor surveys. Given the abundance of similar suitable hunting habitat for kestrel in the surrounding area, no significant effects of displacement or barrier effects are anticipated. Significant effects are not anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low*. The cross tablature of a *Medium* sensitivity species and *Low* impact corresponds to a ***Low*** effect significance.	**Likely long-term constant slight negative effect**
Collision	The species was recorded flying within PCH during vantage point surveys. A "Random" collision risk analysis has been undertaken (full details provided in Appendix 7-5). The collision risk has been calculated at a ratio of 0.12 collisions per year, or one bird every 8 years. Annual mortality of adult kestrel has been calculated at an average 35% per annum (range 30%-40%; Orta *et al.*, 2020). If 0.12 collisions were to occur per year, it would mean that the losses at the proposed wind farm would increase the annual mortality of the county population (c.519) by 0.07%. The predicted collision risk is therefore negligible. Significant effects are not anticipated.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Likely long-term imperceptible effect**

7.5.2.16 Snipe (all seasons)

Table 7-27 Impact Characterisation for Snipe based on Percival (2003) and EPA (2017)

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Construction Phase			
Direct Habitat Loss	Snipe were occasionally recorded within the wind farm study area. Breeding displays were also observed (see Appendix 7-4 for details). Snipe were generally observed in grassland areas. A large proportion of the proposed development site is cutover bog, therefore direct loss of foraging and breeding habitat relative to its availability onsite will be minimal. Furthermore, substantial areas of undisturbed suitable grassland habitat will remain post-construction in the surrounding area. Significant direct habitat loss effects are not anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low*. The cross tablature of a *Medium* sensitivity species and *Low* impact corresponds to a ***Low*** effect significance.	**Likely long-term constant slight negative effect**
Displacement & Barrier Effect	This species was occasionally observed within the wind farm study area. However, significant numbers were not recorded (maximum 6 birds). On a precautionary basis, it is assumed that some temporary displacement may occur. Should any displacement or barrier effect occur, there are extensive areas of suitable habitat in the wider area to render this potential impact inconsequential. Significant effects are not anticipated at the county, national or international scale.	The magnitude of the effect is assessed as *Low*. The cross tablature of a *Medium* sensitivity species and *Low* impact corresponds to a ***Low*** effect significance.	**Likely short-term frequent slight negative effect**
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	This species was occasionally observed in low numbers within the wind farm study area. Pearce-Higgins *et al.* (2009) state that breeding snipe avoid habitat	The magnitude of the effect is assessed as *Low*.	**Likely long-term constant slight negative effect**

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
	within 400m of wind turbines. There will therefore be a measurable reduction in the amount of available habitat onsite. However, given the low numbers recorded and the extent of suitable foraging and breeding habitat in the wider area, significant displacement and barrier effects during the operational phase are not anticipated at the county, national or international scale.	The cross tablature of a *Medium* sensitivity species and *Low* impact corresponds to a ***Low*** effect significance.	
Collision	The species was recorded flying within PCH during vantage point surveys during the winter season. A "Random" collision risk analysis has been undertaken (full details provided in Appendix 7-5). The collision risk has been calculated at a ratio of 0.01 collisions per year, or one bird every 92 years. Annual mortality of adult snipe has been calculated at 37.5% per annum (Spence, 1988). If 0.01 collisions were to occur per year, it would mean that the losses at the proposed wind farm would increase the annual mortality of the county population (c.328) by 0.008%. The predicted collision risk is therefore negligible. Significant effects are not anticipated.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Likely long-term imperceptible effect**

7.5.2.17 Buzzard (all seasons)

Table 7-28 Impact Characterisation for Buzzard based on Percival (2003) and EPA (2017)

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Construction Phase			
Direct Habitat Loss	This species was occasionally recorded within the wind farm study area. There was no evidence of breeding activity within the wind farm study area during either the 2019 or 2020 breeding seasons. This low level of activity limits the potential for ecologically significant impacts to result from the wind farm study area. Direct loss of potential foraging habitat to the footprint of the wind farm study area will be minimal. Significant impacts are not anticipated at the county, national or international level.	The magnitude of the effect is assessed as ***Low.*** The cross tablature of a *Low* sensitivity species and *Low* impact corresponds to a ***Very Low*** effect significance.	**Likely long-term constant non-significant negative effect**
Displacement & Barrier Effect	As previously discussed, this species was occasionally recorded within the wind farm study area. There was no evidence of breeding activity within the wind farm study area during either the 2019 or 2020 breeding seasons. Significant effects are not predicted, given the low levels of activity recorded and that extensive areas of suitable hunting habitat will remain post construction. Significant effects are not anticipated at the county, national or international level.	The magnitude of the effect is assessed as ***Low.*** The cross tablature of a *Low* sensitivity species and *Low* impact corresponds to a ***Very Low*** effect significance.	**Likely short-term frequent non-significant negative effect**
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	As previously discussed, this species was occasionally recorded within the wind farm study area. There was no evidence of breeding activity within the wind farm study area during either the 2019 or 2020 breeding seasons. Significant effects are not predicted, given the low levels of activity recorded and that	The magnitude of the effect is assessed as ***Low.***	**Likely long-term constant non-significant negative effect**

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
	extensive areas of suitable hunting habitat will remain post-construction. Significant effects are not anticipated at the county, national or international level.	The cross tablature of a *Low* sensitivity species and *Low* impact corresponds to a ***Very Low*** effect significance.	
Collision	The species was recorded flying within PCH during vantage point surveys during the winter season. A "Random" collision risk analysis has been undertaken (full details provided in Appendix 7-5). The collision risk has been calculated at a ratio of 0.07 collisions per year, or one bird every 15 years. Annual mortality of adult buzzard has been calculated at 10% per annum (Kenward *et al*.,, 2000). If 0.07 collisions were to occur per year, it would mean that the losses at the proposed wind farm would increase the annual mortality of the county population (c.116) by 0.6%. The predicted collision risk is therefore negligible. Significant effects are not anticipated.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Low* Sensitivity species and *Negligible* impact corresponds to a ***Very Low*** effect significance.	**Likely long-term imperceptible effect**

7.5.2.18 Sparrowhawk (all seasons)

Table 7-29 Impact Characterisation for Sparrowhawk based on Percival (2003) and EPA (2017)

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
Construction Phase			
Direct Habitat Loss	This species was occasionally recorded within the wind farm study area. There was no evidence of breeding activity within the wind farm study area during either the 2019 or 2020 breeding seasons. This low level of recorded activity limits the potential for ecologically significant impacts to result from the wind farm study area and direct loss of potential hunting habitat to the footprint of the wind farm study area will be minimal. Significant effects are not anticipated at the county, national or international level.	The magnitude of the effect is assessed as *Low*. The cross tablature of a *Low* sensitivity species and *Low* impact corresponds to a ***Very Low*** effect significance.	**Likely long-term constant non-significant negative effect**
Displacement & Barrier Effect	As previously outlined, this species was occasionally recorded within the wind farm study area. There was no evidence of breeding activity within the wind farm study area during either the 2019 or 2020 breeding seasons. Significant effects are not predicted, given the low levels of activity recorded and that extensive areas of suitable foraging habitat will remain post-construction. Significant effects are not anticipated at the county, national or international level.	The magnitude of the effect is assessed as *Low*. The cross tablature of a *Low* sensitivity species and *Low* impact corresponds to a ***Very Low*** effect significance.	**Likely short-term frequent non-significant negative effect**
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	As previously outlined, this species was occasionally recorded within the wind farm study area. There was no evidence of breeding activity within the wind farm study area during either the 2019 or 2020 breeding seasons. Significant effects are not predicted, given the low levels of activity recorded and that	The magnitude of the effect is assessed as *Low*.	**Likely long-term constant non-significant negative effect**

Analysis of potential effects during construction and operational phases of the Proposed Development		Significance of potential effect (Percival, 2003)	Significance of potential effect (EPA, 2017)
	extensive areas of suitable foraging habitat will remain post-construction. Significant effects are not anticipated at the county, national or international level.	The cross tablature of a *Low* sensitivity species and *Low* impact corresponds to a ***Very Low*** effect significance.	
Collision	The species was recorded flying within PCH during vantage point surveys during the winter season. A "Random" collision risk analysis has been undertaken (full details provided in Appendix 7-5). The collision risk has been calculated at a ratio of 0.02 collisions per year, or one bird every 55 years. The predicted collision risk is insignificant. Annual mortality of adult sparrowhawk has been calculated at 31% per annum (Newton, 1986). If 0.02 collisions were to occur per year, it would mean that the losses at the proposed wind farm would increase the annual mortality of the county population (c.350) by 0.018%. The predicted collision risk is therefore negligible. Significant effects are not anticipated.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Low* Sensitivity species and *Negligible* impact corresponds to a ***Very Low*** effect significance.	**Likely long-term imperceptible effect**

7.5.3 Effects on Key Ornithological Receptors during Decommissioning

Table 7-30 describes potential effects on KORs that may occur during the decommissioning of the wind farm. The magnitude and significance of these effects according to Percival (2003) and EPA (2017) is also outlined.

Table 7–30 Impact Characterisation during decommissioning based on Percival (2003) & EPA (2017)).

Analysis of potential impacts during decommissioning phase of the Proposed Development		Significance of potential effect (Percival 2003)	Significance of potential effect (EPA 2017)
Direct Habitat Loss	Direct or indirect effects are not anticipated	**No Effect**	**No Effect**
Displacement	As above for construction phase for each species listed as a KOR.	As above for the construction phase for each KOR	As above for the construction phase for each KOR

7.5.4 Effect Associated with the Grid Connection and Turbine Delivery Route

The proposed grid connection cable route will commence from the proposed onsite substation and will run along existing roads to either the existing Clahane Substation within the townland of Pallas (Option A; 13.4km) or the existing Triene Substation within the townland of Trieneragh (Option B; 21.12km). As previously discussed, approximately 200m of Option A is located within the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA. Although the grid connection route is partially located within the SPA, it is confined to the existing public road corridor and will not result in the loss of any potential supporting habitat for hen harrier. As per Percival (2003), the magnitude of the effect on hen harrier is assessed as ***Negligible***. The cross tablature of a *High* sensitivity species and *Negligible* impact corresponds to a ***Very Low*** effect significance. As per EPA (2017), the significance of this potential impact is **likely short-term frequent non-significant negative effect**.

The proposed turbine delivery route will require temporary junction accommodation for abnormal loads. Required works are minor and are all located within the existing road corridor (full details in Chapter 4 of this EIAR). Upon completion of the turbine delivery phase, the route delivery temporary accommodation works location will revert back to its existing condition.

For both the grid connection and turbine delivery route, the existing habitats (i.e. existing roads) do not have the potential to support other species of conservation interest in the area. On a precautionary basis, it is assumed that some temporary displacement may occur during works. However, given the extent of suitable habitat in the wider area, significant displacement effects are not predicted. The effect significance for all KORs is classed as no greater than ***Low*** (Percival, 2003) or a **likely short-term slight negative effect** (EPA, 2017).

7.5.5 Effects on Designated Areas

The wind farm study area is not located within the boundaries of any European or Nationally designated sites (see Figure 7-8 and Chapter 6 of this EIAR). In relation to nationally designated sites, no proposed National Heritage Area (pNHA) or National Heritage Area (NHA) within the ZOI were considered as ecological receptors in their own right due to the separation distance from the Proposed Development and the absence of connectivity, and due to the nature of the conservation sites (terrestrial habitats).

In relation to European sites, an Appropriate Assessment screening was prepared to provide the information necessary to complete an Appropriate Assessment for the Proposed Development. The screening for Appropriate Assessment concludes as follows:

"It cannot be excluded beyond reasonable scientific doubt, in view of best scientific knowledge, on the basis of objective information and in light of the conservation objectives of the relevant European sites, that the proposed development, individually or in combination with other plans and projects, would be likely to have a significant effect on the Lower River Shannon SAC [002165], Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA [004161], and Tralee Bay Complex SPA [004188]".

The screening identifies the following European sites as being within the Likely Zone of Impact:

- Lower River Shannon SAC (located immediately adjacent to Proposed Development site).
- Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (located 4.8 km south of the Proposed Development site and adjacent to the grid connection route Option A)
- Tralee Bay Complex SPA (12.9km from south-west of the wind farm study area)

As a result, an Appropriate Assessment of the Proposed Development is required, and a NIS has been prepared in respect of the Proposed Development. The NIS concludes as follows:

"Where the potential for any adverse effect on any European Site has been identified, the pathway by which any such effect may occur has been robustly blocked through the use of avoidance, appropriate design and mitigation measures as set out within this report and its appendices. The measures ensure that the construction and operation of the proposed development does not adversely affect the integrity of European sites. Therefore, it can be objectively concluded that the Proposed Development, individually or in combination with other plans or projects, will not adversely affect the integrity of any European Site".

7.6 Mitigation and Best Practice Measures

This section describes the measures that are in place to mitigate negative effects associated with the Proposed Development on avian receptors. Effects on avian receptors have been addressed in two ways:

- Design of the Proposed Development.
- Management of the development phases.

7.6.1 Mitigation by Design

The project design has followed the basic principles outlined below to avoid the potential for significant effects on avian receptors:

- Hard standing areas have been designed to the minimum size necessary to accommodate the turbine model that is selected.

- The proposed grid connection routes have been selected to utilise built infrastructure for the majority of its length (i.e. cables to be laid within public roads). Cables will be laid underground to avoid effects on roadside hedgerows and disturbance to nesting birds.

- Whooper swan is known to occur in Nationally Important numbers in the vicinity of the Proposed Development. Swans forage on agricultural land along the Cashen River, particularly at Ballyouneen. There is also a historical roost site at Ballyouneen. Please see Appendix 7-8 for details. The turbine layout of the Proposed Development has been specifically designed to minimise impacts to whooper swan in their key foraging and roost sites at Ballyouneen. The nearest proposed turbines are T1 and T2, both located further than 600m from the near boundary of the Cashen River, which is greater than the 600m zone of sensitivity distance to wind farms outlined by McGuinness *et al.* (2015).

- Similarly, by design, a significant separation distance (c. 1.4km) now exists between the identified hen harrier roost and the wind farm study area. Please refer to Confidential Appendix 7-8 for location details.

7.6.2 Mitigation by Management of the Development Phases

The following section describes the mitigation measures to be implemented during each phase of the Proposed Development.

7.6.2.1 Construction Phase

A Construction and Environmental Management Plan (CEMP) has been prepared and will be in place prior to the start of the construction phase. Fulls details of the CEMP are available in Chapter 4 and Appendix 4-4, while details pertinent to birds are summarised below. Note that these measures are proposed as industry best practise rather than to mitigate any identified significant effect.

- The footprint of the Proposed Development will be clearly marked out and fenced off prior to works commencing by a qualitied ecologist. There will be no access to the wider woodland area. All machinery will work from the existing access road corridor. Vegetation removal will be conducted in line with the provisions of the Wildlife Acts 1976-2021

- Works will commence outside the bird nesting season (1st of March to 31st of August inclusive). Any requirement for construction works to run into the subsequent breeding season following commencement will be subject to pre-construction bird surveys to confirm the absence of breeding birds. Construction works along the c. 0.2km section of the proposed cable route within the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (if required) will be undertaken outside the bird breeding season (1st of March to the 31st of August inclusive).
- The removal of woody vegetation will be undertaken in full compliance with Section 40 of the Wildlife Act 1976 – 2021. Where sections of woody vegetation are removed for the purposes of the junction and road upgrades, these will be replaced with suitable hedge/tree species which are common in the local context
- During the construction phase, noise limits, noise control measures, hours of operation (i.e. dusk and dawn is high faunal activity time) and selection of plant items will be considered in relation to disturbance of birds. All plant and equipment for use will comply with the European Communities (Noise Emission By Equipment For Use Outdoors) Regulations, 2001, as amended (SI 632/2001). Plant machinery will also be turned off when not in use.
- Silt fences will be installed as an additional water protection measure around existing watercourses.
- If bird breeding activity of species of conservation concern are identified during the works, the nest sites will be located, and no works shall be undertaken within 500m buffer in line with industry best practise.
- An Environmental Clerk of Works and Project Ecologist will be appointed. Duties will include:

  - Organise the undertaking of a pre-construction walkover bird survey to ensure that significant effects on birds will be avoided.
  - Inform and educate on-site personnel of the ornithological and ecological sensitivities within the wind farm study area.
  - Oversee management of ornithological issues during the construction period and advise on ornithological issues as they arise.
  - Provide guidance to contractors to ensure legal compliance with respect to protected species onsite.
  - Liaise with officers of consenting authorities and other relevant bodies with regular updates in relation to construction progress.

7.6.2.2 Operational Phase

No significant operational phase impacts requiring mitigation were identified.

7.6.2.3 Decommissioning Phase

During the decommissioning phase, disturbance limitation measures will be as per the construction phase described in Section 7.6.2.1.

7.6.3 Whooper Swan Enhancement Plan

As outlined in Section 7.5.2.4, 373ha of land within 5km of the wind farm study area (ie. core foraging range for whooper swan) is considered to be regularly used by foraging whooper swan. Within this area, there is a known roost site at Ballyouneen. The turbine layout of the Proposed Development has been specifically designed to minimise impacts to Ballyouneen by locating the nearest proposed turbines (T1 and T2) further than 600m from the near boundary of the Cashen River, which forms the boundary between the wind farm study area and Ballyouneen. Also outlined in Section 7.5.2.4, the majority of whooper swan foraging activity within the wind farm study area was in the vicinity of two proposed turbines, T5 and T7. The area that is expected to become unavailable to foraging whooper swan as a result of the Proposed Development was calculated as 30ha. This amounts to 8% of the total area of regularly used whooper swan foraging habitat within 5km of the wind farm study area (ie. 8% of 373ha).

Following the significance of effects guidance by Percival (2003), a low effect occurs when 1-5% of habitat is lost to a species. According to this guidance, for a low effect on whooper swans at the Proposed Development site to occur, a maximum of 18ha of suitable foraging habitat could be removed (ie. 5% of the regularly used habitat within 5km of the wind farm study area). However, given that current survey data suggests that whooper swans are expected to be displaced from 30ha of suitable foraging habitat in the vicinity of proposed T5 and T7, mitigation is required for the remaining 12ha of land.

A total of 15.76ha of land is proposed for enhancement as foraging habitat for whooper swan. It comprises two land parcels: one to the north of the wind farm study area, adjacent to Ballyouneen, and one in the southern section of the study area, adjacent to known foraging sites. Both are suitably located, in that they are further than 600m from the nearest turbine, yet close to the existing roost site, therefore will not require excessive commuting distance nore require swans to commute between turbines. The parcels are currently classed as Wet Grassland (GS4) or improved Wet Grassland (GS4), which can be improved for the benefit of foraging whooper swan. Whooper swan were not recorded in these areas at any time during the two winter seasons of the bird survey between October 2019 and March 2021, although they were recorded in adjacent fields. Enhancement measures comprise converting the wet grassland to improved agricultural grassland and ensuring undisturbed foraging habitat will persist throughout the winter season for the lifetime of the wind farm.

A series of management prescriptions to maintain high quality and attractive foraging habitat for whooper swan are proposed. These include maintaining a suitable grazing sward through grazing/cutting/topping and maintaining a high quality green sward through fertilising. Furthermore, potential disturbance such as livestock, will be avoided when the whooper swan are wintering in Ireland (October to March). In addition to the 15.76ha proposed for enhancement, a further 5.26ha of adjacent improved grassland will be included in the management plan to ensure it is available to whooper swan throughout the winter season for the lifetime of the wind farm. Full details are available in the Whooper Swan Enhancement Plan in Appendix 7-7.

Enhancement of the lands should be completed before construction activity commences at the wind farm study area. This will mitigate the impact of disturbance displacement of whooper swans within the wind farm study area during the construction phase. As such, suitable foraging habitat for whooper swan should be fully established on the enhancement lands by the 1st of October prior to construction Year 1.

Given that 15.76ha of land will be enhanced for foraging whooper swan, it is predicted that there will be a net loss of 14.24ha of whooper swan foraging habitat as a result of the proposed development. This is less than 5% of the existing regularly used foraging habitat within foraging range for whooper swan. Following these mitigation measures, the residual impact to whooper swan with respect to indirect habitat loss (during both the construction and operational phase) is assessed as *Low* (impact magnitude: 1-5%) as per Percival (2003). The cross tablature of a *High* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance (Percival, 2003). The significance of the potential effect is assessed as a ***Likley Long-term Constant Slight Negative Effect*** (EPA, 2017).

7.7 Monitoring

The following monitoring measures are proposed as industry best practise rather than in response to any identified impacts associated with the Proposed Development.

7.7.1 Commencement and Construction

Pre-commencement surveys will be undertaken prior to the initiation of works at the wind farm. The survey will include a thorough walkover survey to a 500m radius of the development footprint and all works areas, where access allows. If winter roosting or breeding activity of birds of high conservation concern is identified, the roost or nest site will be located and earmarked for monitoring at the beginning of the first winter or breeding season of the construction phase. If it is found to be active during the construction phase, no works shall be undertaken within a disturbance buffer (Forestry Commission Scotland, 2006; Ruddock and Whitfield, 2007) in line with industry best practise. No works shall be permitted within the buffer until it can be demonstrated that the roost/nest is no longer occupied.

During pre-commencment surveys, the whooper swan enhancement lands will be visited to confirm that there is suitable high quality foraging habitat for swans. The lands should comprise agricultural pasture with a sward height of 30cm or less. There should be no disturbance (including livestock) between the start of October until the migration of the swans in spring. Enhancement lands should be established prior to the commencement of construction activity.

7.7.2 Post Construction

A detailed post-construction Bird Monitoring Programme has been prepared for the operational phase of the proposed development (refer to Appendix 7-6 for further details). The programme of works will monitor parameters associated with collision, displacement/barrier effects and habituation during the lifetime of the project. Surveys will be scheduled to coincide with Years 1, 2, 3, 5, 10 and 15 of the lifetime of the wind farm. Monitoring measures are broadly based on guidelines issued by SNH (2009). The following individual components are proposed:

- Monthly flight activity surveys: vantage point surveys
- Targeted bird collision surveys: corpse searches with trained dogs
- Hen harrier roost monitoring: hen harrier roost surveys
- Whooper swan monitoring: enhancement land site visits and adjacent Ballyouneen I-WeBS site.

7.7.3 Decommissioning

Decommissioning monitoring surveys will be undertaken prior to works associated with decommissioning at the wind farm. The survey will include a thorough walkover survey to a 500m radius of the development footprint and all works areas, where access allows. If winter roosting or breeding activity of birds of high conservation concern is identified, the roost or nest site will be located and earmarked for monitoring at the beginning of the first winter or breeding season of the decommissioning phase. If it is found to be active during the decommissioning phase, no works shall be undertaken within a disturbance buffer (Forestry Commission Scotland, 2006; Ruddock and Whitfield, 2007) in line with industry best practise. No works shall be permitted within the buffer until it can be demonstrated that the roost/nest is no longer occupied.

7.8 Residual Effects

The following species were identified as KORs and were subject to detailed impact assessment:

- Golden Plover (wintering)
- Hen Harrier (wintering)
- Little Egret (all seasons)
- Whooper Swan (wintering)
- Black-headed Gull (wintering)
- Common Gull (wintering and passage)
- Cormorant (all seasons)
- Curlew (all seasons)
- Lapwing (wintering and passage)
- Mallard (all seasons)
- Oystercatcher (all seasons)
- Redshank (wintering and passage)
- Teal (wintering)
- Barn Owl (all seasons)
- Kestrel (all seasons)
- Snipe (all seasons)
- Buzzard (all seasons)
- Sparrowhawk (all seasons)

Following the enhancement measures described in Section 7.6.3, no effect significance greater than ***Low,*** as per Percival (2003) criteria, was identified for any KOR. No effect significance greater than ***Slight,*** as per EPA (2017) criteria, was identified for any KOR. Taking into consideration the effect significance levels identified and the proposed best practice and mitigation, significant residual effects on the KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

7.9 Cumulative Effects

As per NatureScot guidance "Assessing the Cumulative Impacts of onshore Wind Energy Developments" (SNH, 2012), cumulative effects arising from two or more developments may be:

- **Additive** (a multiple independent additive model)
- **Antagonistic** (the sum of impacts are less that in a multiple independent additive model)
- **Synergistic** (the cumulative impact is greater than the sum of the multiple individual effects)

7.9.1 Other Plans and Projects

Assessment material was compiled for relevant developments within the vicinity of the wind farm study area. The material was gathered through a search of relevant online Planning Registers, reviews of relevant EIS/EIAR documents, planning application details and planning drawings. It served to identify past and future plans and projects, their activities and their environmental impacts. These are then considered for in-combination or cumulative effects with the proposed wind farm development. All plans and projects reviewed are outlined below.

7.9.1.1 Plans Considered in the Cumulative Impact Assessment

The following plans were considered in the cumulative impact assessment:

- Kerry County Development Plan 2015 – 2021
- Regional Planning Guidelines for the South – West Region 2010 – 2022
- National Biodiversity Action Plan 2017-2021

7.9.1.2 Projects Considered in the Cumulative Impact Assessment

NatureScot guidance "Assessing the Cumulative Impacts of onshore Wind Energy Developments" (SNH, 2012; 2018) was consulted while undertaking the cumulative assessment. SNH (2012; 2018) emphasises that its priority is to 'maintain the conservation status of the species population at the national level.' However, it is acknowledged that consideration should also be allowed for impacts at the regional level 'where regional impacts have national implications (for example where a specific region holds the majority of the national population)'. A 20km radius of the Proposed Development was considered an appropriate regional scale given the foraging range of the key ornithological receptors identified within the Proposed Development area.

To conduct the cumulative impact assessment, Kerry and Clare County Council online planning registers, relevant EIAR (or historical EIS) documents, planning application details and planning drawings in the vicinity of the proposed wind farm study area and all associated works were reviewed to identify past and future projects, their activities and their environmental impacts. The findings of this review are outlined in the following sections for forestry and agricultural practices, other developments/landuses, and other wind farm developments.

7.9.1.2.2 Forestry and Agricultural Practices

The wider surroundings of the Proposed Development primarily consist of land managed for agriculture in the form of livestock grazing of low ecological value. To the south is the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA. The SPA consists of a variety of upland land uses including grazing, with almost half its area covered in commercial forestry. These landuses have been taken into account in this cumulative assessment.

7.9.1.2.3 Other Developments/Landuses

The review of the Kerry County Council planning register identified relevant general development planning applications in the vicinity of the Proposed Development. Most of these relate to the provision and/or alteration of one-off rural housing and agriculture-related structures, as described in Chapter 2 of the EIAR. Owing to the scale and nature of these developments, significant cumulative impacts are not anticipated.

7.9.1.2.4 Other Wind Farm Developments

Wind farm projects within 20km of the Proposed Development are provided in Table 7-31, including details of their planning status. A total of 208 existing/permitted turbines were identified for consideration. The environmental impacts of each permitted or existing wind farm are outlined in detail in this section.

Table 7-31 Wind Energy Applications within 20km of the Wind Farm Study Area

Wind Farm	County	Planning Status	Number of Turbines
Pallas - Clahane	Kerry	Existing	20
Pallas – Clahane Extension	Kerry	Existing	6
Ballincollig Hill	Kerry	Existing	8
Cloghaneleskirt	Kerry	Permitted	5
Beale Hill	Kerry	Existing	6
Ballylongford	Kerry	Permitted	6
Beenageeha	Kerry	Existing	6
Cloghboola	Kerry	Existing	16
Knocknagoum/ Maghanknockane	Kerry	Existing	15
Tursillagh I	Kerry	Existing	23
Tursillagh II	Kerry	Existing	8
Tylagh	Kerry	Existing	4
Tullahennel South	Kerry	Existing	9
Tullahennel North	Kerry	Existing	2
Larha	Kerry	Existing	2
Curraghderrig	Kerry	Existing	2
Stacks Mountain	Kerry	Existing	4
Dromadda Beg	Kerry	Under Construction	3
Dromadda More	Kerry	Existing	11
Knocknacaheragh	Kerry	Permitted	2

Wind Farm	County	Planning Status	Number of Turbines
Moyvane	Kerry	Existing	2
Muingnaminnan	Kerry	Existing	18
Leanamore	Kerry	Existing	9
Cahercullanagh/Muingnatee	Kerry	Existing	11
Beenanaspuck	Kerry	Existing	3
Kilathmoy-Toberatooreen	Kerry	Existing	4
Aghanamore North	Kerry	Permitted	1
Breahva	Clare	Existing	2

Pallas – Clahane

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside Pallas-Clahane Wind Farm and extension, which is c. 7km from the wind farm study area, was considered. The planning file was reviewed on the Kerry County Council Planning Register and no information regarding potential effects on birds was available. However, given the location of the wind farm, the nature of the habitats onsite (as reviewed on publicly available aerial photography) and the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

Ballincollig Hill

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside Ballingcollig Hill Wind Farm, which is c. 8km from the wind farm study area, was considered. The planning file was reviewed on the Kerry County Council Planning Register. Information relating to birds was limited: the only ecological documentation with the application available online was a document called “Final report on hen harrier fieldwork at the proposed windfarm at Ballincollig Hill, County Kerry”. This was consulted to determine cumulative impacts from the proposed development. It concluded that the development is “unlikely to significantly reduce the amount of available foraging habitat” and “unlikely to cause direct disturbance displacement of breeding hen harriers”. Based on this information, as well as the location of Ballincollig Hill wind farm, the nature of the habitats onsite (as reviewed on publicly available aerial photography) and the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

Cloghaneleskirt

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside Cloghaneleskirt Wind Farm, which is c. 11km from the wind farm study area, was considered. The planning file was reviewed on the Kerry County Council Planning Register and no information regarding potential effects on birds was available. However, given the location of the wind farm, the nature of the habitats onsite (as reviewed on publicly available aerial photography) and the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

Beale Hill

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside Beale Hill Wind Farm, which is c. 13km from the wind farm study area, was considered. The planning file was reviewed on the Kerry County Council Planning Register and no information regarding potential effects on birds was available. However, given the location of the wind farm, the nature of the habitats onsite (as reviewed on publicly available aerial photography) and the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

Ballylongford

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside Ballylongford Wind Farm, which is c. 12km from the wind farm study area, was considered. The planning file was reviewed on the Kerry County Council Planning Register. Regarding habitat loss, the EIAR states that "the design of the project has avoided the more sensitive semi-natural habitats in the area. The main habitat that will suffer direct habitat loss is conifer plantation. This habitat is typically of low value to breeding birds of conservation concern" and that "the loss of cutover bog and raised bog may cause local displacement of species…This displacement may result in a local decline of the species within the site but would not be expected to displace any of these species altogether." It also states that "the loss of habitat may reduce the area of foraging habitat available to hen harrier…and kestrel… although much of the road edge habitat is likely to continue to support suitable prey for kestrel". However, it concludes that "the total extent of habitat loss is small and the affected habitats are present elsewhere in the surrounding area." Roadside habitat is also widely available in the wider area of the Proposed Development. Regarding disturbance and barrier effects during the operational phase, the EIAR concluded that "barrier effects are not foreseen, based on the scale and characteristics of the proposed development and the recorded behaviour patterns of the various bird species recorded." The significance of disturbance and collision impact was "low" or "very low" for all sensitive bird species identified. Based on the information available in the Ballylongford EIAR and the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

Beenageeha

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside Beennageeha Wind Farm, which is c. 11km from the wind farm study area, was considered. The planning file was reviewed on the Kerry County Council Planning Register and no information regarding potential effects on birds was available. However, given the location of the wind farm, the nature of the habitats onsite (as reviewed on publicly available aerial photography) and the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

Cloghboola

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside Cloghboola Wind Farm, which is c. 16km from the wind farm study area, was considered. The planning file was reviewed on the Kerry County Council Planning Register. The EIS concluded that the development will have "no long-term negative impacts on the environment". Potential impacts were discussed with relation to hen harrier and no significant impacts were identified for this species. Based on the information available in the Cloghboola EIS and the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

Knocknagoum/Maghanknockane

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside Knocknagoum/Maghanknockane Wind Farm, which is c. 11km from the wind farm study area, was considered. The planning file was reviewed on the Kerry County Council Planning Register. The EIS concluded that disturbance and displacement may occur for some species, such as hen harrier, but this disturbance will be minimal due to the availability of habitats in the wider area. Based on the information available in the EIS and the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

Tursillagh I and II

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside Tursillagh I and Tursillagh II Wind Farms, which are c. 12km from the wind farm study area, was considered. The planning file was reviewed on the Kerry County Council Planning Register and no information regarding potential effects on birds was available. However, given the location of the wind farms, the nature of the habitats onsite (as reviewed on publicly available aerial photography) and the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

Tylagh and extension

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside Tylagh Wind Farm and extension, which is c. 14km from the wind farm study area, was considered. The planning file was reviewed on the Kerry County Council Planning Register. An ecological report on Flora and Fauna was available. This concluded that “overall, the site is unlikely to be used frequently by the [hen] harriers because improved grassland forms the principal habitat” and that “there will not be a significant negative impact of the development on breeding hen harrier.” An EIS was also available for the extension. This EIS considered hen harrier activity onsite and concluded that “the risk of adult hen harriers colliding with turbines is considered low. In addition, the absence of nest site within 1km of the study area reduces the potential risk to recently fledged birds”. Although the EIS states that “the proposed development may cause displacement of hen harrier from… suitable habitat” which would “contribute to a long term moderate negative impact”, an equivalent area of suitable mitigation habitat to that lost to the wind farm was identified and a habitat management plan devised. Therefore, the residual impacts of the development were deemed to have a “negligible negative impact on the ecological value of the proposed development site.” As such, based on the information available in the Tylagh Flora and Fauna report and extension EIS, along with the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

Tullahennel

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside Tullahennel Wind Farm, was considered. This comprises Tullahennel South, Tullahennel North and Larha wind farms, all located c.11km from the wind farm study area. The planning file was reviewed on the Kerry County Council Planning Register. An Environmental Impact Report was available for Tullahennel North, which foresaw no significant impact of disturbance, collision mortality or habitat loss and/or damage for birds and concluded that, with regard to the likely significant impacts after mitigation measures for flora and fauna, "overall impacts of the proposed construction of two wind turbines in the proposed site may be considered as Minor." An Environmental Report was available for Larha, which stated that "the proposed development will have no long term negative impacts on the local environments provided that all mitigation measures are implemented." Finally, an EIS was available for Tullahennel South, which stated that "it is possible that birds within the site may be displaced from a zone around the turbines for nesting and foraging purposes. However, the effect of possible displacement is unlikely to have a significant impact on the overall population of any species. Furthermore, the displacement area is likely to decrease over time with habituation." Also, it stated that "it is considered that all species which currently occur on site will hold a presence within the site after the construction of the windfarm." It concluded that "providing the recommendations as outlined are followed there will be no significant adverse impacts on the flora and fauna of the site due to the presence of the windfarm." Thus, based on the information available in the Tullahennel South, Tullahennel North and Larha reports, along with the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

Curraghderrig

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside Curraghderrig Wind Farm, which is c. 12km from the wind farm study area, was considered. The planning file was reviewed on the Kerry County Council Planning Register but the environmental report was unavailable. However, given the location of the wind farm, the nature of the habitats onsite (as reviewed on publicly available aerial photography) and the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

Stacks Mountain

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside Stacks Mountain Wind Farm, which is c. 9km from the wind farm study area, was considered. The planning file was reviewed on the Kerry County Council Planning Register. An Environmental Report was available but this did not include information on birds at the site. However, given the location of the wind farm, the nature of the habitats onsite (as reviewed on publicly available aerial photography) and the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

Dromadda Beg

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside Dromadda Beg Wind Farm, which is c. 15km from the wind farm study area, was considered. The planning file was reviewed on the Kerry County Council Planning Register. The EIS stated that the habitats on the site are "used for foraging by hen harrier" but "the only residual impacts of the proposed development on birds will be the loss of minor areas of young forestry plantation and some temporary displacement of foraging hen harriers during construction. The management of the plantation to provide continuous foraging area for hen harrier in the longer term will mitigate any temporary impacts of the construction of the wind farm" The EIS concluded that "following…mitigation measures… there will be no significant impacts of the proposed development on flora and fauna". Further, the (amended) development will result "in significant positive impacts to hen harrier and the integrity of the SPA." Based on this information, along with the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

Dromadda More

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside Dromadda Beg Wind Farm, which is c. 16km from the wind farm study area, was considered. The planning file was reviewed on the Kerry County Council Planning Register. The ecological reports were consulted to determine cumulative impacts from the Proposed Development. The first report written concluded that "the proposed development will not have a significant impact on avifauna". A later EIS stated that impacts on hen harrier and short-eared owl were low or not significant with regards to collision, habitat loss or disturbance. Kestrel and meadow pipit may be disturbed during the construction stage, but this disturbance would be temporary. Based on this information, along with the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

Knocknacaheragh

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside Knocknacaheragh Wind Farm, which is c. 19km from the wind farm study area, was considered. The planning file was reviewed on the Kerry County Council Planning Register and no information regarding potential effects on birds was available. However, given the location of the wind farms, the nature of the habitats onsite (as reviewed on publicly available aerial photography) and the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

Moyvane

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside Moyvane Wind Farm, which is c. 15km from the wind farm study area, was considered. The planning file was reviewed on the Kerry County Council Planning Register. The EIA concluded that development will "result in an overall low residual impact". Furthermore, the effect for both habitat loss and displacement for bird species observed within the development site was predicted to be temporary and not significant due to the widespread availability of suitable alternative habitat in the wider area. Based on this information, along with the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

Muingnaminnan

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside Muingnaminnan Wind Farm, which is c. 15km from the wind farm study area, was considered. The planning file was reviewed on the Kerry County Council Planning Register and no information regarding potential effects on birds was available. However, given the location of the wind farms, the nature of the habitats onsite (as reviewed on publicly available aerial photography) and the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

Leanamore

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside Leanamore Wind Farm, which is c. 17km from the wind farm study area, was considered. The planning file was reviewed on the Kerry County Council Planning Register. The EIS stated that "no significant residual impacts are expected to arise from the construction phase of the proposal", including those associated with hen harrier. Regarding breeding birds and migrating raptors, "there is a low potential risk that local breeding birds could collide with the wind turbines" and there is "a slight risk of collision for migrating raptors". Based on this information, along with the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

Cahercullanagh/Muingnatee

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside Cahercullanagh/Muingnatee Wind Farm, which is c. 16km from the wind farm study area, was considered. The planning file was reviewed on the Kerry County Council Planning Register. The EIS concluded that "whilst the development would cause a small measure of disturbance to all faunal species during the construction phase, all species would be expected to re-colonise the newly developed area at various stages after completion of construction. It is considered that the development would not have any major negative impacts on the fauna of the site." Based on this information, along with the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

Beenanaspuck

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside Beenanaspuck Wind Farm, which is c. 17km from the wind farm study area, was considered. The planning file was reviewed on the Kerry County Council Planning Register. The EIA concluded that "there could be a temporary non-significant disturbance impact on certain birds at the site during the construction phase". Also, "displacement of birds by the presence of turbines is not considered to be a significant effect on the species assemblage" and "there is a very low risk of collision which would be of low significance." Based on this information, along with the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

Kilathmoy-Toberatooreen

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside Kilathmoy-Toberatooreen Wind Farm, which is c. 20km from the wind farm study area, was considered. The planning file was reviewed on the Kerry County Council Planning Register. The EIS outlined that a Hen Harrier Habitat Management Plan was produced to minimise the potential impact of the proposed development on hen harrier within the Stacks to Mullaghareirk Mountain, West Limerick Hills and Mount Eagle SPA. This comprised landowners receiving a payment for implementing measures beneficial to hen harrier on approximately 50.7ha of land within the SPA and the enhancement of other habitats within the development site. The EIA concluded that "there could be a temporary non-significant impact on nesting birds at the construction phase" but "no significant residual impacts are expected to arise from the construction phase of the proposal." Also, "there is a low risk of collision by some species such as hen harrier which would be of a low significance" and "displacement of birds by the presence of turbines is not considered to be a significant effect on the species assemblage." Based on this information, along with the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

Aghanamore North

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside the wind turbine at Aghanamore North, which is c. 5km from the wind farm study area, was considered. The planning file was reviewed on the Kerry County Council Planning Register. An Environmental Report found that "the loss of small areas of [clear-felled conifer plantation] will not adversely affect the conservation status of the surrounding ecological resource. Disturbance to fauna will be short term and will not result in significant impact." Based on this information, along with the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

Breahva

The potential for the Proposed Development to result in significant cumulative or in-combination effects when assessed alongside Breahva Wind Farm, which is c. 20km from the wind farm study area, was considered. The planning file was reviewed on the Clare County Council Planning Register and no information regarding potential effects on birds was available. However, given the location of the wind farms, the nature of the habitats onsite (as reviewed on publicly available aerial photography) and the lack of significant residual impacts on bird species associated with the proposed Ballynagare Wind Farm when considered on its own, significant cumulative or in-combination effects on KORs with regard to direct habitat loss, displacement or collision mortality are not anticipated.

7.9.2 Assessment of Cumulative Effects

There were 18 KORs identified at the Proposed Development: common gull, hen harrier, whooper swan, curlew, golden plover, little egret, lapwing, oystercatcher, redshank, barn owl, kestrel, snipe, black-headed gull, cormorant, mallard, teal, buzzard and sparrowhawk. Following SNH (2012) guidance, the cumulative impact assessment has been carried out at the scale of the importance rating of the receptor: National Importance (hen harrier, whooper swan and curlew); County Importance (common gull, golden plover, little egret, lapwing, redshank, snipe, black-headed gull, cormorant, mallard and teal); and Local Importance Higher Value (oystercatcher, barn owl, kestrel, buzzard and sparrowhawk). Note that for the purposes of the cumulative assessment, the local scale is considered to be a 5km radius of the wind farm study area. There was only one wind farm within 5km of Ballynagare wind farm; the remaining wind farms were between 5-20km of Ballynagare wind farm.

The assessment of cumulative effects on KORs is provided in Table 7-32 below. In particular, cumulative habitat loss and displacement associated with operational turbines is assessed. Short-term impacts (e.g. construction disturbance) are highly unlikely to give rise to significant cumulative impacts, therefore further consideration is not required. For all KORs the predicted rate of collisions (negligible) is sufficiently low that significant cumulative effects can be ruled out. Therefore cumulative collision risk is not considered further for these KORs.

Table 7-32 Assessment of Cumulative Effects on KORs

KOR	Evaluation of Cumulative Impacts	Determination
Hen Harrier (National Importance)	Hen harrier was recorded hunting within 500m of the wind farm study area on 16 occasions over 2 years of surveys. Hen harrier displacement up to 500m from turbines has been recorded (Pearce-Higgins *et al.*, 2009). However, the frequency of occurrence of hen harrier at the wind farm study area is low and the amount of foraging habitat that will be (potentially) subject to disturbance displacement impacts is insignificant relative to the abundance of suitable habitat in the wider surroundings. The potential for other developments to have resulted in significant cumulative or in combination effects when assessed alongside the Proposed Development was considered. Several wind farms within the wider area provide suitable habitat for hen harrier and birds have been recorded using these wind farms (Cloghboola, Ballylongford, Knocknagoum/Maghanknockane, Dromadda More and Leanamore). Breeding hen harrier were also recorded at Ballincollig Hill. However, no significant impacts of the wind farms on this species were identified. Mitigation measures were carried out at other wind farms. At Tylagh, suitable mitigation habitat equivalent to that lost to the wind farm is subject to a habitat management plan for hen harrier. Similarly, at Dromadda Beg, the conifer plantation onsite is managed to provide a continuous foraging area for hen harrier in the long term. Finally, at Kilathmoy-Toberatooreen, approximately 50.7ha of land within the site is managed to benefit hen harrier. Following these measures, no significant impacts on hen harrier were identified at any site. Taking into consideration the reported effects at other wind farms and the predicted effects of the Proposed Development, no residual additive, antagonistic or synergistic effects have been identified with regard to habitat loss or displacement.	Significant cumulative impacts are not predicted.
Whooper Swan (National Importance)	Whooper swan was recorded foraging and roosting in Ballyouneen, which is adjacent to the wind farm study area. Whooper swan were also recorded in lower numbers foraging within the wind farm study area. Whooper swan displacement up to 300m from turbines has been recorded (Percival, 2003). However, because 15.76ha of land will be enhanced for foraging whooper swan as part of the Proposed Development, the net loss of foraging habitat as a result of the Proposed Development will amount to less than 5% of the existing regularly used foraging habitat within foraging range. Following these measures, the residual impact to whooper swan with respect to indirect habitat loss is assessed as low. The whooper swan that	Significant cumulative impacts are not predicted.

KOR	Evaluation of Cumulative Impacts	Determination
	have been recorded to winter at the adjacent Ballyouneen site, show a high degree of site fidelity. As these birds remain at Ballyouneen and its immediate surroundings throughout the winter, significant collision risk at other wind farms is unlikely. Furthermore and as previously discussed, the actual collision risk is likely to be lower than predicted at Ballynagare wind farm, given the majority of the flights included in the "Regular" collision risk analysis involved birds following/flying along the River Brick at Ballynagare. No turbines are proposed that would overhang this river. The potential for other developments to have resulted in significant cumulative or in combination effects when assessed alongside the Proposed Development was considered. No significant impacts on this species were identified for local wind farms (within 5km). No significant effects were reported for any of the wind farms located within a 20km radius of the wind farm study area. Furthermore, the majority of these wind farms are located in the uplands to the southeast of the wind farm study area. Uplands are unlikely to provide optimal foraging habitats for this species. Taking into consideration the reported effects at other wind farms and the predicted effects of the Proposed Development (following enhancement measures), no residual additive, antagonistic or synergistic effects have been identified with regard to habitat loss or displacement.	
Curlew (National Importance)	Curlew were frequently recorded travelling over, roosting and foraging along the wind farm study area boundary, particularly along the River Brick. Displacement of non-breeding curlew up to 200m from turbines has been recorded (Hötker *et al.*, 2006). However, the frequency of occurrence of foraging and roosting birds near the wind farm study area is low (the majority were travelling) and the amount of foraging habitat that will be (potentially) subject to disturbance displacement impacts is insignificant relative to the abundance of suitable habitat in the wider surroundings. The potential for other developments to have resulted in significant cumulative or in combination effects when assessed alongside the Proposed Development was considered. No significant impacts on this species were identified for local wind farms (within 5km). Furthermore, no significant effects were reported for any of the wind farms located within a 20km radius of the wind farm study area.	Significant cumulative impacts are not predicted.

KOR	Evaluation of Cumulative Impacts	Determination
	Taking into consideration the reported effects at other wind farms and the predicted effects of the Proposed Development, no residual additive, antagonistic or synergistic effects have been identified with regard to habitat loss or displacement.	
Common Gull (County Importance)	Common gull was recorded flying through the wind farm study area once, in winter (all other observations were further than 500m from the wind farm study area boundary). Given the very low level of activity within the wind farm study area, no significant effects of displacement or barrier effects are anticipated. The potential for other developments to have resulted in significant cumulative or in combination effects when assessed alongside the Proposed Development was considered. No significant impacts on this species were identified for local wind farms (within 5km). Furthermore, no significant effects were reported for any of the wind farms located within a 20km radius of the wind farm study area. Taking into consideration the reported effects at other wind farms and the predicted effects of the Proposed Development, no residual additive, antagonistic or synergistic effects have been identified with regard to habitat loss or displacement.	Significant cumulative impacts are not predicted.
Golden Plover (County Importance)	Golden plover was recorded roosting within 500m of the wind farm study area boundary on 1 occasion over 2 years of surveys (all other observations were further than 500m from the wind farm study area boundary). Given the very low level of activity within the wind farm study area, no significant effects of displacement or barrier effects are anticipated. The potential for other developments to have resulted in significant cumulative or in combination effects when assessed alongside the Proposed Development was considered. No significant impacts on this species were identified for local wind farms (within 5km). Furthermore, no significant effects were reported for any of the wind farms located within a 20km radius of the wind farm study area. Taking into consideration the reported effects at other wind farms and the predicted effects of the Proposed Development, no residual additive, antagonistic or synergistic effects have been identified with regard to habitat loss or displacement.	Significant cumulative impacts are not predicted.

KOR	Evaluation of Cumulative Impacts	Determination
Little Egret (County Importance)	Little egret was regularly recorded (in low numbers) foraging within the wind farm study area during the breeding and winter seasons. Given the low numbers of little egret within the wind farm study area and the abundance of similar suitable foraging habitat for little egret in the surrounding area, a low displacement or barrier effect is anticipated. The potential for other developments to have resulted in significant cumulative or in combination effects when assessed alongside the Proposed Development was considered. No significant impacts on this species were identified for local wind farms (within 5km). No significant effects were reported for any of the wind farms located within a 20km radius of the wind farm study area. Furthermore, the majority of these wind farms are located in the uplands to the southeast of the wind farm study area. These uplands are unlikely to provide optimal foraging habitats for this species, particularly given they are devoid of significant water bodies. Taking into consideration the reported effects at other wind farms and the predicted effects of the Proposed Development, no residual additive, antagonistic or synergistic effects have been identified with regard to habitat loss or displacement.	Significant cumulative impacts are not predicted.
Lapwing (County Importance)	Lapwing was occasionally recorded commuting along the river channel that forms the wind farm study area boundary and twice roosting or circling over grassland within the wind farm study area. Given the low frequency records within the wind farm study area and the abundance of suitable habitat in the surrounding area, significant displacement and barrier effects are not predicted. The potential for other developments to have resulted in significant cumulative or in combination effects when assessed alongside the Proposed Development was considered. No significant impacts on this species were identified for local wind farms (within 5km). Furthermore, no significant effects were reported for any of the wind farms located within a 20km radius of the wind farm study area. Taking into consideration the reported effects at other wind farms and the predicted effects of the Proposed Development, no residual additive, antagonistic or synergistic effects have been identified with regard to habitat loss or displacement.	Significant cumulative impacts are not predicted.

KOR	Evaluation of Cumulative Impacts	Determination
Redshank (County Importance)	Redshank was recorded 4 times along the river channel that forms the wind farm study area boundary. Given the low frequency of occurrence and the extent of similar suitable river channel habitat in the surrounding area, no significant effects of displacement or barrier effects are anticipated. The potential for other developments to have resulted in significant cumulative or in combination effects when assessed alongside the Proposed Development was considered. No significant impacts on this species were identified for local wind farms (within 5km). No significant effects were reported for any of the wind farms located within a 20km radius of the wind farm study area. Furthermore, the majority of these wind farms are located in the uplands to the southeast of the wind farm study area. These uplands are unlikely to provide optimal foraging habitats for this species, particularly given they are devoid of significant water bodies. Taking into consideration the reported effects at other wind farms and the predicted effects of the Proposed Development, no residual additive, antagonistic or synergistic effects have been identified with regard to habitat loss or displacement.	Significant cumulative impacts are not predicted.
Snipe (County Importance)	Snipe was occasionally observed in low numbers within the wind farm study area, including some breeding displays. Pearce-Higgins et al. (2009) state that breeding snipe avoid habitat within 400m of wind turbines. However, given the low numbers recorded and the extent of suitable foraging and breeding habitat in the wider area, significant displacement and barrier effects are not predicted. The potential for other developments to have resulted in significant cumulative or in combination effects when assessed alongside the Proposed Development was considered. No significant impacts on this species were identified for local wind farms (within 5km). Furthermore, no significant effects were reported for any of the wind farms located within a 20km radius of the wind farm study area. Taking into consideration the reported effects at other wind farms and the predicted effects of the Proposed Development, no residual additive, antagonistic or synergistic effects have been identified with regard to habitat loss or displacement.	Significant cumulative impacts are not predicted.

KOR	Evaluation of Cumulative Impacts	Determination
Black-headed Gull (County Importance)	Black-headed gull was recorded commuting across the proposed development site, likely moving between agricultural grassland foraging sites in the wider area. This species was only recorded on 5 occasions utilising habitats within the wind farm study area boundary (the remainder of observations were birds flying over the site). A large proportion of the wind farm study area is dominated by cutover peat that is of limited ecological value for foraging black-headed gull, while suitable habitat is widely available in the surrounding area. As such, significant effects are not anticipated. The potential for other developments to have resulted in significant cumulative or in combination effects when assessed alongside the Proposed Development was considered. No significant impacts on this species were identified for local wind farms (within 5km). No significant effects were reported for any of the wind farms located within a 20km radius of the wind farm study area. Furthermore, the majority of these wind farms are located in the uplands to the southeast of the wind farm study area. These uplands are unlikely to provide optimal foraging habitats for this species, particularly given they are devoid of significant water bodies. Taking into consideration the reported effects at other wind farms and the predicted effects of the Proposed Development, no residual additive, antagonistic or synergistic effects have been identified with regard to habitat loss or displacement.	Significant cumulative impacts are not predicted.
Cormorant (County Importance)	This species was principally recorded commuting along the river that forms the wind farm study area boundary, but is not dependent on the wind farm study area proper for foraging. A large proportion of the wind farm study area is dominated by cutover peat that is of limited ecological value for cormorant. The potential for other developments to have resulted in significant cumulative or in combination effects when assessed alongside the Proposed Development was considered. No significant impacts on this species were identified for local wind farms (within 5km). No significant effects were reported for any of the wind farms located within a 20km radius of the wind farm study area. Furthermore, the majority of these wind farms are located in the uplands to the southeast of the wind farm study area. These uplands are unlikely to provide optimal foraging habitats for this species, particularly given they are devoid of significant water bodies.	Significant cumulative impacts are not predicted.

KOR	Evaluation of Cumulative Impacts	Determination
	Taking into consideration the reported effects at other wind farms (or predicted effects if pre-construction) and the predicted effects of the Proposed Development, no residual additive, antagonistic or synergistic effects have been identified with regard to habitat loss or displacement.	
Mallard (County Importance)	Mallard was regularly recorded commuting and, to a lesser extent, foraging within the wind farm study area, particularly in agricultural grassland along the River Brick. However, mallard preferentially utilise wet areas for foraging and roosting, therefore loss of foraging habitat relative to its availability onsite will be minimal. Furthermore, substantial areas of undisturbed agricultural grassland habitat will remain in the surrounding area. As such, no significant effects of displacement or barrier effects are anticipated. The potential for other developments to have resulted in significant cumulative or in combination effects when assessed alongside the Proposed Development was considered. No significant impacts on this species were identified for local wind farms (within 5km). Furthermore, no significant effects were reported for any of the wind farms located within a 20km radius of the wind farm study area. Taking into consideration the reported effects at other wind farms and the predicted effects of the Proposed Development, no residual additive, antagonistic or synergistic effects have been identified with regard to habitat loss or displacement.	Significant cumulative impacts are not predicted.
Teal (County Importance)	This species was observed 3 times over the 2 year survey period. Given the low frequency of occurrence, no significant effects of displacement or barrier effects are anticipated. The potential for other developments to have resulted in significant cumulative or in combination effects when assessed alongside the Proposed Development was considered. No significant impacts on this species were identified for local wind farms (within 5km). Furthermore, no significant effects were reported for any of the wind farms located within a 20km radius of the wind farm study area. Taking into consideration the reported effects at other wind farms and the predicted effects of the Proposed Development, no residual additive, antagonistic or synergistic effects have been identified with regard to habitat loss or displacement.	Significant cumulative impacts are not predicted.

KOR	Evaluation of Cumulative Impacts	Determination
Oystercatcher (Local Importance Higher Value)	Oystercatcher was recorded 5 times on the river channel within 500m of the wind farm study area. It is likely that these birds are associated with the Cashen River estuary, 5km north of the wind farm study area. Given the low frequency of occurance and separation from the wind farm study area, significant effects are not anticipated. The potential for other developments to have resulted in significant cumulative or in combination effects when assessed alongside the Proposed Development was considered. No significant impacts on this species were identified for local wind farms (within 5km). No significant effects were reported for any of the wind farms located within a 20km radius of the wind farm study area. Furthermore, the majority of these wind farms are located in the uplands to the southeast of the wind farm study area. These uplands are unlikely to provide optimal foraging habitats for this species, particularly given they are devoid of significant water bodies. Taking into consideration the reported effects at other wind farms and the predicted effects of the Proposed Development, no residual additive, antagonistic or synergistic effects have been identified with regard to habitat loss or displacement.	Significant cumulative impacts are not predicted.
Barn Owl (Local Importance Higher Value)	Barn owl was recorded once, in agricultural grassland 400m from the wind farm study area boundary, during the 2 year survey period. A large proportion of the wind farm study area is cutover bog, which is of limited value to hunting barn owl. Furthermore, the agricultural grassland habitat in which the bird was observed is widely available in the surrounding area. As such, significant impacts of displacement and barrier effects are not anticipated. The potential for other developments to have resulted in significant cumulative or in combination effects when assessed alongside the Proposed Development was considered. No significant impacts on this species were identified for local wind farms (within 5km). Furthermore, no significant effects were reported for any of the wind farms located within a 20km radius of the wind farm study area.	Significant cumulative impacts are not predicted.

KOR	Evaluation of Cumulative Impacts	Determination
	Taking into consideration the reported effects at other wind farms and the predicted effects of the Proposed Development, no residual additive, antagonistic or synergistic effects have been identified with regard to habitat loss or displacement.	
Kestrel (Local Importance Higher Value)	Kestrel was regularly recorded hunting within the wind farm study area. Direct loss of hunting habitat relative to its availability onsite will be minimal. Furthermore, substantial areas of undisturbed suitable hunting habitat will remain in the surrounding area. Significant effects of habitat loss or displacement are not predicted. The potential for other developments to have resulted in significant cumulative or in combination effects when assessed alongside the Proposed Development was considered. No significant impacts on this species were identified for local wind farms within 5km. Ballylongford wind farm (c. 12km from the wind farm study area) provides suitable habitat for kestrel and birds have been recorded in these habitats. However, the loss of foraging habitat for kestrel was considered to be small and the affected habitats are abundant in the surrounding area. No significant residual impacs were identified. Taking into consideration the reported effects at other wind farms and the predicted effects of the Proposed Development, no residual additive, antagonistic or synergistic effects have been identified with regard to habitat loss or displacement.	Significant cumulative impacts are not predicted.
Buzzard (Local Importance Higher Value)	Buzzard was occasionally recorded within the wind farm study area. Direct loss of hunting habitat relative to its availability onsite will be minimal. Due to the low level of activity and minimal hunting habitat loss, significant effects of habitat loss or displacement are not predicted. The potential for other developments to have resulted in significant cumulative or in combination effects when assessed alongside the Proposed Development was considered. No significant impacts on this species were identified for local wind farms (within 5km). Furthermore, no significant effects were reported for any of the wind farms located within a 20km radius of the wind farm study area.	Significant cumulative impacts are not predicted.

KOR	Evaluation of Cumulative Impacts	Determination
	Taking into consideration the reported effects at other wind farms and the predicted effects of the Proposed Development, no residual additive, antagonistic or synergistic effects have been identified with regard to habitat loss or displacement.	
Sparrowhawk (Local Importance Higher Value)	Sparrowhawk was occasionally recorded within the wind farm study area. Direct loss of hunting habitat relative to its availability onsite will be minimal. Due to the low level of activity and minimal hunting habitat loss, significant effects of habitat loss or displacement are not predicted. The potential for other developments to have resulted in significant cumulative or in combination effects when assessed alongside the Proposed Development was considered. No significant impacts on this species were identified for local wind farms (within 5km). Furthermore, no significant effects were reported for any of the wind farms located within a 20km radius of the wind farm study area. Taking into consideration the reported effects at other wind farms and the predicted effects of the Proposed Development, no residual additive, antagonistic or synergistic effects have been identified with regard to habitat loss or displacement.	Significant cumulative impacts are not predicted.

7.10 Conclusion

Following consideration of the residual effects (post-mitigation), it is concluded that the Proposed Development will not result in any significant effects on any of the identified KORs. No significant effects on receptors of International, National or County Importance were identified. Provided that the Proposed Development is constructed, operated and decommissioned in accordance with the design, best practice mitigation and enhancement measures that are described within this application, significant individual or cumulative effects on the identified KORs are not anticipated.

8. LAND SOILS AND GEOLOGY

8.1 Introduction

8.1.1 Background and Objectives

Hydro-Environmental Services (HES) was engaged by MKO Ireland (MKO) to carry out an assessment of the potential impacts of the proposed Ballynagare Wind Farm, Co. Kerry. The proposed wind farm site is located approximately 2km north of Lixnaw village, 3.7km southeast of Ballyduff and 9.6km west of Listowel. The proposed development is situated in the townlands of Ballynagare, Dysert and Dysert Marshes.

The proposed wind farm development comprises 7 no. turbines and associated hardstands, site access tracks, upgrades to existing roads, 1 no. on-site electrical substation, 1 no. borrow pit, 2 no. temporary construction compounds, 2 no. temporary peat repositories, underground cable works and all associated drainage infrastructure. The development also includes a proposed grid route connection between the proposed on-site substation and the 110kV substation at Clahane.

This chapter provides a baseline assessment of the environmental setting of the proposed Ballynagare Wind Farm development and the grid connection routes in terms of land, soils and geology and discusses the potential effects that the construction and operation of the proposed development will have. Where required, appropriate mitigation measures to limit any identified significant impacts to land, soils and geology are recommended.

8.1.2 Statement of Authority

Hydro-Environmental Services (HES) are a specialist geological, hydrological, hydrogeological and environmental practice which delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core areas of expertise and experience includes soils, subsoils and geology. We routinely complete impact assessments for land, soils and geology, hydrology and hydrogeology for a large variety of project types including wind farms and renewable energy projects.

This chapter of the EIAR was prepared by Michael Gill, Adam Keegan and Conor McGettigan.

Michael Gill P. Geo (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 18 years' environmental consultancy experience in Ireland. Michael has completed numerous land, soils and geology impact assessments of wind farms and renewable projects in Ireland. In addition, he has substantial experience in surface water drainage design and SUDs design and surface water/groundwater interactions. For example, Michael has worked on the EIS/EIAR for Oweninny WF, Cloncreen WF, and Yellow River WF, and over 100 other wind farm related projects across the country.

Adam Keegan (BSc, MSc) is a hydrogeologist with two years' of experience in the environmental sector in Ireland. Adam has been involved in Environmental Impact Assessment Reports (EIARs) for numerous projects including wind farms, grid connections, quarries and small housing developments. Adam holds an MSc in Hydrogeology and Water Resource Management. Adam has worked on several wind farm EIAR projects, including Croagh WF, Lyrenacarriga WF (SID), Cleanrath WF, Carrownagowan WF (SID), and Fossy WF.

Conor McGettigan (BSc, MSc) is a recent graduate, holding an M.Sc. in Applied Environmental Science (2020) from University College Dublin, graduating with a First-Class Honours degree. Conor has also completed a B.Sc. in Geology (2016) from University College Dublin (First Class Honours). In recent times Conor has assisted in the preparation of the land, soils and geology chapters for several wind farm developments.

8.1.3 Scoping and Consultation

The scope for this assessment has been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties as summarised in Section 2.6 of Chapter 2 of the EIAR. Consultation responses relating to the land, soils and geological environment were received from the Geological Survey of Ireland and the Health Services Executive. Details of these scoping responses and actions taken to address them are outlined in Section 2.6.2 of this EIAR.

8.1.4 Relevant Legislation

The EIAR is prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive') as amended by Directive 2014/52/EU.

Regard has also been taken of the requirements of the following legislation:

- Planning and Development Acts, 2000-2021;
- Planning and Development Regulations, 2001 (as amended);
- Directives 2011/92/EU and 2014/52/EU on the assessment of the effects of certain public and private projects on the environment, including Circular Letter PL 1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive);
- S.I. No. 296 of 2018 European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018;
- European Communities (Environmental Impact Assessment) Regulations 1989 to 2017; and,
- S.I. No. 4 of 1995: The Heritage Act 1995, as amended.

8.1.5 Relevant Guidance

The land, soils and geology chapter of this EIAR was prepared having regard to guidance contained in the following documents:

- Environmental Protection Agency (2017): Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports;
- Environmental Protection Agency (2015): Draft - Advice Notes on Current Practice (in the preparation of Environmental Impact Statements);
- Environmental Protection Agency (2015): Draft – Revised Guidelines on the Information to be contained in Environmental Impact Statements;
- Environmental Protection Agency (2003): Advice Notes on Current Practice (in the Preparation of Environmental Impact Statements);
- Environmental Protection Agency (2002): Guidelines on the information to be contained in Environmental Impact Statements;
- Institute of Geologists Ireland (2013): Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements;
- National Roads Authority (2008); Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Wind Farm Development Guidelines for Planning Authorities (2006);
- COFOR (2004) Forest Road Manual – Guidelines for the Design, Construction and Management of Forest Roads;

- Good Practice During Wind Farm Construction (Scottish Natural Heritage, 2010);
- PPG1 – General Guide to Prevention of Pollution (UK Guidance Note); and,
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, 2018).

8.2 Assessment Methodology

8.2.1 Desk Study

A desk study of the proposed wind farm site was completed in advance of undertaking the walkover surveys and site investigation works. The desk study involved collecting all the relevant geological data for the proposed 7 no. turbine wind farm development and the proposed grid route. This included consultation with the following:

- Environmental Protection Agency soils and subsoils mapping (www.epa.ie);
- Geological Survey of Ireland – Geological databases (www.gsi.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 17 - Geology of the Shannon Estuary (GSI, 1999);
- Geological Survey of Ireland – 1:25,000 Field Mapping Sheets; and,
- General Soil Map of Ireland 2nd Edition (www.epa.ie).

8.2.2 Baseline Monitoring and Site Investigations

Geological mapping and a detailed walkover survey within the proposed wind farm site was undertaken by HES on 1st July 2021. In addition, geotechnical ground investigations were undertaken by HES (July 2021) and Gavin and Doherty Geosolutions (GDG), and a peat stability assessment was also undertaken by GDG.

In summary, site investigations to address the soil and geology section of the EIAR included the following:

- A total of over 180 no. peat probe depths were carried out by GDG and HES to determine the depth and geomorphology of the peat at the Ballynagare wind farm site;
- A total of 11 no. shear vane tests were carried out by GDG to determine to strength and stability of the peat at the Ballynagare Wind Farm site; and,
- Mineral subsoils and peat were logged according to BS: 5930 and Von Post Scale respectively.

The data presented and reviewed in this chapter incorporates site investigations conducted by HES and GDG with regard to the baseline environment.

8.2.3 Impact Assessment Methodology

Using information from the desk study and data from the site investigations, an assessment of the importance of the soil and geological environment within the study area and proposed site is assessed using the criteria set out in Table 8-1 (NRA, 2008).

Table 8-1 Estimation of Importance of Soil and Geology Criteria (NRA, 2008).

Importance	Criteria	Typical Example
Very High	Attribute has a high quality, significance or value on a regional or national scale. Degree or extent of soil contamination is significant on a national or regional scale. Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale.	Geological feature rare on a regional or national scale (NHA). Large existing quarry or pit. Proven economically extractable mineral resource.
High	Attribute has a high quality, significance or value on a local scale. Degree or extent of soil contamination is significant on a local scale. Volume of peat and/or soft organic soil underlying site is significant on a local scale.	Contaminated soil on site with previous heavy industrial usage. Large recent landfill site for mixed wastes. Geological feature of high value on a local scale (County Geological Site). Well drained and/or highly fertility soils. Moderately sized existing quarry or pit Marginally economic extractable mineral resource.
Medium	Attribute has a medium quality, significance or value on a local scale. Degree or extent of soil contamination is moderate on a local scale. Volume of peat and/or soft organic soil underlying site is moderate on a local scale.	Contaminated soil on site with previous light industrial usage. Small recent landfill site for mixed wastes. Moderately drained and/or moderate fertility soils. Small existing quarry or pit. Sub-economic extractable mineral resource.
Low	Attribute has a low quality, significance or value on a local scale. Degree or extent of soil contamination is minor on a local scale. Volume of peat and/or soft organic soil underlying site is small on a local scale.	Large historical and/or recent site for construction and demolition wastes. Small historical and/or recent landfill site for construction and demolition wastes. Poorly drained and/or low fertility soils. Uneconomically extractable mineral resource.

The guideline criteria (EPA, 2017) for the assessment of likely significant effects require that likely effects are described with respect to their extent, magnitude, type (i.e. negative, positive or neutral) probability, duration, frequency, reversibility, and transfrontier nature (if applicable). The descriptors used in this environmental impact assessment report are those set out in the EPA (2017) *Glossary of Impacts* as shown in Chapter 1 of this EIAR. In addition, the two impact characteristics proximity and probability are described for each impact and these are defined in Table 8-2.

In order to provide an understanding of this descriptive system in terms of the geological/hydrological environment, elements of this system of description of effects are related to examples of potential likely significant effects on the geology and morphology of the existing environment, as listed in Table 8-3.

Table 8-2: Additional Impact Characteristics.

Impact Characteristic	Degree/ Nature	Description
Proximity	Direct	An impact which occurs within the area of the proposed project, as a direct result of the proposed project.
	Indirect	An impact which is caused by the interaction of effects, or by off-site developments.
Probability	Low	A low likelihood of occurrence of the impact.
	Medium	A medium likelihood of occurrence of the impact.
	High	A high likelihood of occurrence of the impact.

Table 8-3: Impact descriptors related to the receiving environment.

Impact Characteristics		Potential Hydrological Impacts
Quality	Significance	
Negative only	Profound	Widespread permanent impact on: › The extent or morphology of a cSAC. › Regionally important aquifers. › Extent of floodplains. Mitigation measures are unlikely to remove such impacts.
Positive or Negative	Significant	Local or widespread time-dependent impacts on: › The extent or morphology of a cSAC /NHA/ ecologically important area. › A regionally important hydrogeological feature (or widespread effects to minor hydrogeological features). › Extent of floodplains. Widespread permanent impacts on the extent or morphology of an NHA/ecologically important area. Mitigation measures (to design) will reduce but not completely remove the impact – residual impacts will occur.
Positive or Negative	Moderate	Local time-dependent impacts on: › The extent or morphology of a cSAC / NHA / ecologically important area. › A minor hydrogeological feature. › Extent of floodplains. Mitigation measures can mitigate the impact OR residual impacts occur, but these are consistent with existing or emerging trends.

Impact Characteristics		Potential Hydrological Impacts
Quality	Significance	
Positive, Negative or Neutral	Slight	Local perceptible time-dependent impacts not requiring mitigation.
Neutral	Imperceptible	No impacts, or impacts which are beneath levels of perception, within normal bounds of variation, or within the bounds of measurement or forecasting error.

8.3 Existing Environment

8.3.1 Site Description and Topography

8.3.1.1 Wind Farm Site

The proposed Ballynagare wind farm site ("the site") is located approximately 500m northeast of Lixnaw village, 3.7km southeast of the village of Ballyduff and 8.3 km southwest of Listowel, Co. Kerry. The site has a total area of approximately 594 hectares and is located in the townlands of Ballynagare, Dysert Marshes Dysert.

Much of the centre of the site is located on a peat bog which has historically been subject to peat harvesting. Narrow peat fields are orientated southwest to northeast towards the south of the bog area, and northwest to southeast in the north. The bog basin is surrounded by agricultural grasslands on all sides. Much of the east and south of the site comprises agricultural lands with fields separated by hedgerows and drains with occasional farmhouses located within the site boundary.

Topography at the site is generally flat and low-lying with ground elevations ranging from 0-5m OD (metres above Ordnance Datum). The site is located in the Tralee Bay Feale Catchment and is bordered by the Brick river to the west and the River Feale to the east. These two watercourses confluence to the north of the site, forming the Cashen River Estuary. The Lower River Shannon SAC is located immediately to the west, north and east of the site while the Cashen River Estuary pNHA is also located to the northeast of the site along the upper tidal reaches of the Feale River. Flood embankments have been installed along the Brick and Feale Rivers in the vicinity of the site.

Access to the site is via a local Ballynagare to Clahane road which dissects the southwest of the site before crossing the Brick River. The bog area of the site is accessible by various access tracks, which are used to facilitate ongoing peat harvesting. These tracks branch off the local road and criss-cross the bog area. The agricultural areas in the south of the site are accessed via access tracks from a farmyard. An existing quarry is located immediately to the south of the site, with a local road linking the quarry to the R557.

8.3.1.2 Grid Connection Route

The proposed underground connection route to Clahane 110kV substation is approximately 13.8km in length. The route travels from the existing local road which serves the quarry, before veering northwards along the R557 for 2.7km where it turns to the southeast in the townland of Ballyhorgan East. The route then travels south along tertiary roads for 5.5km before turning west on the L1027 for 0.35km. The route then turns to the south in the townland of Lissahane, where it continues for 1.1km. The route joins the L6074 for 0.4km to Banemore Cross where it joins the N69. It then continues southwest for 0.45km before turning to the south along the entrance to Clahane substation. The topography of the route is relatively flat along public road networks with a notable increase in slope before it joins the L6074. There are a total of 5 no. watercourse crossings along this proposed grid connection route.

8.3.2 Land and Landuse

8.3.2.1 Wind Farm Site

Corine land cover maps (2018) show that the site is located largely on peat bogs in the north and agricultural pastures in the west, south and east. Land use in the wider area is predominantly agricultural pastures with areas of peat bogs, coniferous forestry and transitional woodland scrub. The closest mapped urban centres are the villages of Lixnaw and Ballyduff to the south and northwest respectively.

Historic Corine land cover maps were consulted to investigate how land cover has changed historically at the site and in the surrounding lands. Since 1990, the north of the site has been consistently mapped as peat bogs with the exception of the 2006 Corine land cover map which records a small area of transitional woodland scrub within the current bog area. The 1990 Corine land cover map records the presence of a peat bog to the southwest of the site which later has a change of land use to coniferous forestry (2006 Corine land cover map). Land cover in the surrounding land has otherwise been almost continuously mapped as agricultural pastures since 1990 with the exception of land to the west of the Brick River which was recorded as having significant areas of natural vegetation in the 2000 Corine Land Cover Map.

Recent aerial photographs and site walkovers verified the current land use at the site comprises agricultural lands in the west and south of the site and a peat bog towards the centre and in the north. The site is crosscut by a series of small local roads and tracks which serve the peat bog and the numerous rural dwellings located in the surrounding lands. Historic maps show that the local Ballynagare to Clahane county road which dissects the site, was constructed between 1842 and 1888. Text on the Historic Map 6 inch (1837 – 1842) indicates that the land in the north of the site is liable to flood. Recent aerial photographs and site visits confirmed that land use in the surrounding lands is largely agriculture with a scattered pattern of residential dwellings along local roads to the south and east of the site.

In terms of key wind farm infrastructures, 2 no. turbines (T5 and T7), both construction compounds, the substation and the borrow pit are located on agricultural pastures. The remaining 5 no. turbines (T1, T2, T3, T4 and T6) are mapped within the peat bog. Meanwhile both proposed peat repositories are located on agricultural pastures. Site investigation data (see below) show T5 is located on peat also, so it appears this area at T5 has been improved for agricultural purposes.

Comparison of land cover/land use and mapped soils/subsoils (refer to Section 8.3.3.1) indicates that the agricultural land in the west of the site, in the vicinity of T5, was formerly part of the peat bog but has been reclaimed for agricultural purposes.

8.3.2.2 Grid Connection Route

According to the Corine land cover maps, the grid connection route is mapped to run through predominantly farmland consisting of agricultural pastures with a scattered pattern of rural dwellings along the local roads. The grid route also passes through approximately 1km of peat bogs on local roads between the townlands of Ballyhorgan East and Lissahane.

8.3.3 Peat/Soils and Subsoils

8.3.3.1 Wind Farm Site

The published soils maps (www.epa.ie) show that cutaway peat (Cut) is mapped as the topsoil across the north of the site. On the northern and western boundaries of the site, extensive areas of mineral alluvium (AlluvMin) are mapped along Feale and Brick Rivers. Further south, the EPA record areas of poorly drained mineral soils with peaty topsoil (AminPDT), acid deep poorly drained mineral soils (AminPD) and basic shallow poorly drained mineral soils.

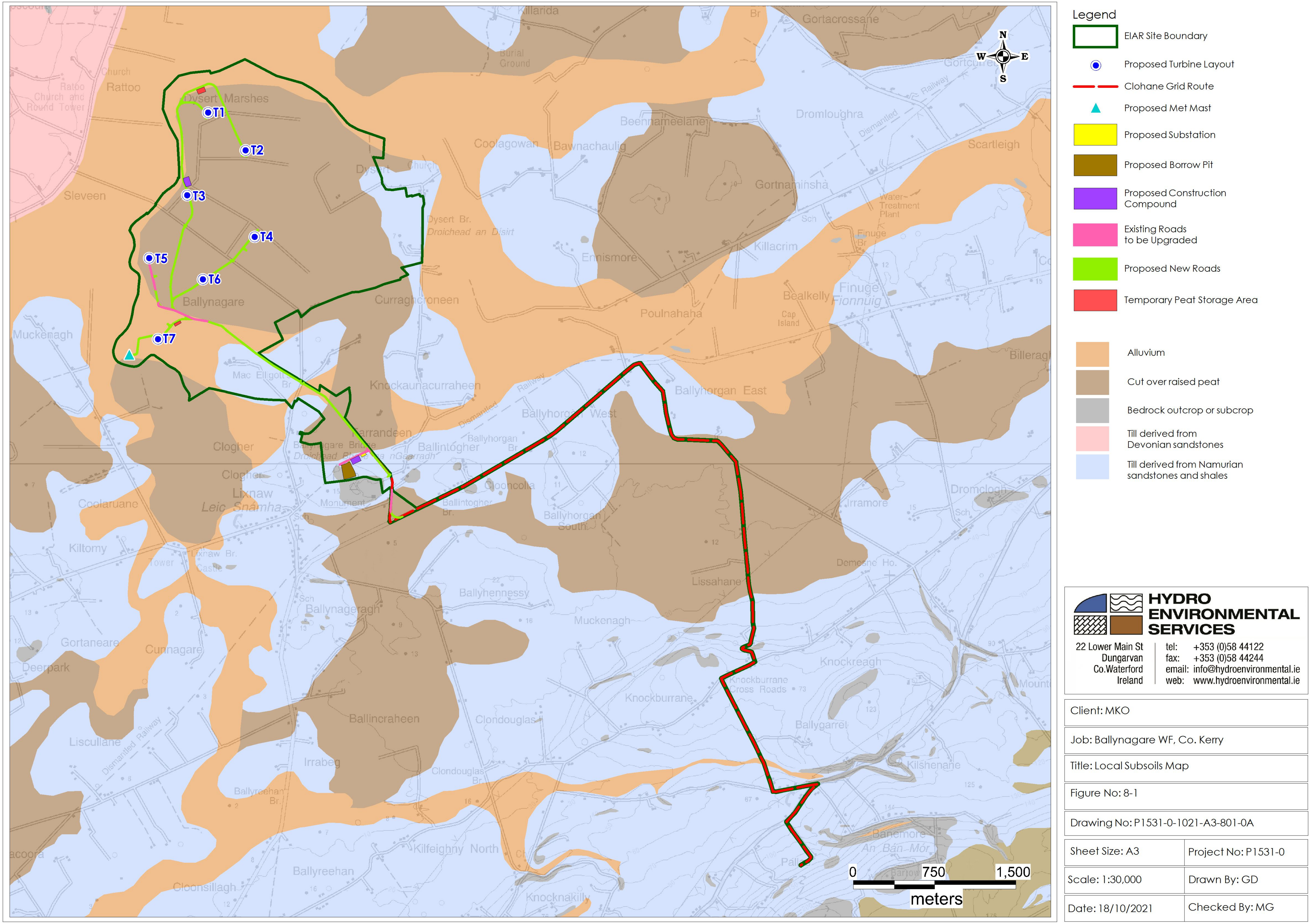
In terms of key wind farm infrastructure, 6 no. turbines (T1, T2, T3, T4, T5 and T6), the northern construction compound and the southern peat repository are mapped on peat. Meanwhile T7, the met mast and the northern peat repository are located on mineral alluvium in the vicinity of the Brick River. Further south the substation, the borrow pit and the southern construction compound are mapped on acid deep poorly drained mineral soils. Soils in the surrounding lands are generally the same as that recorded within the wind farm site but with widespread alluvium cover in lands adjacent the Brick and Feale Rivers and along the Cashen River Estuary.

The published subsoil maps (www.gsi.ie) for the site show that it is underlain largely by cut over raised peat (Cut) with alluvium (A) mapped in the west and pockets of till derived from Namurian sandstones and shales in the south. In terms of key wind farm infrastructure, 6 no. turbines are mapped on cut over raised peat while T7 in the west of the site is mapped on alluvium. To the south the substation, borrow pit and the southern construction compound are mapped to be underlain by tills derived from Namurian sandstones and shales. Subsoils in the surrounding lands include till derived from Namurian sandstones and shales, cutover peat and widespread alluvium deposition along local watercourses. Further west the GSI maps a large area of till derived from Devonian sandstones (TDSs). A subsoil map is shown as Figure 8-1.

The presence of subsoil peat on site has been confirmed by intrusive site investigation conducted by Gavin & Doherty Geosolutions (GDG) on the 24th - 26th November 2020 and on the 9th - 10th March 2021. HES conducted further peat probing investigations at key infrastructure locations on the 01st July 2021. A combined total of 180 no. peat probes (HES and GDG) were conducted at the site during these site investigations. Overall peat depths ranged from 0 to 6.3m (refer to Plate 8-1 for peat depth distribution plat) with an average of 2.6m. A peat depth map produced by GDG is included in the Peat and overburden management plan attached as Appendix 8-1.

Consistent with the GSI subsoils map, all proposed turbine locations are underlain by peat with the exception of T7 in the southwest of the site. Average peat depths at the other 6 no. turbine locations ranged from 3.4 to 4.8m. Mineral subsoils underlying the peat generally comprised grey silty clay which was noted to be gravelly in places. Shown on

Table 8-4 below is a summary of the peat depths and mineral subsoils encountered at the proposed locations of key wind farm infrastructures.



Legend
EIAR Site Boundary
Proposed Turbine Layout
Clohane Grid Route
Proposed Met Mast
Proposed Substation
Proposed Borrow Pit
Proposed Construction Compound
Existing Roads to be Upgraded
Proposed New Roads
Temporary Peat Storage Area
Alluvium
Cut over raised peat
Bedrock outcrop or subcrop
Till derived from Devonian sandstones
Till derived from Namurian sandstones and shales
T1
T2
T3
T4
T5
T6
T7
N
S
E
W
0
750
1,500
meters
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Job: Ballynagare WF, Co. Kerry
Title: Local Subsoils Map
Figure No: 8-1
Drawing No: P1531-0-1021-A3-801-0A
Sheet Size: A3
Project No: P1531-0
Scale: 1:30,000
Drawn By: GD
Date: 18/10/2021
Checked By: MG

Plate 8-1: Peat depth frequency across the proposed Ballynagare Wind Farm Site.

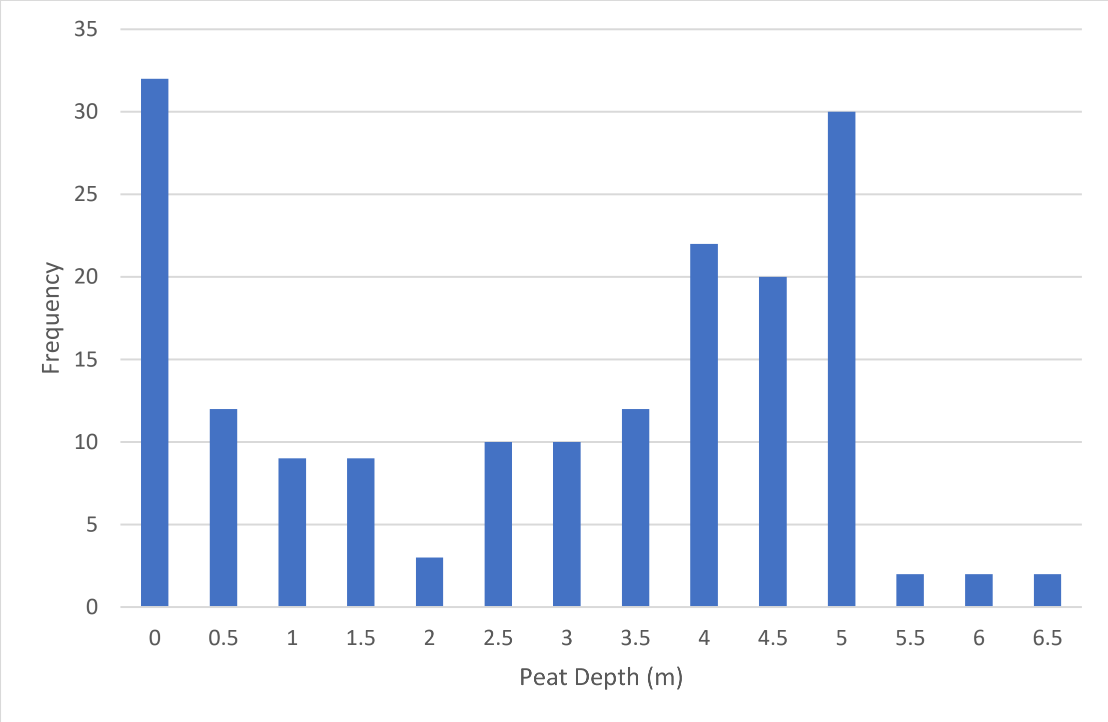


Table 8-4: Summary of Peat Depths and Subsoil Lithology at Proposed Development Locations

Infrastructure Location	Average Peat Depth (m) (From GDG and HES data)	Summary of Underlying Mineral Subsoil Lithology
T1	4.83	Grey silty clay
T2	4.36	Grey silty clay
T3	4.78	Grey gravelly clay
T4	3.85	No returns, gravelly texture
T5	3.86	No returns
T6	3.40	Grey gravelly clay
T7	0	-
Met Mast	3.83	-
Substation	0	-
Borrow Pit	0	-
Construction Compound (north)	4.05	-
Construction Compound (south)	0	-

8.3.3.2 Grid Connection Route

The published soils map (www.epa.ie) for the area shows that acid deep poorly drained mineral soils (AminPD) and cutover peat (Cut) dominate the northern section of the grid route. While the southern section of the grid route is also dominated by acid deep poorly drained soils, the EPA also map small pockets of acid shallow poorly drained mineral soils (AminSP) and mineral alluvium (AlluvMin) along Knockburrane River. Soils in the vicinity of Clahane 110kV substation are mapped as acid deep well drained mineral soils (AminDW).

The published subsoils map (www.gsi.ie) for the area shows that grid route is underlain largely by till derived from Namurian sandstones and shales (TNSSs). Cut over raised peat (Cut) is mapped to the east of Lixnaw village and along small local roads running from the townland of Ballyhorgan East to Lissahane. Other subsoils mapped along the grid route include small pockets of bedrock outcrop (Rck) and alluvium (A) along the Knockburrane River just north of Banemore Cross.

8.3.4 Bedrock Geology

8.3.4.1 Wind Farm Site

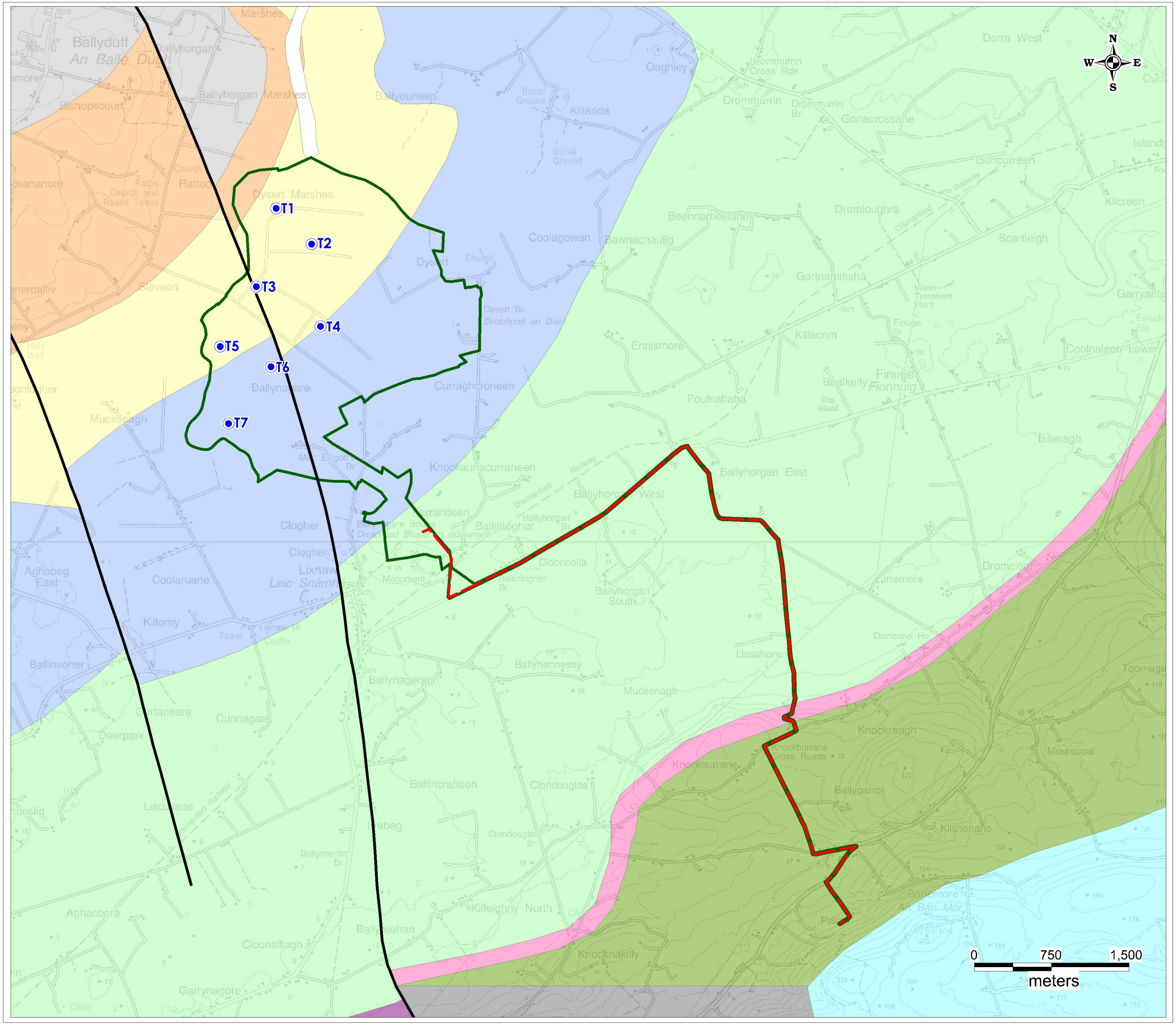
The GSI map the bedrock geology underlying the site as Dinantian Sandstones, Shales and Limestones (DESSL) in the northwest and Dinantian Lower Impure Limestones (DLIL) and Dinantian Pure Unbedded Limestones (DPUL) across the remainder of the site.

The Lower Limestone Shale comprising sandstone, mudstone and thin limestones is mapped to underlie the northwestern section of the site. However, no key wind farm infrastructures are mapped in this area of the site. The Ballysteen Formation underlies much of the north and west of the site including 5 no. turbines (T1, T2, T3, T4 and T5), the northern construction compound and the northern peat repository. The Ballysteen Formation comprises dark muddy limestone and shales. The GSI provide the following lithological description of the Ballysteen Formation: "*Irregularly bedded and nodular bedded argillaceous bioclastic limestones (wackestones and packstones), interbedded with fossiliferous calcareous shales*". Meanwhile the Waulsortian Limestones are mapped to underlie the south and east of the site. In terms of key wind farm infrastructure, 2 no. turbines (T6 and T7) and the southern peat repository are mapped on Waulsortian Limestones, comprising dominantly pale-grey massive, unbedded lime mudstones. Further south the proposed substation location, borrow pit and the southern construction compound are mapped as being underlain by undifferentiated Visean Limestones.

The dominant geological structure in the region is a large anticline which plunges to the east-northeast and bedding dipping steeply to the north and south on either side of the fold axis (GSI, 2004). The site is located on the southern limb of this anticline and bedding will therefore dip steeply to the south. Large northwest - southeast orientated faults cross-cut the fold axis, one of which is mapped to run through the site, in close proximity to T3 and to the north of T6. A second fault of similar orientation is mapped approximately 1.4km to the west of the site.

The GSI do not record the presence of any bedrock outcrop within the northern section of the site. However several bedrock outcrops are mapped in the south of the site, near the proposed borrow pit and substation locations. Following a review of the GSI database no karst features were identified within the site. The closest mapped karst feature is located to the southwest of Lixnaw, approximately 1km from the site. Here the GSI record the presence of a cave and spring.

The bedrock geology map of the region is shown as Figure 8.2.



Legend

EIAR Site Boundary

Proposed Turbine Layout

Clohane Grid Route

Mapped Faults

Ballysteen Formation

Central Clare Group

Clare Shale Formation

Inshaboy Formation

Kilmore Formation

Lower Limestone Shale

Namurian (undifferentiated)

Shannon Group

Visean Limestones (undifferentiated

Waulsortian Limestones

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Client: MKO	
Job: Ballynagare WF, Co. Kerry	
Title: Local Bedrock Geology Map	
Figure No: 8-2	
Drawing No: P1531-0-1021-A3-802-0A	
Sheet Size: A3	Project No: P1531-0
Scale: 1:35,000	Drawn By: GD
Date: 07/10/2021	Checked By: MG

8.3.4.2 Grid Connection Route

The western and northern sections of the grid route are underlain by undifferentiated Visean Limestones. Namurian Shales (NSH) of the Clare Shale Formation are mapped to the south, in the townland of Lissahane. This is a small bedrock formation comprising mudstone which is cherty in nature at its base. The GSI provide the following lithological description: "*the formation consists of a condensed sequence of black shales with closely spaced layers rich in goniatites, underlain by shales with phosphatic horizons. Nodules and bands of clay ironstone occur near the top of the formation*". The remainder of the grid route is mapped to be underlain by Namurian Undifferentiated (NU) rocks of the Shannon Group comprising mudstones, sandstones and siltstones.

8.3.5 Soil Contamination

8.3.5.1 Wind Farm Site

According to the EPA online mapping (www.epa.ie), there are no licenced waste facilities or IPPC licenses in the site or its immediate environs. The closest mapped waste facility is the Listowel Civic Amenity Centre, located approximately 7km east of the site. In addition 2 no. IPCC Facilities are located near Listowel, belonging to Celtic Circuits Ltd and Kerry Ingredients Ltd.

The GSI map several historic pits and quarries in the south of the site and in the lands surrounding Lixnaw village which might potentially have contaminated tailings. Most of these pits and quarries date from the early to mid-20th Century. A large quarry pit, known as Lixnaw Quarry, exists immediately to the south of the site and less than 20m from the proposed borrow pit location.

During the site walkovers, no large areas of particular contamination concern were identified within the site. Some minor dumping was noted along the edge of access tracks but this was very localised and will not be of concern in relation to the proposed development.

8.3.5.2 Grid Connection Route

There are no known areas of soil contamination along the proposed grid connection route. During the site walkovers and investigations, no areas of contamination concern were identified.

The closest mapped waste facility to the proposed grid route is Listowel Civic Amenity Centre. This waste facility site is located on the N69 southwest of Listowel and approximately 4.5km northeast of the proposed grid route. There are several historic pits located in the lands surrounding the proposed grid route. The GSI also maps a historic quarry along grid route in the townland of Lissahane, mapped in the Clare Shale Formation. Lixnaw Quarry exists immediately to the south of the proposed Ballynagare sub-station and adjacent to the beginning of the grid route.

During the site walkovers, no areas of particular contamination concern were identified along the proposed grid route.

8.3.6 Economic Geology

8.3.6.1 Wind Farm Site

The GSI Online Minerals Database accessed via the Public Data Viewer (www.gsi.ie) shows a small number of historic quarries, pits, mines and mineral occurrences in the lands surrounding the site. These consist of small limestone bedrock quarries and gravel pits. There are several historic extraction sites located in the south of the site.

The GSI also records the presence of several mineral localities in the vicinity of the site. To the south, limestone quarries have been reported to be abandoned due to a lack of reserves in the townlands of Ballintogher and Ballynageragh, northeast of Lixnaw village. The GSI also maps the occurrence of lead deposits near Lixnaw. Other mapped mineral localities in the wider area are generally noted as being for limestone with low potential for development.

The closest active mapped quarry is located approximately 10km east of the site. Listowel Quarry is a bedrock quarry into Namurian sandstones and shales. Meanwhile approximately 11km southwest of the site there is an active limestone quarry at Ardfert in the Cloonagh Limestone Formation. The limestone quarry ("Lixnaw Quarry") located immediately to the south of the site is not included in the GIS database of active quarries.

The GSI online Aggregate Potential Mapping Database (www.gsi.ie) shows that the north and west of the site, which is underlain by the Ballysteen Formation, are mapped as being of low crushed rock aggregate potential. Meanwhile, the Waulsortian Limestones are mapped as being of moderate crushed rock aggregate potential. Further south in the vicinity of the proposed substation and borrow pit the Visean Limestones are mapped as having very high crushed rock aggregate potential.

The majority of the site is not located within an area mapped for granular aggregate potential (i.e. potential for gravel reserves), while the areas along the Brick and Feale rivers are recorded as having moderate potential.

8.3.6.2 Grid Connection Route

The GSI online Aggregate Potential Mapping Database (www.gsi.ie) shows that the crushed rock potential along the grid route ranges from Low to Very High. The crushed rock aggregate potential generally decreases to the southeast, however localised pockets of high potential occur throughout the route.

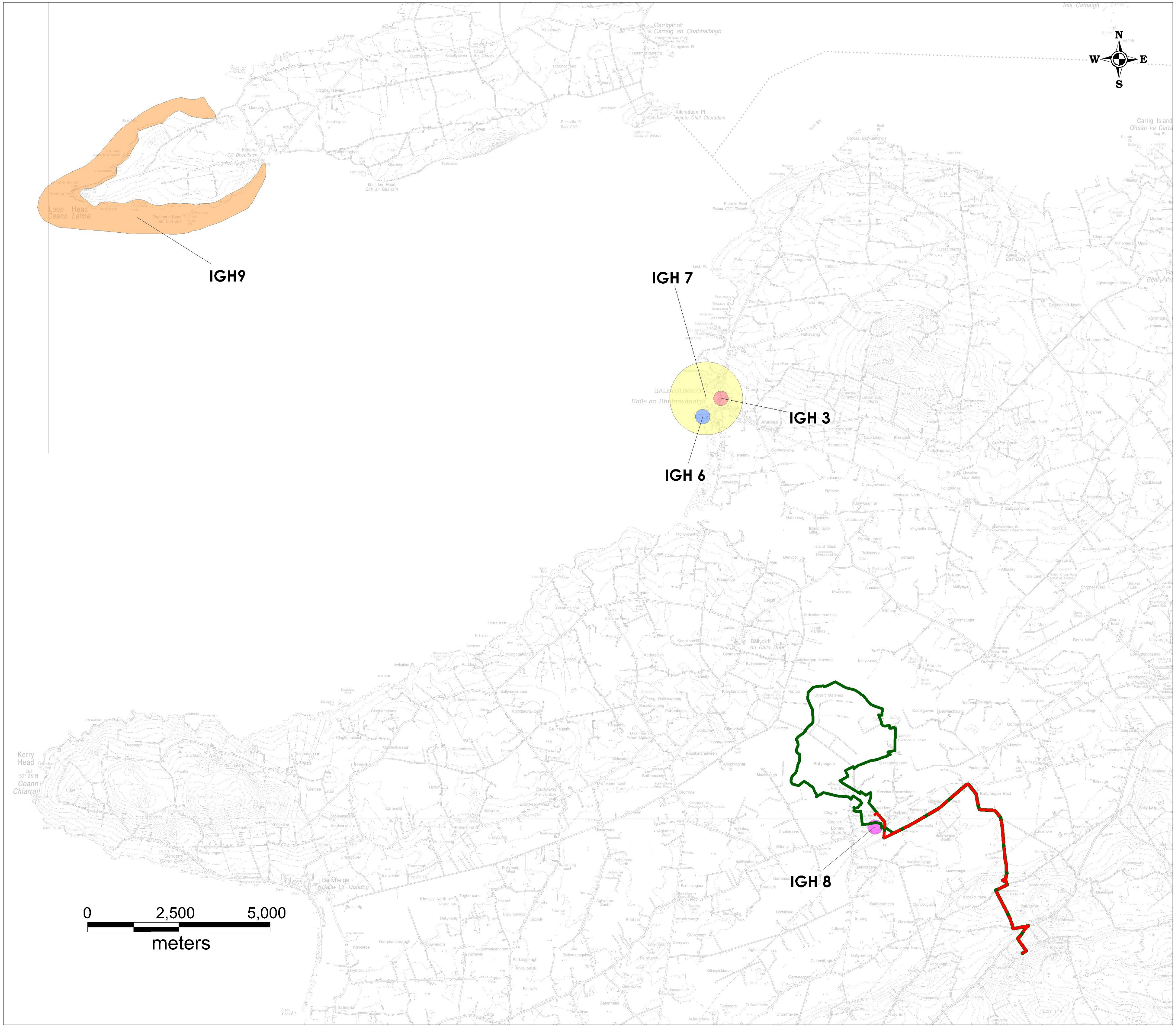
The majority of the proposed grid route is not located within an area mapped for granular aggregate potential (i.e. potential for gravel reserves). A small area of moderate potential is recorded along Knockburrane River just north of Banemore Cross.

8.3.7 Geological Heritage Sites

8.3.7.1 Wind Farm Site

There are no recorded audited Geological Heritage sites within the wind farm site. The closest mapped Geological Heritage Site is the unaudited Lixnaw Quarry, located immediately to the south of the site. The site is described as "*a working quarry in striped Carboniferous Limestone of Visean Age. This is an unusual and distinctive rock type*". This unaudited site has no direct connection to the site and will not be affected in any way by the proposed development.

Other geological heritage sites within 10km of the site include 2 no. unaudited sites at Ballybunnion to the northwest of the site. Meanwhile the closest audited Geological Heritage Area is located at Loop Head, Co. Clare, approximately 21km northwest of the site. These sites have no connection with the proposed wind farm site and are briefly described in Table 8-5 below.



Legend

EIAR Site Boundary

Clohane Grid Route

Heritage Site - Audited

Loop Head (IGH 9)

Heritage Site - Unaudited

Ballybunnion (IGH 3)

Ballybunnion (IGH 6)

Ballybunnion (IGH 7)

Lixnaw Quarry (IGH 8)

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Client: MKO	
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Title: Geological Heritage Sites Map	
Figure No: 8-3	
Drawing No: P1531-0-1021-A3-803-0A	
Sheet Size: A3	Project No: P1531-0
Scale: 1:100,000	Drawn By: GD
Date: 07/10/2021	Checked By: MG

Table 8-5: Regional Geological Heritgge Sites

Site Code	Site Name	IGH Theme	Features	Distance from WF Site/ Grid Route
Unaudited site	Lixnaw Quarry	IGH8	Working Quarry, Visean Limestone, Distinctive Rock Type	Approx. 0.02km
Unaudited site	Ballybunnion	IGH7	General stratigraphy. Till composed of largely Carboniferous shale, sandstone and limestone.	Approx. 8km
Unaudited site	Ballybunnion	IGH3	Goniatites and bivalves	Approx. 8km
CE027	Loop Head	IGH9	Coastal cliff section representing the Ross Sandstone Formation	Approx. 21km

8.3.7.2 Grid Connection Route

With the exception of Lixnaw quarry, the proposed grid connection route is not in close proximity to any Geological Heritage Site.

8.3.8 Peat Stability Assessment

This section summarises the report on assessment of peat stability undertaken by GDG (2021) for the proposed 7 no. turbines and related infrastructure. The peat stability risk assessment report is included as Appendix 8-2 of this EIAR.

The purpose of this peat stability assessment was to determine the stability i.e. Factor of Safety (FoS), of the peat slopes where construction is proposed during the development of the wind farm. This involved geotechnical assessments of each of the infrastructure locations and included peat depth measurements and shear strength testing. The minimum required Factor of Safety (FoS) is 1.3 based on BS6031:2009: Code of Practice for Earthworks (BSI, 2009). The assigned probability of instability associated with a given FoS value is described in **Table 8-6** below.

In addition the desk-based study, site investigations (gouge augering and shear vane testing), stability analyses and a risk assessment were carried out to assess the risks presented by peat failures at the site. The risks were assessed following the principles in Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Scottish Executive, 2017).

Table 8-6: Probability Scale for Factor of Safety.

Scale	Factor of Safety	Probability
1	1.30 or greater	Negligible/None
2	1.29 to 1.20	Unlikely
3	1.19 to 1.11	Likely

Scale	Factor of Safety	Probability
4	1.01 to 1.10	Probable
5	<1.0	Very Likely

8.3.8.1 Peat Stability Assessment Results

The findings of the GDG peat stability assessment report (2021) showed that the site has an acceptable margin of safety and is suitable for the proposed development. The main findings are outlined below:

- Due to the almost flat topography of the site and its geomorphological context (a low-lying peat land area beside an estuary), landslides at the site are very unlikely.
- Peat depth across the site ranged from 0 to 6.9m, with no peat encountered in the west and south of the site i.e. T7. Peat depths across the remaining 6 no. turbines, ranged from 3.6 to 6m.
- The proposed wind farm elements were found to have both acceptable factors of safety and levels of risk against peat instability.
- The risk assessment identified 8 no. safety buffers which will have restricted construction activities and should not be used for the storage of peat. For the most part, the proposed site layout avoids these however some stretches of the proposed access roads lie within 20-40m of these safety buffers.
- All the proposed key wind farm infrastructures are located in areas of negligible risk i.e. the project will proceed with monitoring and mitigation of peat landslide hazards at these locations as appropriate.

8.4 Characteristics of the Proposed Development

The proposed development comprises of the following:

- Construction of 7 no. wind turbines with the following maximum and minimum parameters:
  - Overall ground to blade tip height in the range of 170m maximum to 169.5m minimum
  - Hub height of 95m
  - Rotor diameter in the range of 150m maximum to 149m minimum
- Turbine hardstand areas
- Provision of 1 no. permanent meteorological mast with a height of 110 metres
- Upgrade of existing roads and access junctions
- Provision of new site entrances, roads and hardstand areas
- 2 no. temporary peat storage areas
- 2 no. temporary construction compounds
- 1 no. borrow pit
- All site drainage works
- 1 no. onsite 38kV substation, control building and plant, associated security fencing and wastewater holding tank
- All associated underground electrical and communication cabling connecting the turbines to the proposed on-site substation

- Connection of the proposed 38kV on-site substation via underground cable in the public road to the entrance of the existing Clahane 110kV substation in the townland of Pallas
- All ancillary site and ground works, apparatus and signage.

The main characteristics of the proposed development that could impact on soils and geology are:

- Opening of the on-site borrow pit, which will involve the stripping of topsoil/subsoil and rock extraction, and subsequent processing, of approximately 144,000m^3 of suitable rock to create aggregate for use on site in access tracks and hardstand construction.
- Establishment of the 2 no. construction compounds. One compound located in the north of the proposed wind farm site will involve minor regrading of peat and the use of a floated technique. This northern construction compound will involve the use of approximately 4,451m^3 of Class 6 crushed stone and general fill materials. The second site compound is located on mineral soils in the south of the site and will use approximately 2,221m^3 of fill. Welfare facilities will be provided at the site compounds. Wastewater effluent will be collected in a wastewater holding tank and periodically emptied by a licensed contractor.
- Construction of the on-site substation will be completed using a floated technique, and will also involve the use of approximately 695m^3 of concrete, aggregate and building materials. Welfare facilities will be provided at the substation. Wastewater effluent will be collected in an underground concrete holding tank and periodically emptied by a licensed contractor for the operational phase of the wind farm.
- The upgrade and widening of existing founded access roads. This will involve the excavation on one or both sides of the existing access road to competent strata, followed by the benching of the existing road and the placement of granular fill in layers. The existing access road is then overlayed with granular fill and finished with a layer of capping. It is estimated that up to 11,059m^3 of peat will be extracted during the upgrade of these founded access tracks. This will involve the use of approximately 30,428m^3 of stone materials.
- The upgrade and widening of existing floating access roads and the construction of new floating roads. The typical methodology includes the placement of a geotextile membrane on both sides of the existing access track. Benching of the existing road and placement of granular fill. Overlay existing road with granular fill and new access road to be finished with a layer of capping. No peat extraction will be required in the upgrade of existing floated access roads and/or construction of new floating roads. The upgrade and construction of these tracks will require approximately 22,467m^3 of Class 6 crushed stone and general fill.
- Construction of the cranage areas and turbine assemblage will require the removal of approximately 50,523m^3 of peat. The construction will also involve the use of aggregate, sourced from the onsite borrow pit (total fill required is estimated to be 61,379m^3).
- With the exception of T7 all turbines and their associated crane hardstands are likely to require a piled foundation as a result of the depth of peat present at these locations. Estimated volumes of peat/subsoils to be removed at the 7 no. turbines locations is estimated to be 5,576m^3 peat and 6,013m^3 of non-peat subsoils. The construction of the turbine foundations will require approximately 15,593m^3 of materials.
- The construction of the met mast hard stand is estimated to require the excavation of approximately 1,986m^3 of peat and the use of 2,511m^3 of materials.
- Peat generated by construction will be reused or reinstated and may be used for landscaping on edges of constructed infrastructure. As part of the reinstatement plan, it is proposed to place 3m of excavated peat in the borrow pit.
- Grey water will be supplied by rainwater harvesting and water tankered to site where required. Bottled water will be used for potable supply.

- Construction of the turbine foundations, which will require large volumes of concrete (approximately 550m^3 per turbine foundation plus approximately 50m^3 of lean-mix concrete for the blinding layer), placing demand on local concrete batching plants / quarries.
- Cabling between turbine locations and the site substation. This will involve the excavation of a shallow trench (approximately 1.2m deep), placement of ducting and backfilling with aggregate, lean-mix concrete and excavated material, as appropriate (depending on the location of the cable trench).
- Cabling between the site substation and the Trien or Clahane 110 kV Substation. This will involve the excavation of a shallow trench along the public road, placement of ducting and backfilling with lean-mix concrete and compacted engineered fill.

Summary volumes are provided in Table 8-7.

Table 8-7: Summary of Excavated Peat, Overburden and Bedrock Volumes

Infrastructure Item	Excavated volume (m3)		
	Peat	Non-peat	
		Overburden	Rock
Floated access roads	0	-	-
Founded access roads	11,059	-	-
Turbine Foundations	7,576	6,013	-
Crane hardstands	50,523	-	-
Construction compound north hardstand	0	-	-
Construction compound south hardstand	0	-	-
Substation hardstand	0	-	-
Met mast hardstand	1,968	-	-
Borrow pit	0	0	144,000
Total	71,127	6,013	144,000

8.5 Likely Significant Effects on Land, Soils and Geology

8.5.1 Do Nothing Scenario

If the Proposed Development were not to proceed the Ballynagare Wind Farm would not be able to supply the electricity generated to the national grid. The opportunity to generate renewable energy and electrical supply to the national grid would be lost. Local peat harvesting, agricultural operations and other existing land-use practices would continue at the site.

The land, soils and geology would remain largely unaltered as a result of the Do-Nothing Scenario.

8.5.2 Construction Stage - Likely Significant Effects and Mitigation Measures

The likely significant effects of the proposed development, including construction works at the site and along the proposed grid connection route, and mitigation measures that will be put in place to eliminate or reduce them are shown below. These relate to the construction stage. It should be noted that the main potential impacts on the soils and geology environment will occur during the construction stage.

8.5.2.1 Peat, Subsoil Excavation and Bedrock Excavation

Excavation of approximately 71,127m^3 of peat and 6,013m^3 of mineral subsoil (overburden) will be required for the construction of all turbine bases, hardstands and access roads within the wind farm site. An additional 144,000m^3 of bedrock will be excavated from the borrow pit. These works will result in temporary disturbance or permanent removal of peat, subsoil and/or bedrock at various excavation locations.

The proposed grid connection is largely in the carriageway of existing public roads and the majority of subsoil excavated along the route will be reinstated back within the trench. These minor works will have minimal impact on the local soils and geology.

Pathway: Extraction/excavation.

Receptor: Peat, mineral subsoils and bedrock.

Pre Mitigation Potential Impact: Negative, slight/moderate, direct, high probability, permanent impact on peat, mineral subsoil and bedrock.

Proposed Mitigation Measures by Design:

- Placement of turbines and associated infrastructure in areas with shallower peat where possible;
- Use of piled foundations in areas of deeper peat and soft mineral soils;
- Use of floating roads (where geotechnically acceptable to do so) to reduce peat excavation volumes (i.e. along wind farm access tracks and the link road);
- The peat and subsoil which will be removed during the construction of 7 no. turbines will be localised to the turbine location;
- The majority of peat excavated at the wind farm site will be permanently stored in the on-site borrow pit;
- Smaller volumes of peat will be excavated and used for landscaping along proposed access/link roads;
- Placement of internal cable trenching will be volume neutral, and all excess material will be used locally as landscaping; and,
- Subsoils will be reinstated back into the cable trench along the proposed grid connection route.

Residual Effect: The mineral soil and peat deposits at the site are classified as of "Low" importance as they have already been degraded by extensive drainage. The local bedrock, to be extracted at the proposed borrow pit, is classified as being of "High" importance, with an existing quarry located immediately to the south of the site. The overall site area is extensive while the proposed development footprint is approximately 1.2% of the overall site area. The impact is the disturbance and relocation of approximately 71,127m^3 of peat and 6,013m^3 of mineral subsoil during the construction phase. In addition approximately 144,000m^3 of bedrock will be excavated and used for construction purposes. All work will be in accordance with the Peat and overburden management plan (GDG, 2021). The design measures incorporated into the project as described above in particular the avoidance of deeper peat areas combined with the 'low' importance of the soils/subsoils deposits means that the residual effect is- Negative, direct, slight, high probability, permanent impact on peat, mineral subsoils, and bedrock due to disturbance and relocation within the site.

Significance of Effects: For the reasons outlined above, and with the implementation of the mitigation measures, no likely significant effect on soils, subsoils or bedrock will occur.

8.5.2.2 Effects on Land and Landuse

The overall site area is extensive while the proposed development footprint is approximately 1.6% of the overall site area. The construction of the proposed development will result in the loss of approximately c.2.04ha of peat bog and c.7.63ha of agricultural land. The loss of this agricultural land and peat bogs is not significant and will not materially affect land use within the site. Existing agricultural activities and peat harvesting can readily co-exist and there will be no perceptible effect on these activities.

There will be no effects on land and/or landuse on the whooper swan mitigation lands which will remain improved agricultural grassland.

There will be no indirect effects on the lands adjoining the proposed development site

There will be no effects on land and/or landuse along the grid connection route as all ground will be reinstated once cabling works are complete

Pathway: Excavation and infrastructure construction.

Receptor: Land and Landuse.

Pre-Mitigation Potential Impact: Negative, direct, slight, likely, permanent impact on land and landuse.

Proposed Mitigation Measures: The effects on land and land use will be reduced by minimising the development footprint, through the incorporation of existing access tracks/roads in the wind farm design. However, for the most part no major mitigation measures are required with regard to effects on land and landuse within the wind farm site as it is an acceptable part of the development as in agreement with landowners.

Residual Effect: Due to the small footprint of the wind farm development infrastructure in comparison to the overall site area and surrounding land use, the residual effect is - Negative, direct, slight, likely, permanent impact on land and landuse.

Significance of Effects: For the reasons outlined above, no likely significant effect on soils, mineral subsoils or bedrock will occur.

8.5.2.3 Contamination of Soil by Leakages and Spillages and Alteration of Peat/Soil Geochemistry

Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a pollution risk. The accumulation of small spills of fuels and lubricants during routine plant use can also be a significant pollution risk. Hydrocarbon has a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. Large spills or leaks have the potential to result in significant effects (i.e. contamination of peat, subsoils and pollution of the underlying aquifer) on the geological and water environment.

Pathway: Peat, mineral subsoil and bedrock pore space.

Receptor: Peat, mineral subsoil and bedrock.

Pre-Mitigation Potential Impact: Negative, direct, slight, short term, medium probability impact on peat, soils and bedrock.

Proposed Mitigation Measures:

- Where possible maintenance of construction vehicles or plant will take place off-site. This applies to both at the site and along the grid connection route. Minimal maintenance of construction vehicles or plant will take place on-site;
- On-site re-fuelling will be undertaken using a double skinned bowser with spill kits at the ready for any minor accidental leakages or spillages;
- Fuels stored on site will be minimised but will be in bunded locations;
- The electrical control building at the site will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage of any associated chemicals to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- All waste tar material arising from the chipping and resurfacing of the roads during construction of the grid route will be removed off-site and taken to an appropriately licenced facility;
- The plant used during construction will be regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages will be contained within the Construction Environmental Management Plan (CEMP). Spill kits will be available to deal with accidental spillage in and outside of re-fuelling areas.

Residual Effect: The use and storage of hydrocarbons and small volumes of chemicals is a standard risk associated with all construction sites. Proven and effective measures to mitigate the risk of spills and leaks have been proposed above and will break the pathway between the potential source and the receptor. The residual effect is considered to be - Negative, imperceptible, direct, short-term, low probability effect on peat and subsoils and bedrock.

Significance of Effects: For the reasons outlined above, and with the implementation of the above outlined mitigation no likely significant effects on soils, mineral subsoils or bedrock will occur.

8.5.2.4 Erosion of Exposed Subsoils and Peat During Access Road, Turbine Base Construction Work and works along the Grid Route

Peat and spoil removed from turbine locations and access roads and all elements of the proposed project listed in Table 8-7. Peat generated by construction will be reused or reinstated and/or used for landscaping on edges of constructed infrastructure, with up to 3m of excavated peat to be used to reinstate the borrow pit. Landscaping will be limited to locations carefully selected by the project geotechnical expert and project hydrologist.

The excavation of made ground, subsoils and bedrock will also be required along the grid connection route.

During the construction phase these peat soils and spoil will be eroded by vehicle movements, wind action and by water movement.

Pathway: Vehicle movement, surface water and wind action.

Receptor: Peat, subsoil & weathered bedrock.

Pre-Mitigation Potential Impact: Negative, direct, slight, high probability impact on peat, subsoils and bedrock.

Proposed Mitigation Measures:

All excavated material will be completed in accordance with the Peat and overburden management plan. Peat generated by construction will be reused or reinstated and may be used for landscaping on edges of constructed infrastructure. As part of the reinstatement plan, it is proposed to place 3m of excavated peat in the borrow pit.

Material will be moved over the least possible distance. Any excess peat will be moved to peat storage areas or will be temporarily surrounded by earthen berms to prevent erosion. Where possible, the peat acrotelm (surface vegetation layer) will be stored with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the stored peat within the borrow pits. Re-seeding and spreading/planting of heather and moss cuttings will also be carried out in these areas. These measures will prevent erosion of stored peat in the short term until vegetation has established and binds the peat/soils together, preventing the erosion of soil. Silt fences will also be installed around temporary stockpiles to limit movement of entrained sediment in surface water runoff. The use of earthen berms and silt fencing around earthworks and spoil mounds will prevent egress of water from the works.

In order to minimize erosion of mineral subsoils stripping of peat will not take place during extremely wet periods[1] (to prevent increased silt rich runoff). Temporary drainage systems (as outlined in Section 9.3.17 of Chapter 9) will be required to limit runoff impacts during the construction phase.

Peat and subsoils removed from the cable trench will be used to reinstate the trench where possible or removed to an appropriately licenced facility.

Residual Effects: Peat soils and spoil are eroded by vehicle movements, wind action and by water movement. To prevent this, all excavation works will be completed in accordance with the detailed Peat and overburden management plan (GDG, 2021). Material will be moved the least possible distance, and reseeding and planting will be completed to bind landscaped peat and spoil together. Following implementation of these measures the residual effected is considered - Negative, slight, direct, short-term, medium probability effect on peat and subsoils by erosion and wind action.

Significance of Effects: For the reasons outlined above, and with the implementation of the above outlined mitigation no likely significant effect on soils, subsoils or bedrock will occur.

8.5.2.5 Peat Instability and Failure

Peat instability or failure refers to a significant mass movement of a body of peat that would have an adverse impact on proposed wind farm development and the surrounding environment. Peat failure excludes localised movement of peat that could occur below an access road, creep movement or erosion type events. The consequence of peat failure at the wind farm site may result in:

- Death or injury to site personnel;
- Damage to machinery;
- Damage or loss of access tracks;
- Drainage disrupted;
- Site works damaged or unstable;
- Contamination of watercourses, water supplies by particulates;

- [1] >10 mm/hr (i.e. high intensity local rainfall events);
- >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
- >half monthly average rainfall in any 7 days.

- Degradation of the peat environment.

While peat failure at the wind farm site and along the grid routes may lead to road failure/slumping along with the above mentioned consequences.

Pathway: Vehicle movement and excavations.

Receptor: Peat subsoils.

Pre Mitigation Potential Impact: Direct, negative, significant, low probability impact on peat and subsoils.

Proposed Mitigation Measures: The findings of the GDG peat stability assessment report (2021) showed that the site has an acceptable margin of safety and is suitable for the proposed development. The risk rating for each infrastructure element at the proposed Ballynagare Wind Farm site is designated trivial following mitigation/control measures being implemented. A number of control measures are given in the GDG Ltd peat stability risk assessment (Appendix 8-2) to manage all risks associated with peat instability. These are outlined below.

The following general measures incorporated into the construction phase of the project will assist in the management of the risks for the proposed wind farm site and grid route:

- Appointment of experienced and competent contractors;
- Investigate any small peat failures (1m or less) which may have occurred along escarpments of excavated peat;
- Take into account the proposed safety buffers outlined in the peat stability assessment report (GDG, 2021);
- The site will be supervised by experienced and qualified personnel;
- Allocate sufficient time for the project (be aware that decreasing the construction time has the potential to increase the risk of initiating a peat movement);
- Prevent undercutting of slopes and unsupported excavations;
- Maintain a managed robust drainage system;
- Prevent placement of loads/overburden on marginal ground;
- During construction activities, monitoring will be carried out to identify the possible emergence of new features of precursory peat instability. These monitoring works will be undertaken following intense rainfall events, prolonged rainfall events or significant man-made changes in terrain conditions;
- Set up, maintain and report findings from monitoring systems and update the Peat Stability Risk Assessment with findings;
- Inspection and approval of turbine base sub-formation by a competent person;
- In areas of deep peat access and working area formed using bog mats. The excavation side walls shall be supported, or the excavation face battered to a shallow angle along with detailed excavation of faces and daily monitoring, increased exclusion zone around excavation to avoid increased loading.
- Ensure construction method statements are followed or where agreed modified/ developed; and,
- Revise and amend the Geotechnical Risk Register as construction progresses.

Residual Effects: A detailed Geotechnical Stability Assessment has been completed for the wind farm site (GDG, 2021). While the findings of the assessment demonstrated that there is a low risk of peat failure as a result of the proposed development, a number of mitigation measures are proposed. With the implementation of these control measures outlined above the residual effect is considered to be - Negative, imperceptible, direct, low probability, permanent effect on peat and subsoils.

Significance of Effects: For the reasons outlined above, and with the implementation of the above outlined mitigation no likely significant effect on soils, mineral subsoils or bedrock will occur.

8.5.2.6 Assessment of Health Effects

Potential health effects arise mainly through the potential for soil and ground contamination. A wind farm/grid connection route is not a recognized source of pollution and so the potential for effects during the construction phase are negligible. Hydrocarbons will be used onsite during construction however the volumes will be small in the context of the scale of the project and will be handled and stored in accordance with best practice mitigation measures. The potential residual impacts associated with soil or ground contamination and subsequent health effects are negligible.

8.5.3 Operational Stage – Likely Significant Effects and Mitigation Measures

Very few potential direct impacts are envisaged during the operational phase of the wind farm. These may include:

- Maintenance of site roads;
- Some construction traffic may be necessary for maintenance of turbines which could result in minor accidental leaks or spills of fuel/oil; and,
- The grid transformer in the substation and transformers in each turbine are oil cooled. There is potential for spills / leaks of oils from this equipment resulting in contamination of soils and groundwater.

There will be no direct impacts from the grid connection route during the operational stage.

8.5.3.1 Site Road Maintenance during the Operational Stage

In relation to indirect impacts a small amount of granular material will be required to maintain access tracks/site roads during operation which will place intermittent minor demand on local quarries. Please note the on-site borrow pit will have been reinstated with excavated peat and spoil following the construction stage and will not be available to source aggregate during the operational phase.

Pathway: Peat, subsoil and bedrock pore space.

Receptor: Peat, subsoil and bedrock.

Potential Pre-Mitigation Impact: Negative, indirect, imperceptible, short term, likely impact bedrock

Proposed Mitigation Measures:

- Use of aggregate from authorised quarries for use in road and hardstand maintenance.

Residual Impact: The use of aggregate for site road maintenance will be minor and infrequent, and all material will be imported to the site from local authorised quarries. The residual effect is considered to be - Negative, imperceptible, indirect, short-term, low probability effect on bedrock.

Significance of Effects: For the reasons outlined above, no significant effects on land, soils or geology will occur.

8.5.3.2 Site Vehicle/Plant Use During Operational Stage

Plant and site vehicles used in site maintenance will be run on fuels and use hydraulic oils. Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a significant pollution risk to land, soils and associated ecosystems. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Hydrocarbon has a high toxicity to humans, and all flora and fauna, and is persistent in the environment.

Pathway: Peat, subsoil and bedrock pore space.

Receptor: Peat, subsoil and bedrock.

Potential Pre-Mitigation Impact: Negative, direct, slight, short term, unlikely impact on peat, subsoil and bedrock.

Proposed Mitigation Measures:

- Vehicles used during the operational phase will be refuelled off site before entering the site;
- No fuels will be stored on-site during the operational phase; and
- Spill kits will be available in all site vehicles to deal with an accidental spillage and breakdowns; and,
- An emergency plan for the operational phase to deal with accidental spillages and breakdowns will be contained in the Environmental Management Plan.

Residual Impact: The use of hydrocarbons in plant and vehicles is a standard risk associated with all operational wind farm sites. Proven and effective measures to mitigate the risk of spills and leaks have been proposed above and will break the pathway between the potential source and the receptor. The residual effect is considered to be - Negative, imperceptible, direct, short-term, low probability effect on peat and subsoils and bedrock.

Significance of Effects: For the reasons outlined above, no likely significant effects on land, soils, subsoils or bedrock will occur.

8.5.3.3 Use of Oils in Turbine Transformers During Operational Stage

The transformer in the substation and transformers in each turbine are oil cooled. There is potential for spills / leaks of oils from this equipment resulting in contamination of soils and groundwater. Hydrocarbon has a high toxicity to humans, and all flora and fauna, and is persistent in the environment.

Pathway: Peat, subsoil and bedrock pore space.

Receptor: Peat, subsoil and bedrock.

Potential Pre-Mitigation Impact: Negative, direct, slight, short term, unlikely impact on peat, subsoil and bedrock.

Proposed Mitigation Measures:

- All transformers and substation areas will be bunded to 110% of the volume of oil used in each transformer/substation;
- An emergency plan for the operational phase to deal with accidental spillages will be contained in the Environmental Management Plan.

Residual Impact: The use of hydrocarbons in transformers and substations is a standard risk associated with all operational wind farm sites. Proven and effective measures to mitigate the risk of spills and leaks have been proposed above and will break the pathway between the potential source and the receptor. The residual effect is considered to be - Negative, imperceptible, direct, short-term, low probability effect on peat and subsoils and bedrock.

Significance of Effects: For the reasons outlined above, no likely significant effects on land, soils, subsoils or bedrock will occur.

8.5.4 Decommissioning Stage - Likely Significant Effects and Mitigation Measures

The potential impacts associated with decommissioning will be similar to those associated with construction but at a reduced magnitude due to the reduced scale of the works. Please refer to Section 8.5.2 above.

During decommissioning, it will be possible to reverse or at least reduce some of the potential impacts caused during construction by rehabilitating construction areas such as turbine bases, hard standing areas, and the substation. This will be done by covering hard surfaces with peatland vegetation/scraw or poorly humified peat 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 as the extent of the works will be less. However, as noted in the Scottish Natural Heritage report (SNH) *Research and 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. According to the SNH guidance, 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".*

Mitigation measures applied during decommissioning activities will be similar to those applied during construction where relevant. Some of the impacts will be avoided by leaving elements of the Proposed Development in place including the bases which will be rehabilitated by covering with local topsoil/peat in order to regenerate vegetation which will reduce runoff and sedimentation effects. Mitigation measures to avoid contamination by accidental fuel leakage and compaction of soil by on-site plant will be implemented as per the construction phase mitigation measures.

No likely significant effects on the soils and geology environment are envisaged during the decommissioning stage.

8.5.5 Risk of Major Accidents and Disasters

None, as indicated above the risk of a landslide at the Proposed Development site is determined to be negligible/none.

8.5.6 Post Construction Monitoring

None required as no significant effects will occur.

8.5.7 Potential Cumulative Impacts

The land, soils and geological impact assessment undertaken above in this chapter outlines that significant effects are unlikely due to the localized nature of the construction works. Impacts on land soil and geology will not extend beyond the immediate vicinity of the Proposed Development site. The construction of the grid connection route will be predominantly along the carriageway of the existing public road network and any works will be very localised within the grid route corridor and will not contribute to any significant cumulative effects.

Therefore, no cumulative impacts between the Proposed Development, the proposed grid route and other existing, permitted or proposed projects, listed in Section 2.6 of this EIAR, on land, soils and geology will occur.

8.5.8 Conclusion

The geology of the proposed development site has been characterised using desk study and site investigation data. The majority of the proposed wind farm site is underlain by peat with depths ranging from 0 to 6.9m, with an average of 2.6m. Peat is underlain by grey silty clay or grey gravelly clay. Peat is absent from the west and south of the site where the soils are mapped as alluvium and deep mineral soils respectively.

The majority of new access tracks within the proposed wind farm site will be constructed using a floated technique, with some minor areas formed using excavate and replace method. Areas of peat deposits along the grid connection route have also been identified but these are minor and of a small-scale.

Excavation of peat, mineral subsoils and bedrock (~ 144,000m^3 from the borrow pit) will be required for site levelling, infrastructure and foundations for the access roads and turbines. Estimated volumes of peat/subsoils to be removed at the 7 no. turbine foundations, hardstandings and along access roads is 77,140m^3. The handling and storage of peat will be done in accordance with the Peat and overburden management plan (GDG, 2021) (attached as Appendix 8-1), with peat generated during construction to be reused or reinstated across the development.

Storage and handling of hydrocarbons/chemicals will be carried out using best practice methods. Measures to prevent peat and subsoil erosion during excavation, reinstatement and long-term storage of peat will be undertaken to prevent erosion and potential water quality impacts.

A peat stability risk assessment (GDG, 2021) undertaken for the site shows that the risk of peat failure is designated trivial and that the site has an acceptable margin of safety. No peat stability assessment was required for the grid connection route.

Based on the above, and with implementation of the outlined mitigation measures, no likely significant effects on the soils and geology environment are predicted to occur.

Our assessment confirms there will be no cumulative effects on the land, soil and geological environment as a result of the proposed development.

BIBLIOGRAPHY

British Standards Institution (BSI). (2015) BS5930 - Code of Practice for Site Investigations.

Department of Housing, Planning and local Government, 2018: Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment.

Environmental Protection Agency (2017): Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports.

Environmental Protection Agency (September 2015): Draft - Advice Notes on Current Practice (in the preparation of Environmental Impact Statements).

Environmental Protection Agency (2003): Advice Notes on Current Practice (in the Preparation on Environmental Impact Statements).

European Union, 2017: Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU).

Gavin and Doherty Geosolutions (GDG) (2021). Peat and overburden management plan for Ballynagare Renewable Energy Development.

Gavin and Doherty Geosolutions (GDG) (2021). Peat Stability Risk Assessment (PSRA) and Peat Managing Plan (PMP) for Ballynagare wind farm.

Geological Survey of Ireland (GSI). (2005) Geology of Shannon Estuary, 1:100,000 scale Bedrock Geology Series, Sheet 17.

Institute of Geologists Ireland (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements.

National Roads Authority (2008): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.

Scottish Natural Heritage report (SNH) Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms (SNH, 2013).

9. HYDROLOGY AND HYDROGEOLOGY

9.1 Introduction

9.1.1 Background and Objectives

Hydro-Environmental Services (HES) was engaged by MKO Ireland (MKO) to carry out an assessment of the potential effects of the proposed Ballynagare Wind Farm, Co. Kerry. The proposed wind farm site is located approximately 500m northeast of Lixnaw village, 3.7km southeast of Ballyduff and 9.6km west of Listowel. The proposed site is situated in the townlands of Ballynagare, Dysert and Dysert Marshes.

The proposed Ballynagare wind farm development comprises 7 no. turbines and associated hardstands, site access tracks, upgrades to existing roads, 1 no. met mast, 1 no. on-site electrical substation, 1 no. borrow pit, 2 no. temporary construction compounds, 2 no. peat repositories, underground cable works and all associated drainage infrastructure. The development also includes 2 no. proposed grid route connection routes (only one of which will be developed), between the proposed on-site substation and the 110kV substation at Clahane.

This Chapter provides a baseline assessment of the environmental setting of the proposed Ballynagare Wind Farm development and the grid connection route in terms of the water environment (hydrology and hydrogeology) and discusses the potential effects that the construction and operation of the proposed development will have. Where required, appropriate mitigation measures to limit any identified significant impacts to the water environment are recommended.

9.1.2 Statement of Authority

Hydro-Environmental Services (HES) are a specialist geological, hydrological, hydrogeological and environmental practice which delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core areas of expertise and experience include upland hydrology and windfarm drainage design. We routinely complete impact assessments for hydrology and hydrogeology for a large variety of project types.

This chapter of the EIAR was prepared by Michael Gill, Adam Keegan and Conor McGettigan.

Michael Gill P.Geo (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 18 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. He has substantial experience in surface water drainage design and SUDs design and surface water/groundwater interactions. For example, Michael has worked on the EIS for Oweninny WF, Cloncreen WF, and Yellow River WF, and over 100 other wind farm-related projects.

Adam Keegan (BSc, MSc) is a hydrogeologist with two years of experience in the environmental sector in Ireland. Adam has been involved in Environmental Impact Assessment Reports (EIARs) for numerous projects including wind farms, grid connections, quarries and small housing developments. Adam holds an MSc in Hydrogeology and Water Resource Management. Adam has worked on several wind farm EIAR projects, including Croagh WF, Lyrenacarriga WF (SID), Cleanrath WF, Carrownagowan WF (SID), and Fossy WF.

Conor McGettigan (BSc, MSc) is a recent graduate, holding an M.Sc. in Applied Environmental Science (2020) from University College Dublin, graduating with a First-Class Honours degree. Conor has also completed a B.Sc. in Geology (2016) from University College Dublin (First Class Honours). In recent times Conor has assisted in the preparation of the hydrology and hydrogeology chapters for several wind farm developments.

9.1.3 Scoping and Consultation

The scope for this assessment has been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties as summarised in Section 2.6 of Chapter 2 of the EIAR. Consultation responses relating to the water environment were received from the Geological Survey of Ireland and the Health Services Executive. Details of these scoping responses and actions taken to address them are outlined in Section 2.6.2 of this EIAR.

9.1.4 Relevant Legislation

The EIAR is prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive') as amended by Directive 2014/52/EU.

The following legislation has been complied with:

- Planning and Development Acts, 2000 (as amended);
- Planning and Development Regulations, 2001 (as amended);
- S.I. No 296 of 2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 which transposes the provisions of the EIA Directive as amended by the Directive 2014/52/EU into Irish Law;
- S.I. No. 94 of 1997: European Communities (Natural Habitats) Regulations, resulting from EU Directives 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and 79/409/EEC on the conservation of wild birds (the Birds Directive);
- S.I. No. 293 of 1988: Quality of Salmon Water Regulations;
- S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended, and S.I. No. 722 of 2003 European Communities (Water Policy) Regulations, as amended, which implement EU Water Framework Directive (2000/60/EC) and provide for implementation of 'daughter' Groundwater Directive (2006/118/EC). Since 2000 water management in the EU has been directed by the Water Framework Directive (WFD). The key objectives of the WFD are that all water bodies in member states achieve (or retain) at least 'good' status by 2015. Water bodies comprise both surface and groundwater bodies, and the achievement of 'Good' status for these depends also on the achievement of 'good' status by dependent ecosystems. Phases of characterisation, risk assessment, monitoring and the design of programmes of measures to achieve the objectives of the WFD have either been completed or are ongoing. In 2015 it will fully replace a number of existing water related directives, which are successively being repealed, while implementation of other Directives (such as the Habitats Directive 92/43/EEC) will form part of the achievement of implementation of the objectives of the WFD;
- S.I. No. 684 of 2007: Waste Water Discharge (Authroisation)Regulations, resulting from EU Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances (the Groundwater Directive);
- S.I. No. 249 of 1989: Quality of Surface Water Intended for Abstraction (Drinking Water), resulting from EU Directive 75/440/EEC concerning the quality required of surface water intended for the abstraction of drinking water in the Member States (as amended by 2000/60/EC in 2007);
- S.I. No.106 of 2007: European Communities (Drinking Water)Regulations and S.I. No. 122 of 2014: European Union (Drinking Water) Regulations , arising from EU Directive

98/83/EC on the quality of water intended for human consumption (the Drinking Water Directive) and WFD 2000/60/EC (the Water Framework Directive);
- S.I. No. 9 of 2010: European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended; and,
- S.I. No. 296 of 2009: European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, as amended.

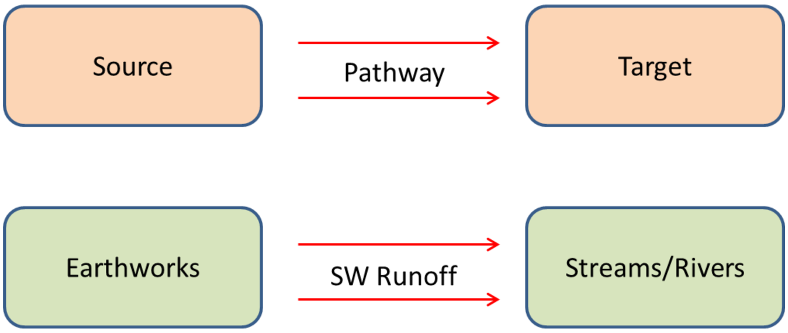
9.1.5 Relevant Guidance

The Hydrology and Hydrogeology chapter of the EIAR is carried out in accordance with guidance contained in the following:

- Environmental Protection Agency (2017): Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;
- Environmental Protection Agency (September 2015): Draft - Advice Notes on Current Practice (in the preparation of Environmental Impact Statements);
- Environmental Protection Agency (September 2015): Draft – Revised Guidelines on the Information to be Contained in Environmental Impact Statements;
- Environmental Protection Agency (2003) Advice Notes on Current Practice (in the preparation of Environmental Impact Statements);
- Environmental Protection Agency (2006): Environmental Management in the Extractive Industry;
- Environmental Protection Agency (2002) Guidelines on the Information to be Contained in Environmental Impact Statements;
- Institute of Geologists Ireland (2013) Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- National Roads Authority (2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Wind Farm Development Guidelines for Planning Authorities (2006);
- Forestry Commission (2004) Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte (2009) Forest Operations & Water Protection Guidelines;
- Forestry Services (Draft) Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures;
- Forestry Services (2000) Forestry and Water Quality Guidelines;
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Watercourses;
- Good Practice During Wind farm Construction (Scottish Natural Heritage, 2010);
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Water Courses (UK Guidance Note);
- CIRIA (Construction Industry Research and Information Association) Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006); and,
- Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2001.

9.2 Overview of Impact Assessment Process

The conventional source-pathway-target model (see below, top) was applied to assess potential effects on downstream environmental receptors (see below, bottom as an example) as a result of the proposed wind farm development and grid connection routes.



Where potential effects are identified, the classification of impacts in the assessment follows the descriptors provided in the Glossary of Impacts contained in the following guidance documents produced by the Environmental Protection Agency (EPA):

- Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003);
- Guidelines on the Information to be contained in Environmental Impact Statements (EPA, 2002); and,
- Environmental Protection Agency (August 2017): Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.

The description process clearly and consistently identifies the key aspects of any potential impact source, namely its character, magnitude, duration, likelihood and whether it is of a direct or indirect nature.

In order to provide an understanding of the stepwise impact assessment process applied below (Sections 9.4.2 to 9.4.4), a summary guide is presented below, which defines the steps (1 to 7) taken in each element of the impact assessment process. The guide also provides definitions and descriptions of the assessment process and shows how the source-pathway-target model and the EPA impact descriptors are combined.

Using this defined approach, this impact assessment process is then applied to all wind farm construction, operation and decommissioning activities (including the grid connection) which have the potential to generate a source of significant adverse impact on the geological and hydrological/ hydrogeological (including water quality) environments.

Table 9-1: Impact Assessment Process Steps

Step 1	Identification and Description of Potential Impact Source This section presents and describes the activity that brings about the potential impact or the potential source of pollution. The significance of effects is briefly described.	
Step 2	Pathway / Mechanism:	The route by which a potential source of impact can transfer or migrate to an identified receptor. In terms of this type of development, surface water and groundwater flows are the primary pathways, or for example, excavation or soil erosion are physical mechanisms by which potential impacts are generated.
Step 3	Receptor:	A receptor is a part of the natural environment which could potentially be impacted upon, e.g. human health, plant / animal species, aquatic habitats, soils/geology, water resources, water sources. The potential impact can only arise as a result of a source and pathway being present.
Step 4	Pre-mitigation Impact:	Impact descriptors which describe the magnitude, likelihood, duration and direct or indirect nature of the potential impact before mitigation is put in place.
Step 5	Proposed Mitigation Measures:	Control measures that will be put in place to prevent or reduce all identified significant adverse impacts. In relation to this type of development, these measures are generally provided in two types: (1) mitigation by avoidance, and (2) mitigation by (engineering) design.
Step 6	Post-Mitigation Residual Impact:	Impact descriptors which describe the magnitude, likelihood, duration and direct or indirect nature of the potential impacts after mitigation is put in place.
Step 7	Significance of Effects:	Describes the likely significant post-mitigation effects of the identified potential impact source on the receiving environment.

9.3 Methodology

9.3.1 Desk Study

A desk study of the proposed wind farm development site, grid connection route and surrounding area was largely completed prior to the undertaking of field mapping and walkover assessments. The desk study involved collecting all relevant geological, hydrological, hydrogeological and meteorological data for the area. This included consultation of the following:

- Environmental Protection Agency database (www.epa.ie);
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Met Eireann Meteorological Databases (www.met.ie);
- National Parks & Wildlife Services Public Map Viewer (www.npws.ie);
- Water Framework Directive "catchments.ie" Map Viewer (www.catchments.ie);

- Bedrock Geology 1:100,000 Scale Map Series, Sheet 17 (Geology of the Shannon Estuary);Geological Survey of Ireland (GSI, 1999);
- Geological Survey of Ireland - Groundwater Body Characterisation Reports;
- OPW Indicative Flood Maps (www.floodmaps.ie);
- Environmental Protection Agency – "Hydrotool" Map Viewer (www.epa.ie);
- CFRAM Preliminary Flood Risk Assessment (PFRA) maps (www.cfram.ie); and,
- Department of Environment, Community and Local Government on-line mapping viewer (www.myplan.ie).

9.3.2 Baseline Monitoring and Site Investigations

A hydrological walkover survey, including detailed drainage mapping and baseline monitoring/sampling, was undertaken by HES on 01st July and 13th July 2021. Previous site visits and walkover surveys were conducted on several dates from April to July 2021.

Site investigations to address the Water Section of the EIAR included the following:

- Walkover surveys and hydrological mapping of the proposed wind farm site, grid connection routes, and the surrounding areas were undertaken whereby water flow directions and drainage patterns were recorded;
- A preliminary flood risk assessment for the proposed wind farm site and grid connection route;
- A total of over 180 no. peat probes were undertaken by GDG and HES to determine the thickness and geomorphology of the peat at the wind farm site;
- A geotechnical assessment of peat stability for the wind farm site was completed by GDG (2021);
- Two continuous water level loggers were installed in the vicinity of the wind farm site to record water levels in surface watercourse to aid the understanding of the local hydrological regime;
- Field hydrochemistry measurements of unstable parameters (electrical conductivity, pH and temperature) were taken to determine the origin and nature of surface water flows within the wind farm site and along the grid connection routes; and,
- A total of 10 no. surface water samples were undertaken to determine the baseline water quality of the primary surface waters originating from the wind farm site and along the grid connection route.

9.3.3 Impact Assessment Methodology

Please refer to Chapter 1 of the EIAR for details on the impact assessment methodology used in this EIAR (EPA, 2002 & 2003). In addition to the above methodology, the sensitivity of the water environment receptors was assessed on completion of the desk study and baseline study. Levels of sensitivity which are defined in Table 9-2 are then used to assess the potential effect that the proposed development may have on them.

Table 9-2: Receptor Sensitivity Criteria (Adapted from www.sepa.org.uk)

Sensitivity of Receptor	
Not sensitive	Receptor is of low environmental importance (e.g. surface water quality classified by EPA as A3 waters or seriously polluted), fish sporadically present or restricted). Heavily engineered or artificially modified and may dry up during summer months. Environmental equilibrium is stable and is resilient to changes which are considerably greater than natural fluctuations, without detriment to its present character. No abstractions for public or private water supplies. GSI groundwater vulnerability "Low" – "Medium" classification and "Poor" aquifer importance.
Sensitive	Receptor is of medium environmental importance or of regional value. Surface water quality classified by EPA as A2. Salmonid species may be present and may be locally important for fisheries. Abstractions for private water supplies. Environmental equilibrium copes well with all natural fluctuations but cannot absorb some changes greater than this without altering part of its present character. GSI groundwater vulnerability "High" classification and "Locally" important aquifer.
Very sensitive	Receptor is of high environmental importance or of national or international value i.e. NHA or SAC. Surface water quality classified by EPA as A1 and salmonid spawning grounds present. Abstractions for public drinking water supply. GSI groundwater vulnerability "Extreme" classification and "Regionally" important aquifer.

9.3.4 Limitations and Difficulties Encountered

No limitations or difficulties were encountered during the preparation of the Hydrology and Hydrogeology Chapter of the EIAR.

9.4 Receiving Environment

9.4.1 Site Description and Topography

9.4.1.1 Wind Farm Site

The proposed wind farm site ("the site") is located approximately 500m northeast of Lixnaw village, 7km southeast of the village of Ballyduff and 8.3km southwest of Listowel, Co. Kerry. The site has a total area of approximately 594 hectares and is located in the townlands of Ballynagare, Dysert Marshes and Dysert.

Much of the centre of the site is located on a peat bog which has historically been subject to peat harvesting. Narrow peat fields are orientated southwest to northeast towards the south of the bog area, and northwest to southeast in the north. The peat bog is surrounded by agricultural grasslands on all sides. Much of the east and south of the site comprises agricultural lands with fields separated by hedgerows and drains with occasional farmhouses located within the site boundary.

Topography at the site is generally flat and low-lying with ground elevations ranging from 0-5m OD (metres above Ordnance Datum). The site is located in the Tralee Bay Feale Catchment and is bordered by the Brick river to the west and the River Feale to the east. These two watercourses confluence to the north of the site, forming the Cashen River Estuary. The Lower River Shannon SAC is located immediately to the west, north and east of the site while the Cashen River Estuary pNHA is also located to the northeast of the site along the upper tidal reaches of the Feale River. Flood embankments have been installed along the Brick and Feale Rivers in the vicinity of the site.

Access to the site is via a local Ballynagare to Clahane road which dissects the southwest of the site before crossing the Brick River. The bog area of the site is accessible by various access tracks, which are used to facilitate local peat harvesting. These tracks branch off the local road and crosscut the bog area. The agricultural areas in the south and west of the site are accessed via access tracks from a farmyard.

9.4.1.2 Grid Connection Route

The proposed underground connection route to the Clahane 110kV substation is approximately 13.8km in length. The route travels from the existing quarry road, before veering northwards along the R557 for 2.7km where it turns to the southeast in the townland of Ballyhorgan East. The route then travels south along tertiary roads for 5.5km before turning west on the L1027 for 0.35km. The route then turns to the south in the townland of Lissahane, where it continues for 1.1km. The route joins the L6074 for 0.4km to Banemore Cross where it joins the N69. It then continues southwest for 0.45km before turning to the south along the entrance to Clahane substation. The topography of the route is relatively flat along public road networks with a notable increase in slope before it joins the L6074. The Ballynagare WF Grid Connection – Preliminary Route Development (2021) states that there are a total of 5 no. major watercourse crossings along this proposed grid connection route which may require Horizontal Direction Drilling (HDD).

9.4.2 Water Balance

Long term rainfall and evaporation data was sourced from Met Éireann. The long-term average rainfall (1981 - 2010) recorded at Ballyduff G.S., approximately 2km northwest of the site, is presented in Table 9-3.

Table 9-3 Local Average long-term Rainfall Data (mm)

Station		X-Coord		Y-Coord		Ht (MAOD)		Year Start		Year End		Total
Ballyduff G.S.		287000		134800		36.00		1941		N/A		
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Total
114	81	81	58	66	65	68	91	95	117	116	122	1,073

The closest synoptic station[1] where the average potential evapotranspiration (PE) is recorded is at Shannon Airport, approximately 50km to the northeast. The long-term average PE for this station is 543mm/yr. This value is used as a best estimate of the site PE. Actual Evaporation (AE) at the site is estimated as 516mm/yr (which is 0.95 × PE).

The effective rainfall (ER) represents the water available for runoff and groundwater recharge. The ER for the site is calculated as follows:

Effective rainfall (ER) = Average Annual Rainfall – AE

= 1,073 mm/yr – 516 mm/yr

ER = 557 mm/yr

[1] *A station at which meteorological observations are made for the purposes of synoptic (large spatial scale) analysis*

Based on the groundwater recharge coefficient of 4% for peat bogs at this site (www.gsi.ie), an estimate of 22.3 mm/year average annual recharge is given for cut over raised peat at the site. This means that the hydrology of the site is characterised by very high surface water runoff rates and very low groundwater recharge rates. Therefore, conservative annual recharge and runoff rates for the site are estimated to be 22.3mm/yr and 534.7mm/yr respectively.

Table 9-4 below presents return period rainfall depths for the area of the site. These data are taken from https://www.met.ie/climate/services/rainfall-return-periods and they provide rainfall depths for various storm durations and sample return periods (1-year, 50-year, 100-year). These extreme rainfall depths will be the basis of the proposed wind farm drainage hydraulic design as described further below.

Table 9-4: Return Period Rainfall Depths for the Wind Farm site

	Return Period (Years)			
Duration	1	5	30	100
5 min	3.5	5.6	9.2	12.5
15 mins	5.7	9.2	15.1	20.5
1 hour	9.7	14.8	22.8	29.8
6 hours	19.4	27.3	38.8	51.9
12 hours	25.4	34.6	47.7	58.1
24 hours	33.2	44.0	58.6	70.1
2 days	42.5	54.8	71.1	83.6

9.4.3 Regional Hydrology

9.4.3.1 Wind Farm Site

On a regional scale, the site is located in the Tralee Bay-Feale surface water catchment within Hydrometric Area 23. On a more local scale, the site is located in the Brick River surface water sub-catchment (Brick_SC_020).

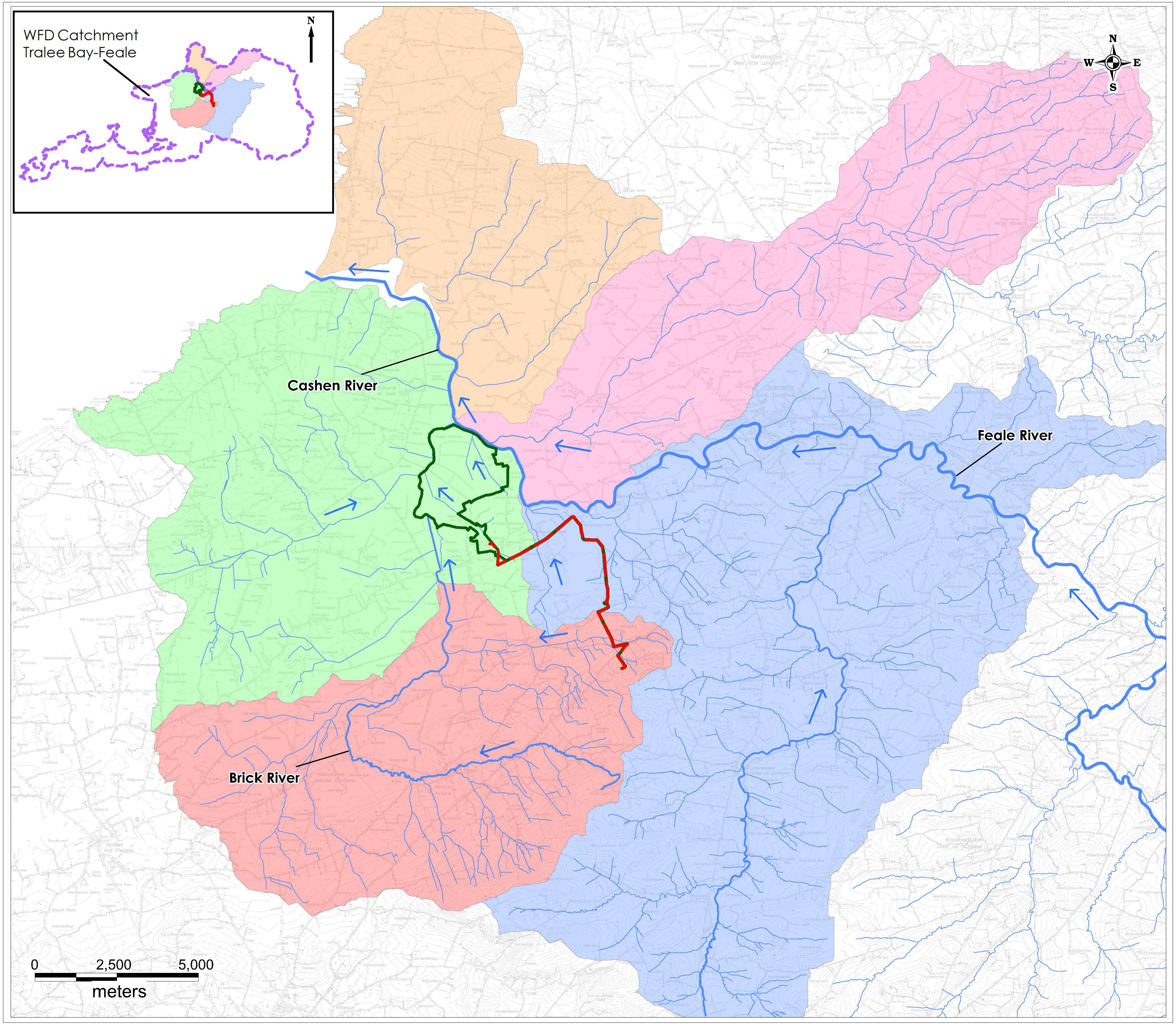
The Feale River (EPA Code: 23F01) forms the north-eastern boundary of the site. The Feale River rises near Rockchapel in the Mullaghareirk Mountains in north Co. Cork and flows to the northwest, through the town of Abbeyfeale, Co. Limerick. Along its route it is joined by several tributaries including the Clydagh, Owveg, Allaghaun and Oolagh Rivers. Closer to the site the Feale is joined by the Smearlagh River to the south of Listowel. The Smearlagh River drains the central and eastern parts of the Stack's Mountains. The Feale then flows westwards collecting from the River Galey to the north and the River Brick to the south. The Brick River (EPA Code: 23B03) forms the western boundary of the site. The Feale River is tidal in the vicinity of the site, referred to as the Upper Feale Estuary and the Cashen River Estuary upstream and downstream of its confluence with the Brick River respectively. The tidal influence extends upstream of the site as far as Finuge, located approximately 4km east of the site. The Cashen River Estuary discharges into the Mouth of the Shannon approximately 3km south of Ballybunnion and 6km northwest of the site.

9.4.3.2 Grid Connection Route

On a regional scale the proposed grid connection route is located in the Tralee Bay-Feale surface water catchment.

The grid connection route begins in the Brick River surface water sub-catchment (Brick_SC_020), and enters the Feale River surface water sub-catchment (Feale_SC_040) to the west of the site in the townland of Ballyhorgan. The grid route then veers to the south and enters the Brick River surface water sub-catchment (Brick_SC_010) in the townland of Lissahane.

A regional hydrology map for the wind farm site and the grid connection route is shown as Figure 9-1.



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Client: MKO	
Job: Ballynagare WF, Co. Kerry	
Title: Regional Hydrology Map	
Figure No: 9-1	
Drawing No: P1531-0-1021-A3-901-0A	
Sheet Size: A3	Project No: P1531-0
Scale: 1:110,000	Drawn By: GD
Date: 07/10/2021	Checked By: MG

9.4.4 Wind farm Site Drainage

On a more local scale, the south and centre of the site are mapped in the Brick_040 WFD River sub-basin (IE_SH_23B030700). In terms of key wind farm infrastructures: 5 no. turbines (T2, T4, T5, T6 & T7), the substation, the southern construction compound, borrow pit, met mast, the southern proposed peat repository and associated access roads are located in this WFD river sub-basin.

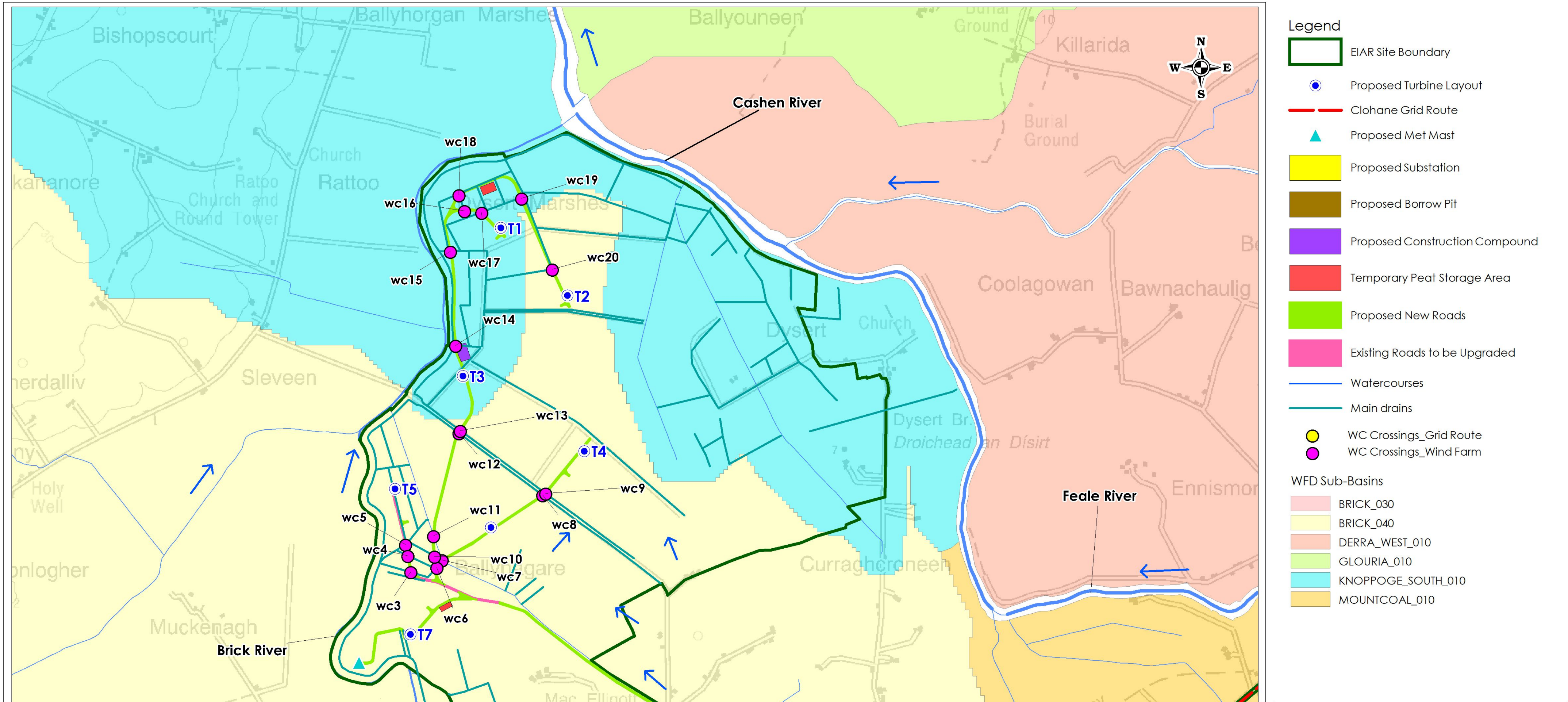
The EPA maps the Brick River to flow to the north, approximately 150m west of T5, 150m south of T7 and approximately 90m west of the proposed met mast. The EPA also maps a small stream/drain, referred to as Monument stream (EPA Code: 23M41), to dissect the western and southern sections of the site. The Monument stream flows to the northwest, approximately 60m east of the proposed substation location and adjacent and parallel to a proposed new access road for 1.8km. This stream then flows approximately 250m southwest of T6 and 90m east of T5 before discharging into the Brick River approximately 400m north of T5. The Brick River then continues to meander northwards before its confluence with the Feale River.

Meanwhile the northwest and east of the site are located in the Knoppoge_South_010 WFD River sub-basin (IE_SH_23K120820). In terms of key wind farm infrastructures, 2 no. turbines (T1 and T3), the northern temporary construction compound and the northern peat repository are mapped in this WFD river sub-basin. The EPA maps the presence of two streams/drains in the east of the site, referred to as the Dysert Marshes (EPA Code: 23D19) and Ballyouneen stream (EPA Code: 23B32). These drains flow to the north before discharging into the Feale River which flows approximately 60m northeast of the site. No wind farm infrastructures are located in the vicinity of these EPA mapped drains. Further west, the Brick River flows along the western boundary of the site, approximately 200m west of T3 and 400m west of T1. Table 9-5 presents a summary of the key proposed wind farm infrastructures and their respective WFD surface water catchments.

A local hydrology map for the site showing WFD river sub-basins is shown as Figure 9-2.

Table 9-5: Summary of Regional/Local hydrology & Proposed Windfarm Infrastructure

Regional Catchments	Sub-catchment	WFD River Sub-Basin	Main Development Infrastructure	Primary Waterbodies
Tralee Bay-Feale	Brick_SC_020	Brick_040	T2, T4, T5, T6, T7, substation, southern construction compound, southern peat repository, borrow pit & met mast	Brick River & Monument Stream
		Knoppoge_South_010	T1, T3, northern construction compound & northern peat repository	Brick and Feale Rivers



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Client: MKO

Job: Ballynagare WF, Co. Kerry

Title: Local Hydrology Map (WF)

Figure No: 9-2

Drawing No: P1531-0-1021-A3-902-0A

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Scale: 1:20,000	Drawn By: GD
Date: 18/10/2021	Checked By: MG

2 no. continuous water level loggers were installed in the main boundary drain (SW1) and on the Brick River (SW2), near the bridge to the southwest of T3, from the 13th April to the 12th July 2021. These continuous water levels are shown in Plate 9-1below, with Plate 9-2 showing continuous water levels for the first week in May 2021. The monitoring results showed a distinctive tidal regime, with two high and two low tides recorded each day. Greater water level fluctuations were recorded in the Brick River, with a maximum recorded water level of 2.05mOD and a minimum recorded water level of -0.47mOD. Meanwhile, smaller water level fluctuations were recorded in the drain, with a range of -0.28 to 0.25mOD.

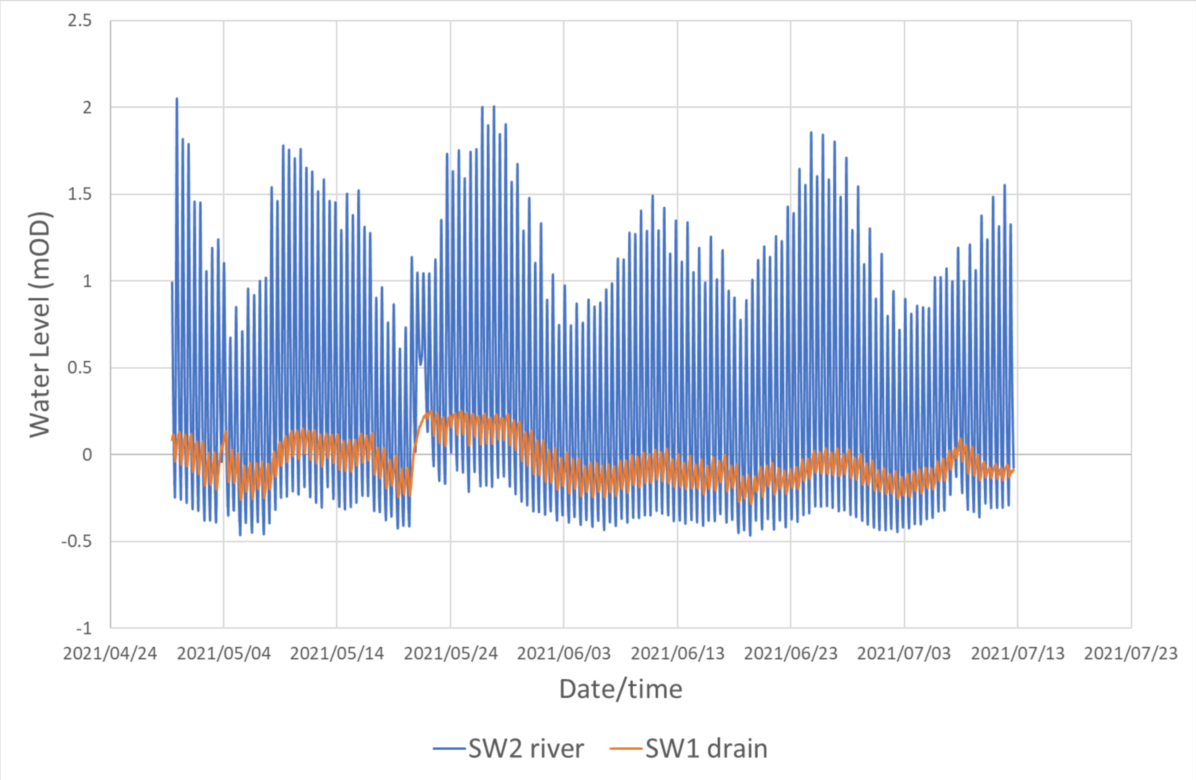


Plate 9-1: Continuous water level monitoring (April to July 2021)

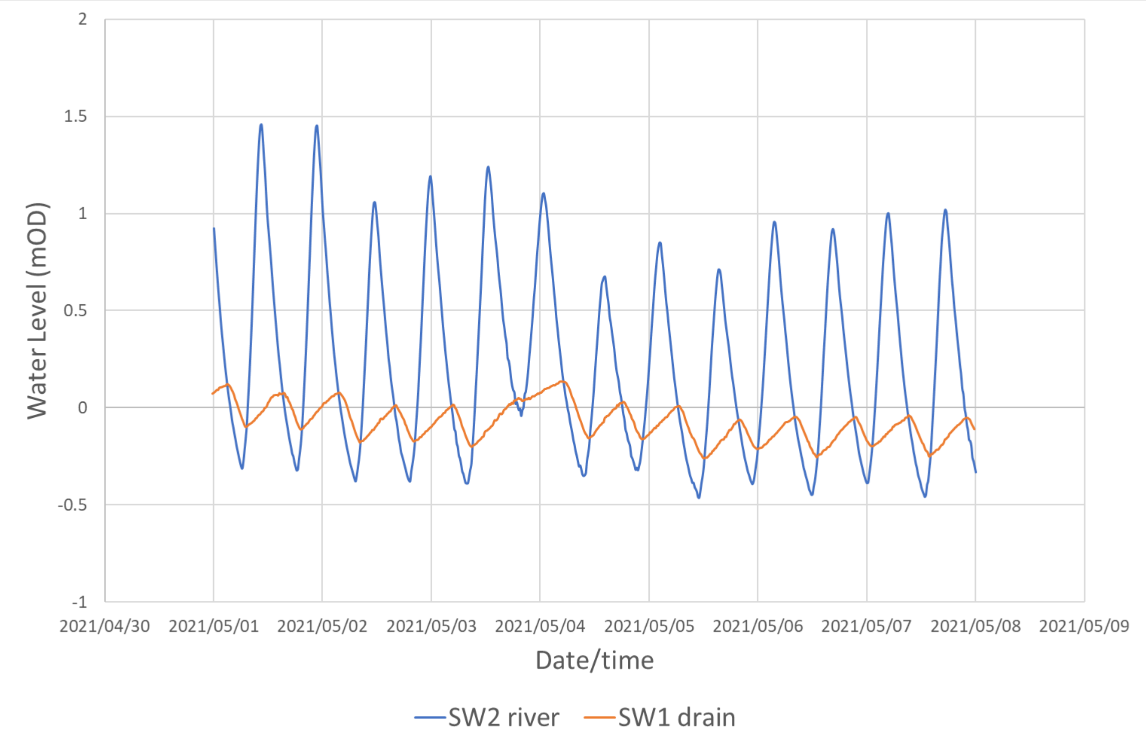


Plate 9-2: Selected continuous water levels (01/05/2021 – 08/05/2021)

As discussed, the majority of the site is located in a peat basin which has its own drainage system. Of the 7 no. turbines, 2 are located on agricultural land (T5 and T7) with the remainder within the peat bog. The format of the drainage system in the cutover bog is outlined below.

The surface of the cutover bog is drained by a network of field drains that are typically spaced every 15 to 20m along the boundary of existing and remnant peat cutting plots. These drains are orientated southwest to northeast in the south and centre of the site and in a northwest to southeast orientation towards the north. Surface water runoff collected in these drains is conveyed to larger main drains which typically run perpendicular to the smaller field drains and also along the edges of the internal bog track network. These main drains direct surface water to a boundary drain that outfalls via sluice gates to the bounding tidal rivers. There are 8 no. main outfalls to the west of the proposed wind farm site which discharge to the Brick River, with an additional 7 no. outfalls located along the Feale River (however no wind farm infrastructure is proposed in the area draining towards the Feale.

During site walkovers conducted on 1st July 2021, the parallel running bog field drains were noted to be relatively shallow and do not intercept the mineral subsoil underlying the peat. The larger main drains, including the Monument stream and the boundary drain were noted be significantly deeper.

In the southwest of the site, T5 and T7 are located on agricultural grasslands. Drainage in these agricultural areas is via drains along field boundaries which discharge into the boundary drain running parallel with the embankment.

The proposed site access roads are mapped to cross several drains within the site.

9.4.5 Grid Connection Route Drainage

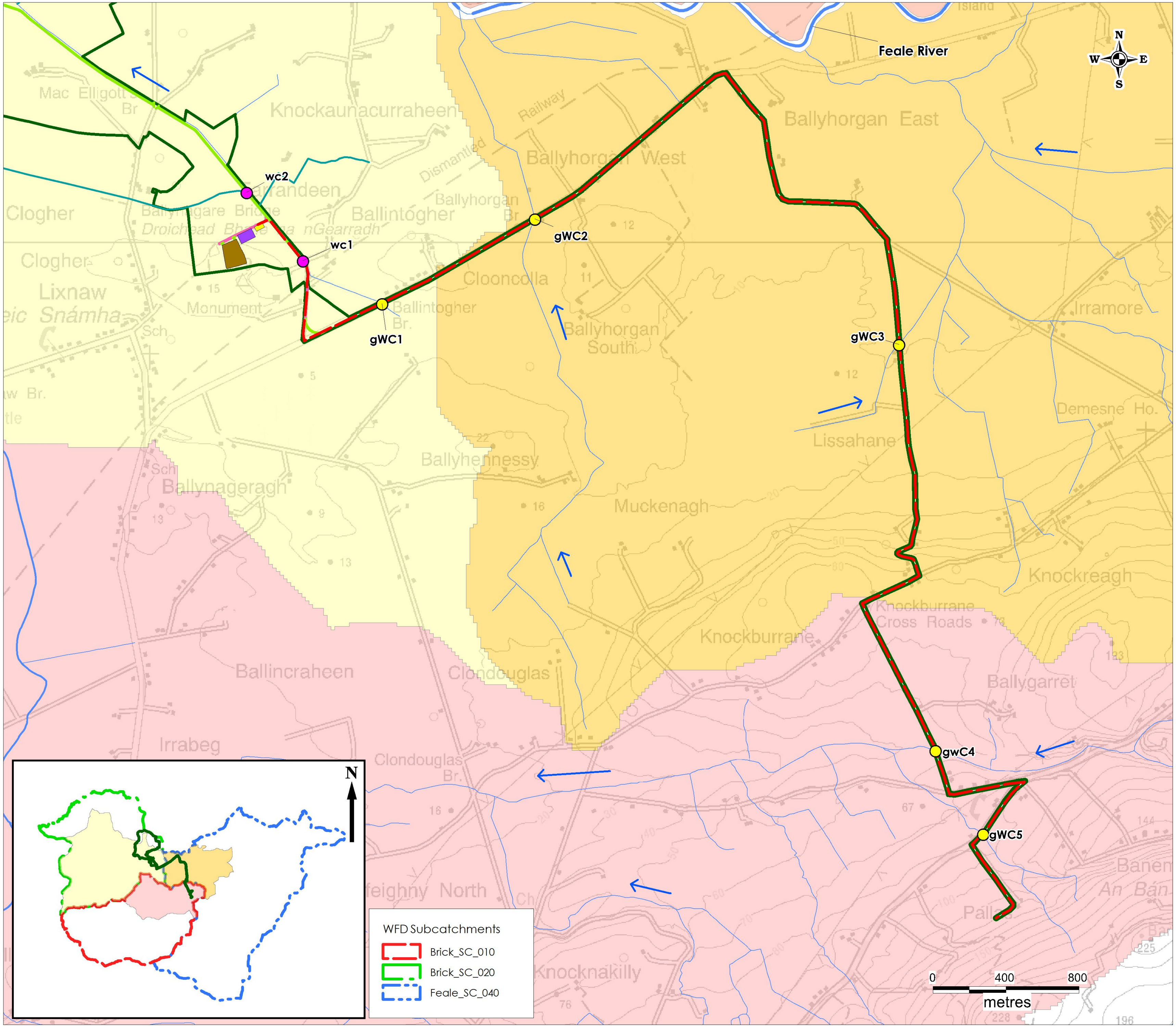
As stated above the grid connection route is located in the Brick River surface water sub-catchment (Brick_SC_020). In the vicinity of the site, the grid route is located in the Brick_040 WFD River sub-basin, with the grid route mapped to cross the Monument stream (EPA Code: 23M41) along the R557. Further east in the townlands of Ballyhorgan West, Ballyhorgan East and south to Lissahane, the route is mapped in the Feale River surface water sub-catchment (Feale_SC_040) and the Mountcoal_010 WFD River sub-basin. Here surface water flows northwards towards the Feale River, with the grid route crossing the Ballyhennessy stream in the west and the Lissahane stream, a tributary of the Mountcoal River, further east. Finally in the townlands of Ballygarret, Banemore and in the vicinity of Clahane 110kV substation the route is located in the Brick River surface water sub-catchment (Brick_SC_010) and the Brick_030 WFD River sub-basin. In this region, drainage is directed to the west towards the Brick River. The grid route is mapped to cross both the Knockburrane stream (EPA Code: 23K73) and the Pallas stream (EPA Code: 23P07).

The drainage density along the proposed grid connection route is relatively high. According to EPA mapping, there are a total of 5 no. main watercourse crossings along this route which are listed in Table 9-6 below. All crossings will be in the carriageway of existing public roads.

A local hydrology map for the grid route showing WFD river sub-basins and watercourse crossings is shown as Figure 9-3. A local hydrology map for the wind farm site is shown as Figure 9-4.

Table 9-6 : Summary of Grid Option A1 watercourse crossings.

WFD Sub-catchment	WRD River Sub-basin	EPA Name	EPA Code	Road Crossing
Brick_SC_020	Brick_040	Monument	23M41	Along R557
Feale_SC_040	Mountcoal_010	Ballyhennessy	23B12	Along R557
Feale_SC_040	Mountcoal_010	Lissahane	23L09	Small Tertiary Road
Brick_SC_010	Brick_030	Knockburrane	23K73	Before junction with L6074
Brick_SC_010	Brick_030	Pallas	23P07	Along N69



Legend

- EIAR Site Boundary
- Clohane Grid Route
- Proposed Substation
- Proposed Borrow Pit
- Proposed Construction Compound
- Proposed New Roads
- Existing Roads to be Upgraded
- Watercourses
- Main drains
- WC Crossings_Grid Route
- WC Crossings_Wind Farm

WFD Sub-Basins

- BRICK_030
- BRICK_040
- MOUNTCOAL_010

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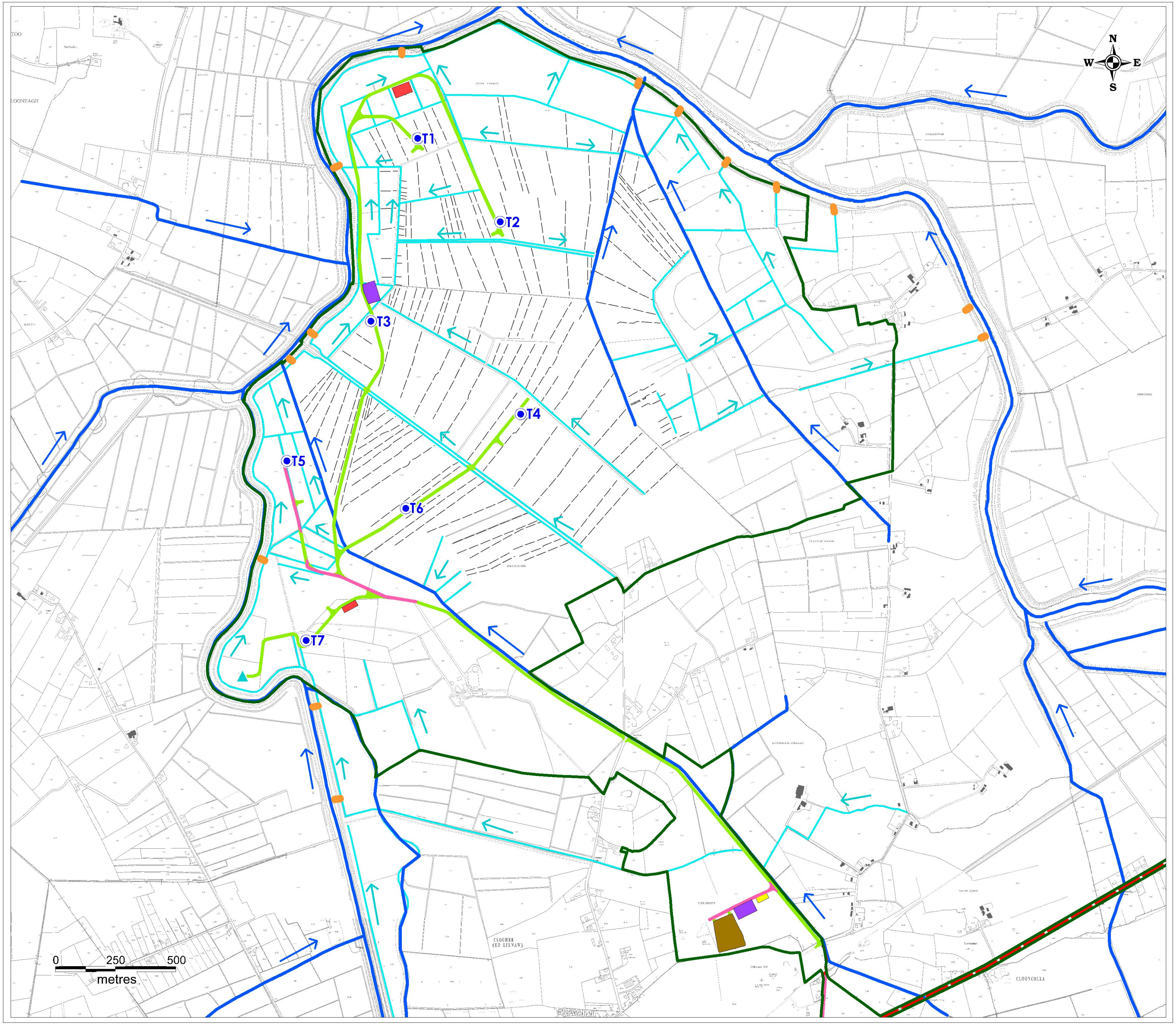
Client: MKO	
Job: Ballynagare WF, Co. Kerry	
Title: Local Hydrology Map (GR)	
Figure No: 9-3	
Drawing No: P1531-0-1021-A3-902-0A	
Sheet Size: A3	Project No: P1531-0
Scale: 1:20,000	Drawn By: GD
Date: 07/10/2021	Checked By: MG



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Clohane Grid Route
- Proposed Met Mast
- Proposed Substation
- Proposed Borrow Pit
- Proposed Construction Compound
- Existing Roads to be Upgraded
- Proposed New Roads
- Temporary Peat Storage Area
- Watercourses
- Main Drains
- Field Drains
- Outfall

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Client: MKO	
Job: Ballynagare WF, Co. Kerry	
Title: Site Drainage Map	
Figure No: 9-4	
Drawing No: P1531-0-1021-A3-904-0A	
Sheet Size: A3	Project No: P1531-0
Scale: 1:15,000	Drawn By: GD
Date: 18/10/2021	Checked By: MG

9.4.6 Baseline Assessment of Site Runoff

This section undertakes a long-term water balance assessment and surface water runoff assessment for the baseline conditions at the site.

The rainfall depths used in this water balance, long term averages, are not used in the design of the sustainable drainage system for the wind farm.

The water balance calculations are carried out for the month with the highest average recorded rainfall minus evapotranspiration, for the current baseline site conditions (Table 9-7). It represents therefore, the long-term average wettest monthly scenario in terms of volumes of surface water runoff from the site pre-wind farm development. The surface water runoff co-efficient for the site is estimated to be 96% based on the predominant peat coverage.

The highest long term average monthly rainfall recorded at Ballyduff G.S. is in December, at 122mm. The average monthly evapotranspiration for the synoptic station at Shannon Airport over the same period in December was 3.1mm. The water balance indicates that a conservative estimate of surface water runoff for the site during the highest rainfall month is 678,942m^3/month or 21,901m^3/day for the proposed wind farm site (Table 9-8).

Table 9-7: Water Balance and Baseline Runoff Estimates for Wettest Month (December)

Water Balance Component	Depth (m)
Average December Rainfall (R)	0.122
Average December Potential Evapotranspiration (PE)	0.0031
Average December Actual Evapotranspiration (AE = PE x 0.95)	0.00295
Effective Rainfall December (ER = R - AE)	0.1191
Recharge (4% of ER)	0.00476
Runoff (96% of ER)	0.1143

Table 9-8: Baseline Runoff for the Wind farm Site

Approx. Area (ha)	Baseline Runoff per month (m3)	Baseline Runoff per day (m3)
594	678,942	21,901

9.4.7 Flood Risk Assessment

9.4.7.1 Wind Farm Site & Grid Connection Routes

A Flood Risk Assessment of the site has been carried out by HES, the results of which are presented in full in Appendix 9-1 of this EIAR. To identify those areas as being at risk of flooding, OPW's indicative river and coastal flood map (www.floodmaps.ie), CFRAM Preliminary Flood Risk Assessment (PFRA) maps (www.cfram.ie), historical mapping (i.e. 6" and 25" base maps) and the Irish Coastal Protection Strategy Study (ICPSS) maps were consulted.

Several recurring flood incidents and historic flood events are recorded in the vicinity of the site. A recurring flood event associated with tidal flooding on the Feale River is mapped approximately 1km north of the site at Ballyhorgan. A significant flood event in this region dates from 1998, with widespread flooding on the Brick and Feale Rivers which encroached upon the area of the site. No historic or recurring flood instances are located on grid route to Clahane substation.

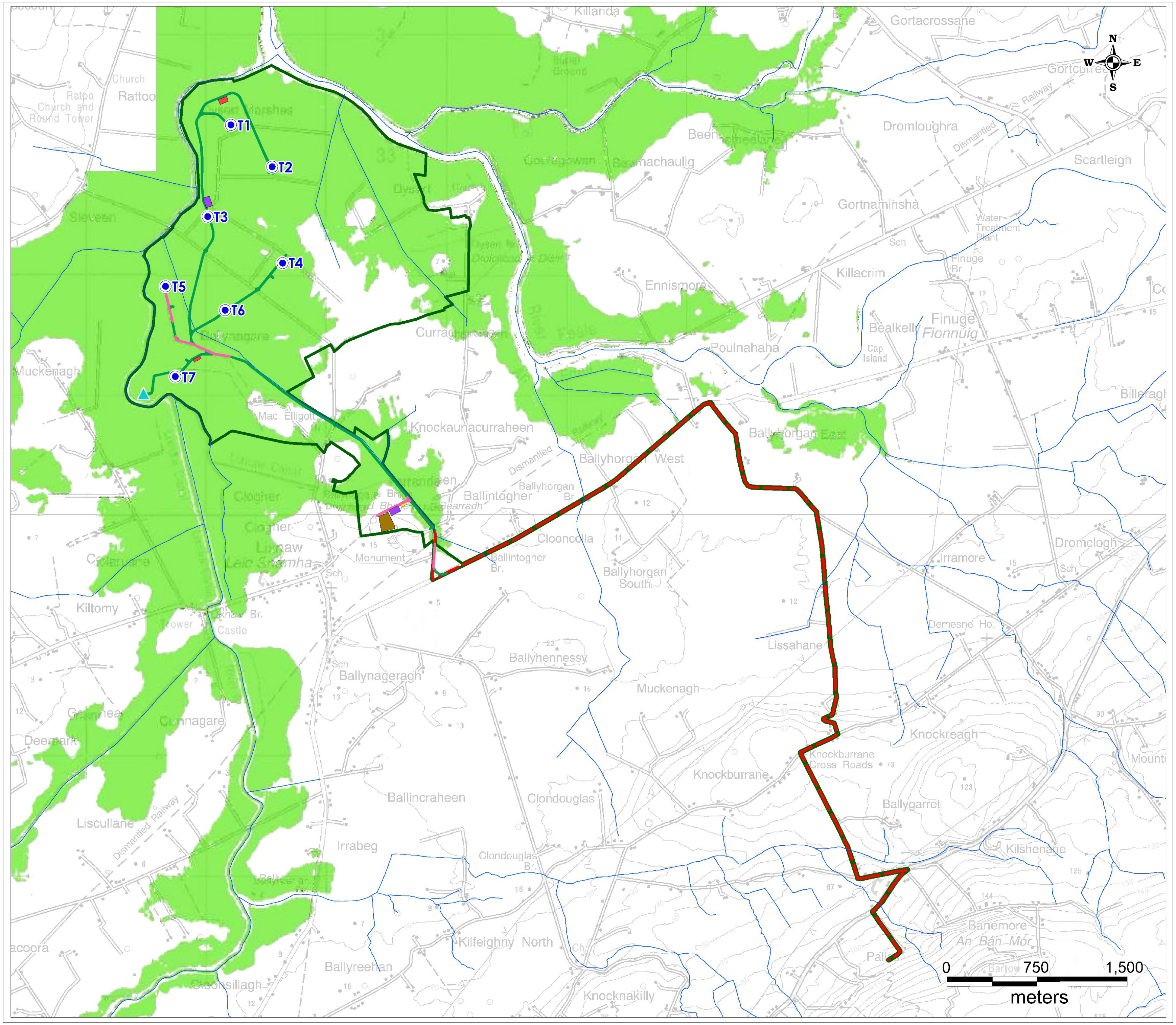
The land on the banks of the Brick and Feale rivers and within the site are mapped as "Benefiting Lands". Benefiting lands are a dataset prepared by the Office of Public Works which identifies land that might benefit from the implementation of Arterial (Major) Drainage Schemes (under the Arterial Drainage Act 1945, as amended) and indicates lands which are subject to flooding or poor drainage. The OPW drainage maps show several drains within the site. Flood defences in the form of embankments running along the Brick and Feale rivers have been erected to prevent floodwaters entering the site. The drainage network described in Section 9.4.4 removes rainfall from the land behind these embankments. In terms of the grid route, the area of the proposed Ballynagare substation and a small section of the R557 near Ballyhorgan west are mapped as Benefited lands.

CFRAM mapping indicates that the site and grid connection route are situated outside the extents of the indicative 1 in 1,000-year fluvial (i.e. river) and coastal (i.e. tidal) food zones. The flood maps suggest that coastal/tidal flooding is widespread within the Cashen River Estuary. The coastal flood zones are mapped on the riverbanks/floodplain opposite the site, to the north and east of the River Feale and to the west of the River Brick. This CFRAM mapping considers the flood defences with preferential flooding to the north. However, the OPW guidelines (2009) state that "the presence of flood protection structures should be ignored in determining flood zones".

The ICPSS (Irish Coastal Protection Strategy Study) flood maps do not consider the presence of the embankments in their flood modelling. These maps show that the majority of the site is located within the 1 in 200-year coastal flood zone. The modelled water level associated with such a flood event is 3.28mOD (0.5% AEP elevation) and would result in flood depths in excess of 1m across much of the site. The ICPSS flood map for the site is shown as Figure 9-5.

Under current conditions the primary potential source of flooding at the site is pluvial as the site is surrounded by flood defences which protect it from coastal flooding. Pluvial flooding is likely after heavy or prolonged periods of rainfall. However, if the flood embankments were to fail then the site would also be at risk from coastal flooding.

Within the flood risk assessment (see Appendix 9-1), a justification test has been completed. The flood risk has been assessed based on the normal defended scenario and in the case of an extreme undefended scenario (where the flood embankments are breeched). Flood resilience measures are proposed which include a custom design of the turbine interior where the sensitive turbine elements will be placed on a platform at an elevation in excess of 7m above ground level and above any future flood level. Other elements of the development are less sensitive to flooding, and infrequent flooding will not effect the maintenance or management of the wind farm. A volume displacement analysis has demonstrated that the potential presence of the wind farm footprint will have a negligible impact on flood water depths under normal conditions or in the extreme coastal flood scenario.



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Clohane Grid Route
- Proposed Met Mast
- Proposed Substation
- Proposed Borrow Pit
- Proposed Construction Compound
- Existing Roads to be Upgraded
- Proposed New Roads
- Temporary Peat Storage Area
- Watercourses
- 0.5% AEP Flood Extent (200 years)
- 0.1% AEP Flood Extent (1000 years)

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Client: MKO	
Job: Ballynagare WF, Co. Kerry	
Title: ICPSS Flood Map	
Figure No: 9-5	
Drawing No: P1531-0-1021-A3-905-0A	
Sheet Size: A3	Project No: P1531-0
Scale: 1:30,000	Drawn By: GD
Date: 18/10/2021	Checked By: MG

9.4.8 Surface Water Hydrochemistry

9.4.8.1 Wind Farm Site

Biological Q-rating data for EPA monitoring points on the Brick and Feale Rivers are shown on Table 9-9 below. The Q-Rating is a water quality rating system based on both the habitat and the invertebrate community assessment and is divided into status categories ranging from 0-1 (Poor) to 4-5 (Good/High).

No Q-ratings are directly available for any streams/drains within the site. Similarly no Q-ratings are available for the Brick or Feale Rivers in the vicinity of the site. The closest EPA monitoring point on the Brick River is located approximately 5km to the southwest and upstream of the site at a bridge west of Garrynagore, 3.5km northeast of the small village of Abbeydorney. Here the Brick River achieved a Q-rating of Q3-4 (2020) and is classified as being of Moderate status. The closest EPA monitoring point on the Feale River is located at Finuge bridge, approximately 4km east and upstream of the site. Here the Feale River has been assigned a Q-rating of Q3-4 ('Moderate' status). No biological Q-rating data is available downstream of the site due to the estuarine nature of the waters.

Table 9-9: EPA Q-rating Scores for waterbodies upstream of Wind Farm Site

Station Code	Station Name	River Waterbody	Year	Q-Rating
RS23B030400	Bridge W of Garrynagore	Brick_020	2020	Q3-4
RS23F010800	Finuge Bridge	Feale_090	2020	Q3-4

Field hydrochemistry measurements of unstable parameters, electrical conductivity (µS/cm), pH (pH units) and temperature (°C) were taken at the surface water sampling locations SW1 (drain) and SW2 (Brick River) in the vicinity of the site on 1st July 2021 and on 13th July 2021. These data are presented in Table 9-10*Table 9-10* below.

Electrical conductivity values for the drain ranged between 251 - 15,427µS/cm. pH values were recorded as being slightly acidic. Electrical conductivity values for the Brick River ranged from 719 – 77,412µS/cm, while the pH was recorded as being slightly basic. Turbidity ranged from 6.7 FNU in the Brick River to 8.4 FNU in the boundary drain on the 1st July 2021.

Grab sampling was also completed on 1st July and 13th July 2021 and results for the site (SW1 and SW2) are shown below in Table 9-11 below alongside relevant EQS values for surface water. The locations of the sampling points are shown on Figure 9-6.

Table 9-10: Field Hydrochemistry Range of Measurements (Windfarm)

Location	Waterbody	EC (µS/cm)	pH [H+]	Temperature (^{0}C)	Turbidity (FTU)
SW1	Boundary drain	251 - 15,427	6.6 - 6.8	17.9 - 18	8.4
SW2	Brick River	719 - 77,412	6.6 - 8.6	17.9 - 19	6.7

Table 9-11: Surface Water Sampling Results (Windfarm)

Parameter	EQS	Sample ID			
		SW1 R1	SW1 R2	SW2 R1	SW2 R2
Total Suspended Solids (mg/L)	25 (+)	64	27	90	20
Ammonia (mg/L)	≤0.065 to ≤ 0.04(*)	0.49	<0.02	0.33	0.15
Nitrate NO3 (mg/L)	-	<5	<5	<5	<5
Nitrite NO2 (mg/L)	-	<0.05	<0.05	<0.05	<0.05
Ortho-Phosphate P (mg/L)	≤ 0.035 to ≤0.025(*)	0.03	0.05	<0.02	0.06
Nitrogen (mg/L)	-	<1	1.9	<1	2.5
Phosphorous (mg/L)	-	0.14	0.2	0.1	0.17
Chloride (mg/L)	-	5582.1	60.6	9919.4	226.8
BOD	≤ 1.3 to ≤ 1.5(*)	4	6	16	2

R1 – 1st July and R2 – 13th July 2021

(+) S.I. No. 293 of 1988: Quality of Salmon Water Regulations.

(*) S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended.

Total suspended solids ranged between 20 – 90mg/L. Ammonia ranged between <0.02 and 0.49mg/L with most results being above the "Good Status" threshold with respect to the Surface Water Regulations (S.I. 272 of 2009). The EPA states that when present in levels above 0.1mg/L it may be indicative of sewage or industrial contamination.

Results for nitrate and nitrite were at or below the detection limit of the laboratory while orthophosphate ranged between <0.02 – 0.06mg/L.

BOD was reported to range from 2 -16 with all results above the "Good Status" threshold. The high BOD results recorded during this monitoring campaign is likely to be a result of organic pollution from agricultural runoff.

Chloride concentrations ranged from 60.6 – 9,919.4mg/L. These elevated chloride levels would be expected due to the site's proximity to the Cashen River Estuary and the tidal influence which this has on nearby surface waters. However the elevated chloride concentrations may also indicate some local pollution as the WFD state that this surface waterbody is under pressure from several stresses including agricultural activities and urban wastewater (refer to Section 9.4.14.1).

9.4.8.2 Grid Connection Route

Biological Q-rating data for EPA monitoring points on the Brick and Feale Rivers in the vicinity of the proposed grid route are shown on Table 9-12 below. Most recent data available (2020) shows that the Q-rating for the Brick River and Feale Rivers ranges from 'Poor' to 'High' status upstream of the of the proposed grid connection route. There are no EPA monitoring points located downstream of the proposed grid connection route.

Similar to the site above the closest monitoring point on the Brick River is located at the bridge west of Garrynagore, where the Brick River is reported as being of 'Moderate' status (Q3-4). Further upstream at Shannow Bridge and a bridge east of Milltown house near Abbeydorney, the Brick River also achieved a Q-ratings of Q3-4 in 2020.

To the east and upstream of the grid route the Feale River achieved a Q-rating of Q5 ('High' status) at Trienearagh, south of Listowel. Further downstream in Listowel the Feale River achieved a Q-rating of Q4 ('Good' status) near the Racecourse Footbridge. Meanwhile at Finuge Bridge, approximately 4km east of the proposed site, the Feale River has been assigned a Q-rating of Q3-4 ('Moderate' status).

Table 9-12:EPA Water Quality Monitoring Q-Rating Values (Grid Route)

Station Code	Station Name	River Waterbody	Year	Q-Rating
RS23F010550	Trienearagh	Feale_070	2020	Q4-5
RS23F010725	0.1km d/s Racecourse Footbridge	Feale_090	2020	Q4
RS23F010800	Finuge Bridge	Feale_090	2020	Q3-4
RS23B030300	Shannow Bridge	Brick_010	2020	Q3-4
RS23M040100	Bridge E of Milltown House	Brick_020	2020	Q3-4
RS23B030400	Bridge W of Garrynagore	Brick_020	2020	Q3-4

Field hydrochemistry measurements of unstable parameters, electrical conductivity (µS/cm), pH (pH units) and temperature (°C) were taken at the surface water sampling locations SW3, SW4 and SW5 along the proposed grid route on 1st July and 13th July 2021. SW3 is located at the proposed grid route crossing of the Ballyhennessy stream on the R557. SW4 is located where the route is proposed to cross the Knockburrane Stream. SW5 is located on one of the major tributaries of the Feale River, the Smearlagh River. These data are presented in Table 9-13 below.

Electrical conductivity values for these watercourses ranged from 77µS/cm to 479µS/cm. pH values were all neutral to slightly basic, ranging from 7.2 to 7.8. Turbidity recorded on the 1st July 2021 ranged from

30 FNU in the Ballyhennessy stream to less than 2 FNU in both the Knockburrane stream and the Smearlagh River.

Grab sampling was also completed on 1st July and 13th July 2021 and results for watercourse along the proposed grid routes (SW3, SW4 and SW5) are shown in Table 9-14 below. The locations of the sampling points are shown on Figure 9-6.

Table 9-13: Field Hydrochemistry Range of Measurements (Grid Route)

Location	Waterbody	EC (µS/cm)	pH [H+]	Temperature (⁰C)	Turbidity (NTU)
SW3	Ballyhennessy stream	77 – 434.6	7.6 - 7.7	15 – 19.2	30.6
SW4	Knockburrane stream	375 - 479	7.2 - 7.7	14 – 16.7	1.9
SW5	Smearlagh River	78 - 151	7.5 - 7.8	15.4 - 17	1.3

Table 9-14: Surface Water Sampling Results (Grid Route)

Parameter	EQS	Sample ID		
		SW3 Range	SW4 Range	SW5 Range
Total Suspended Solids (mg/L)	25 (+)	12 - 14	<5 - <10	<5 - <10
Ammonia (mg/L)	≤0.065 to ≤ 0.04(*)	0.06 - 3.73	<0.02 – 0.04	<0.02 - 0.02
Nitrate NO3 (mg/L)	-	<5	<5 – 5.9	<5
Nitrite NO2 (mg/L)	-	<0.05 – 0.06	<0.05	<0.05
Ortho-Phosphate P (mg/L)	≤ 0.035 to ≤0.025(*)	0.6 - 0.11	0.02 – 0.04	<0.02
Nitrogen (mg/L)	-	2.9 – 3.1	1.6 - 2.2	<1 - 1.5
Phosphorous (mg/L)	-	0.25 – 0.6	<0.1	<0.1
Chloride (mg/L)	-	33.5 - 46.1	25.6 - 37	9.7 - 17.5

Parameter	EQS	Sample ID		
		SW3 Range	SW4 Range	SW5 Range
BOD	≤ 1.3 to ≤ 1.5(*)	2 - 4	<1 - 2	1

R1 – 1st July and R2 – 13th July 2021

(+) S.I. No. 293 of 1988: Quality of Salmon Water Regulations.

(*) S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended.

Total suspended solids ranged between <5 – 14mg/L. Results for nitrate and nitrite were at or below the detection limit of the laboratory while orthophosphate ranged between <0.02 – 0.06mg/L.

Ammonia ranged between <0.02 and 3.73mg/L with both the Smearlagh River and the Knockburrane stream being of "High Status". Results for the Ballyhennessy stream were above the "Good Status" threshold with respect to the Surface Water Regulations (S.I. 272 of 2009).

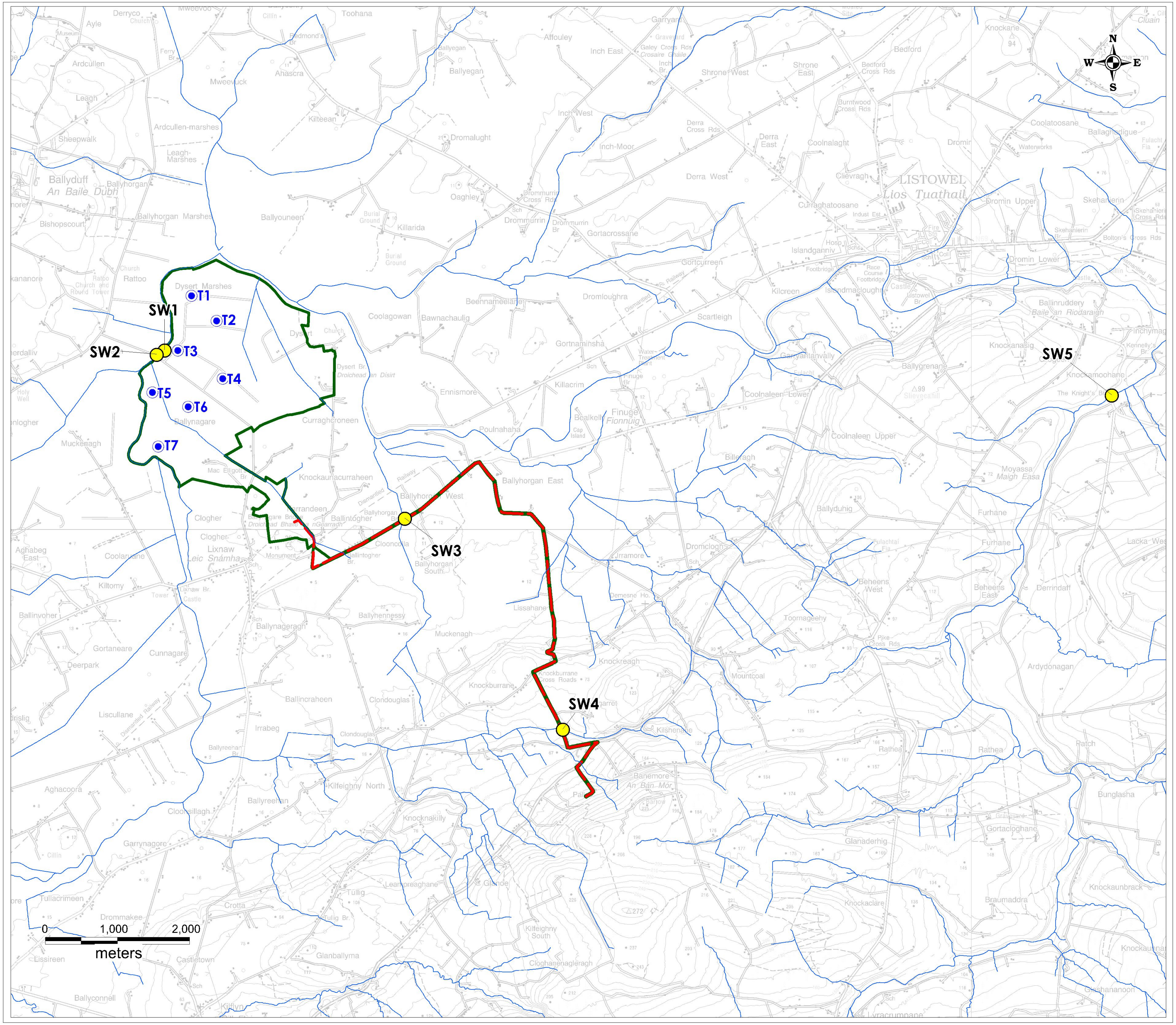
BOD was reported to range from <1 – 4. Results for the Smearlagh River were of "High Status", while results for the Knockburrane stream were above the "Good Status" threshold.

Chloride concentrations ranged from 17.5 – 46.1mg/L. Such chloride concentrations generally fall within the natural levels in rivers and freshwater and are far below the drinking water standards (less than 250mg/L).

*Table 9-15: Chemical Conditions Supporting Biological Elements**

Parameter	Threshold Values (mg/L)
BOD	High status ≤ 1.3 (mean)
	Good status ≤ 1.5 mean
Ammonia-N	High status ≤ 0.04 (mean)
	Good status ≤0.065 (mean)
Orthophosphate	High status ≤0.025 (mean)
	Good status ≤0.035 (mean)

* S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended by S.I. No. 296/2009; S.I. No. 386/2015; S.I. No. 327/2012; and S.I. No. 77/2019 and giving effect to Directive 2008/105/EC on environmental quality standards in the field of water policy and Directive 2000/60/EC establishing a framework for Community action in the field of water policy).



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Clohane Grid Route
- Watercourses
- SW Sampling locations

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Client: MKO	
Job: Ballynagare WF, Co. Kerry	
Title: SW Sampling Location Map	
Figure No: 9-6	
Drawing No: P1531-0-1021-A3-906-0A	
Sheet Size: A3	Project No: P1531-0
Scale: 1:50,000	Drawn By: GD
Date: 07/10/2021	Checked By: MG

9.4.9 Regional Hydrogeology

9.4.9.1 Wind Farm Site

The Dinantian Sandstones, Shales and Limestones (DESS) of the Lower Limestone Shale formation which underlie the northwestern corner of the site are classified by the GSI as a Poor aquifer – Bedrock which is Generally Unproductive except for Local Zones (Pl). Further south, the Dinantian Lower Impure Limestones (DLIL) of the Ballysteen Formation, are classified as a Locally Important Aquifer – Bedrock which is moderately Productive only in Local Zones (Ll). Meanwhile the Dinantian Pure Unbedded Limestones (DPUL) of the Waulsortian Limestone Formation, which underlie the south and east of the site, are classified as a Regionally Important Aquifer – Karstified (diffuse) (Rkd).

According to the EPA, the north and west of the site is underlain by the Kerry Head Groundwater Body (GWB) (WFD Code: IE_SH_G_118), which is classified as poorly productive bedrock (PP). The Kerry Head GWB occupies the uplands and slopes of Kerry Head, with the site located at its northeastern boundary. The western margins of the GWB are underlain by Devonian Old Red Sandstones which form high cliffs, with the lowest ground located in the south and east, underlain by muddy and impure limestones. Transmissivities in the old red sandstone and lower impure limestone aquifers are reported to be in the range of 2 – 20m^3/day, with aquifer storativity low in all rock units. Localized zones of enhanced permeability can occur along fracture zones. The GSI state that the GWB is overlain sandstone till and cutover peat, with subsoil thicknesses ranging from 3m in the uplands to >20m on lower ground. Recharge occurs diffusely through these subsoils. Groundwater flow will follow local topography, with flows concentrated in the upper 15m of the aquifer. Groundwater will have short flow paths and be rapidly discharged to numerous surface watercourses which cross the aquifer and flow to the Cashen River Estuary. Groundwater levels are generally 4 - 10m below ground level but closer to the surface near the Cashen River Estuary. A small volume of groundwater may flow into the Ballybunnion GWB located further to the east (GSI, 2004).

The Ballybunnion GWB, (WFD Code: IE_SH_G_027) which underlies the south and east of the site, is hosted within the Waulsortian Limestones. No GSI Characterization report is available for this GWB. However the GWB is characterised as being Karstic (KA) in nature. Karstification refers to the development of enlarged conduits which form along faults, bedding planes or fractures due to dissolution of the limestone bedrock. Groundwater will therefore flow along these preferential flowpaths. Transmissivity in the pure unbedded limestones can range up to several thousand m^2/day (GSI, 2004). Most groundwater flow is likely to occur in the epikarst layer at the top of the aquifer and in zones of interconnected fissures and conduits. The GSI characterization report for the Kerry Head GWB states that while its groundwater discharges to the Cashen Estuary, it does so in small volumes compared with that from the Ballybunnion GWB.

In terms of key wind farm infrastructures, T1, T2, T3, T5, the northern construction compound and the northern peat repository are underlain by the poorly productive Kerry Head GWB. All remaining infrastructures (T4, T6, T7, southern construction compound, southern peat repository, borrow pit, and substation) are underlain by the karstic Ballybunnion GWB.

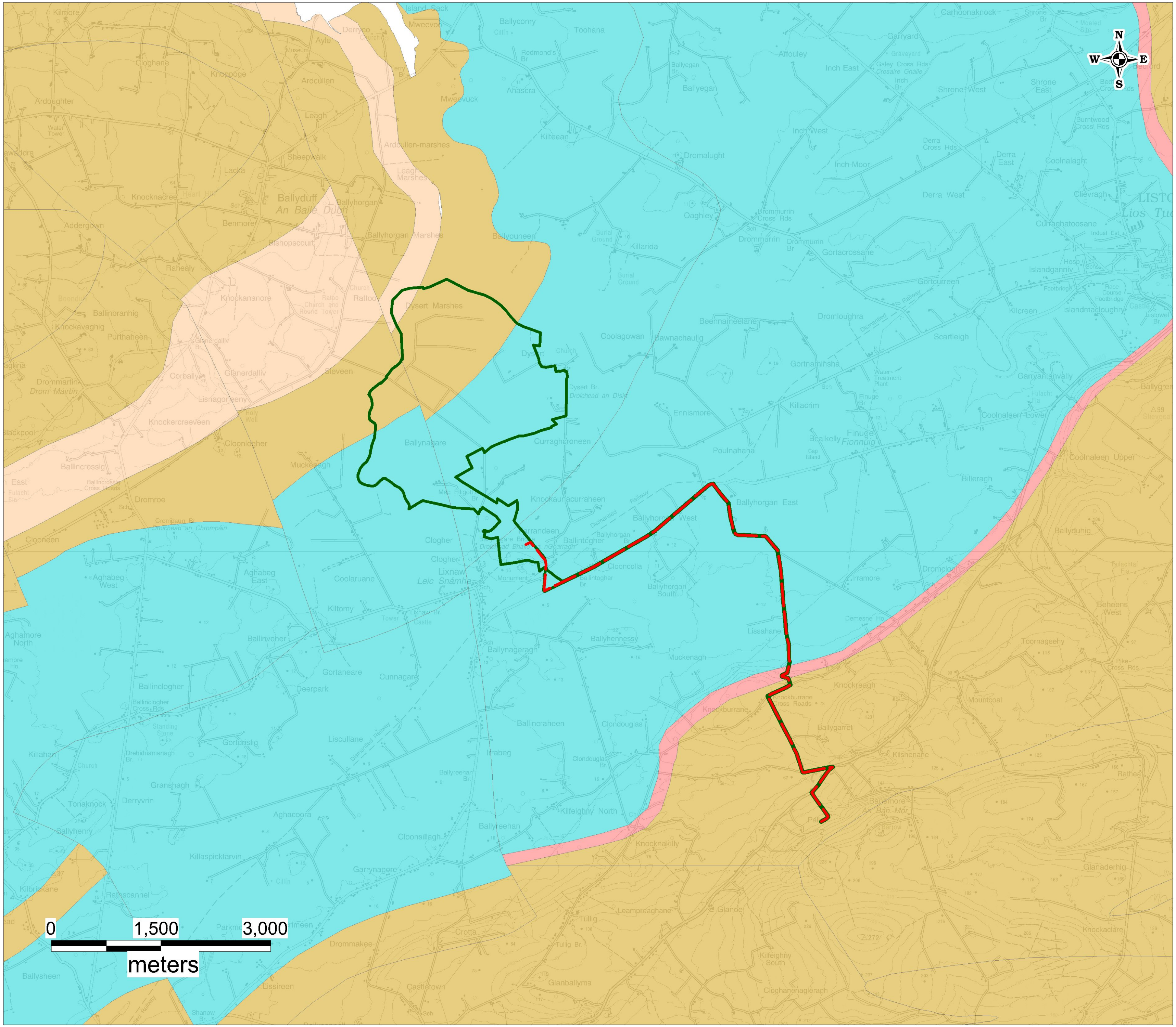
9.4.9.2 Grid Connection Route

In the vicinity of the site, the proposed grid route is underlain by Dinantian Pure Unbedded Limestones (DPUL) of the Waulsortian Limestone Formation, which are classified as a Regionally Important Aquifer – Karstified (diffuse) (Rkd). Further to the southeast, the Namurian Shales (NSH) of the Clare Shale Formation are classified as a Poor Aquifer – Bedrock which is Generally Unproductive (Pu). The southern section of the grid route is underlain by the Namurian Undifferentiated (Nu) rocks of the Shannon Group are classified as a Locally Important Aquifer – Bedrock which is Moderately Productive only in Local Zones.

The grid route is underlain by the Ballybunnion GWB, as described above, from the site as far as the townland of Lissahane. The southern section of the route is mapped to be underlain by the Abbeyfeale GWB (WFD Code: IE_SH_G_001).

The Abbeyfeale GWB is classified by the GSI as comprising poorly productive bedrock (PP). Topography in this GWB is generally hilly and dissected by numerous rivers and streams. The GWB is composed of low permeability rocks although zones of greater permeability may occur along fractures and faults. Transmissivity is in the range of 2 – 20m^2/day while aquifer storativity is low. Groundwater flow is primarily in the upper weathered zone of the aquifer and in deeper fracture zones. The water table ranges from 0 – 6m below ground level and follows the surface topography. Groundwater flow paths are typically short while deep confined flow paths may be longer. Dry weather flows are generally low indicating the low storativity of this aquifer. Groundwater discharges to nearby surface water streams, with the overall flow direction being to the west.

The bedrock aquifer map for the wind farm site and the grid route is shown as Figure 9-7.



Legend

EIAR Site Boundary

Clohane Grid Route

Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones

Poor Aquifer - Bedrock which is Generally Unproductive

Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones

Regionally Important Aquifer - Karstified (diffuse)

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Client: MKO	
Job: Ballynagare WF, Co. Kerry	
Title: Local Bedrock Aquifer Map	
Figure No: 9-7	
Drawing No: P1531-0-1021-A3-907-0A	
Sheet Size: A3	Project No: P1531-0
Scale: 1:50,000	Drawn By: GD
Date: 07/10/2021	Checked By: MG

9.4.10 Groundwater Vulnerability

9.4.10.1 Wind Farm Site

Groundwater vulnerability at the site ranges from 'Low' to 'Extreme-E' vulnerability. The south and east of the site are underlain by a Regionally Important karst aquifer which can be particularly vulnerable to groundwater pollution. The majority of the site, including all proposed turbine locations, is mapped by the GSI as being of 'Low' to 'Moderate' groundwater vulnerability. This is due to the widespread coverage of blanket peat across much of the site. Further south, the substation, construction compound and borrow pit are located in an area of 'Extreme-E'. Subsoils in this area are more permeable, mapped by the GSI as comprising till derived from Namurian sandstones and shales. A small section of the borrow pit is located in an area of 'Extreme-X' vulnerability. This area is mapped by the GSI as having rock close to or at the surface.

9.4.10.2 Grid Connection Routes

Groundwater vulnerability along the proposed grid route to the Clahane 100kV substation ranges from 'Low' to 'Extreme-X'. The sections of the grid route which are particularly vulnerable to groundwater pollution (High to Extreme vulnerability) are outlined below:

- The section from the site along the R557 as far as the townland of Ballyhorgan West;
- Along local roads in the townland of Lissahane; and,
- From Banemore Cross along the L6074, the N69 and along the access road as far as Clahane 110kV substation.

9.4.11 Groundwater Hydrochemistry

9.4.11.1 Wind Farm Site

There are no groundwater quality data for the site and groundwater sampling would generally not be undertaken for this type of development in terms of EIAR reporting, as groundwater quality impacts would not be anticipated.

The GSI (2004) state that there is no hydrochemical data available for the Kerry Head GWB. However, based on data from other GWBs, groundwater is expected to have a calcium-bicarbonate signature. Groundwater in the Ballysteen Formation will be hard to very hard with high alkalinities. Meanwhile the sandstones to the west of the site will be less hard and less alkaline. Hydrochemistry in the Ballybunnion GWB will also have a calcium-bicarbonate signature, with high alkalinities. Typical electrical conductivities of limestone aquifers range from 500-700µS/cm (GSI, 2004). Chloride levels in groundwater may be elevated due to the proximity to the coast.

9.4.11.2 Grid Connection Route

As stated above in Section 9.4.11.1, the Ballybunnion GWB will have a calcium-bicarbonate signature, with high alkalinities and electrical conductivities in the range of 500-700µS/cm.

There is no data currently available for the Abbeyfeale GWB. The GSI (2004) state that groundwater samples in the adjoining Ballylongford GWB, found to the northeast, are moderately hard and have moderate alkalinities. Measured electrical conductivities range from 440 – 560µS/cm. Both iron and magnesium may exceed allowable concentrations due to the presence of bedrock shales. The limestone bedrock aquifers within this GWB will have a calcium-bicarbonate signature.

9.4.12 Water Framework Directive Water Body Status & Objectives

The River Basin Management Plan was adopted in 2018 and has amalgamated all previous river basin districts into one national river basin management district. The River Basin Management Plan (2018 - 2021) objectives, which have been integrated into the design of the proposed wind farm development, include the following:

- Ensure full compliance with relevant EU legislation;
- Prevent deterioration and maintain a 'high' status where it already exists;
- Protect, enhance and restore all waters with aim to achieve at least good status by 2021;
- Ensure waters in protected areas meet requirements; and,
- Implement targeted actions and pilot schemes in focused sub-catchments aimed at (1) targeting water bodies close to meeting their objectives and (2) addressing more complex issues that will build knowledge for the third cycle.

Our understanding of these objectives is that surface waters, regardless of whether they have 'Poor' or 'High' status, should be treated the same in terms of the level of protection and mitigation measures employed, i.e. there should be no negative change in status at all.

Strict mitigation measures (refer to Section 9.6.2 and Section 9.6.3) in relation to maintaining a high quality of surface water runoff from the development and groundwater protection will ensure that the status of both surface water and groundwater bodies in the vicinity of the wind farm site will be at least maintained (see below for WFD water body status and objectives) regardless of their existing status.

9.4.13 Groundwater Body Status

Local Groundwater Body status and risk result are available from (www.catchments.ie) and are summarized in Table 9-16.

The Kerry Head Groundwater Body (GWB: IE_SH_G_118) achieved 'Good Status'[2] (www.wfdireland.ie) in the latest WFD monitoring round (2013-2018). This GWB is deemed to be "Not at risk" and no significant pressures have been identified.

Similarly, the Ballybunnion (GWD: IE_SH_G_027) and Abbeyfeale GWBs have been assigned 'Good Status' applying to both quantitative status and chemical status. The Ballybunnion GWB has been deemed to be "At risk" and is under significant pressure from anthropogenic activities. Meanwhile the Abbeyfeale GWB is 'Not at risk' and the WFD do not recognise any significant pressures to be impacting on this GWB.

Table 9-16: Summary WFD Information for Groundwater Bodies

GWB Code	Groundwater Body Name	Chemical Status	Overall Status	Quantitative Status	Risk Status	Pressure Category
IE_SH_G_118	Kerry Head	Good	Good	Good	Not at risk	N/A
IE_SH_G_027	Ballybunnion	Good	Good	Good	At risk	Anthropogenic
IE_SH_G_001	Abbeyfeale	Good	Good	Good	Not at risk	N/A

[2] *'Status' means the condition of the water in the waterbody. It is defined by its chemical status and its ecological status, whichever is worse. Waters are ranked in one of 5 classes: High, Good, Moderate, Poor and Bad (WFD, 2010).*

9.4.14 Surface Water Body Status

9.4.14.1 Wind Farm Site

A summary of the WFD status and risk result of Surface Water Bodies (SWBs) immediately upstream and downstream of the site are shown in Table 9-17 below. Local Surface Water Body status and risk result are available from www.catchments.ie.

Upstream of the site, the Brick River (Brick_030) has not been assigned a status in the latest WFD monitoring round (2013-2018). The risk status of this SWB is currently 'Under review' while this watercourse has been deemed to be under significant pressure from agricultural and hydromorphological pressures. Similarly in the vicinity of the site, the Brick_040 SWB has not been assigned an overall status or a risk status. This SWB is listed as being under pressure from agricultural activities, river hydromorphology and urban wastewater.

To the east and upstream of the site the Feale_080, east of Listowel, achieved 'Good Status' in the latest WFD monitoring round. This SWB has been deemed to be 'Not at risk' and no significant pressures have been identified. Downstream of Listowel, The Feale_090 SWB, achieved 'Moderate Status' and has been deemed to be 'At risk'. The Feale_090 SWB is listed as being under pressure from agriculture, hydromorphology and urban run-off. Upstream of the village of Finuge, the Feale River has been mapped as a Salmonid River.

Immediately to the east of the site, the Upper Feale Estuary achieved 'Poor Status' and was deemed to be 'At risk' in the latest WFD round. Meanwhile immediately downstream of the site, the Cashen River Estuary also achieved 'Poor Status' and is at 'At risk' of not meeting its WFD objectives. Both of these transitional waterbodies are under pressure from agricultural activities and urban wastewater and have been classified as "Nutrient Sensitive Areas". Meanwhile, the mouth of the Shannon is of 'Good Status' and 'Not at risk'.

Table 9-17: Summary WFD Information for Surface Water Bodies at Wind Farm Site

SWB Code	Water Body	Overall Status	Risk Status	Pressures
IE_SH_23B030500	Brick_030	Unassigned	Under review	Agriculture, Hydromorphology
IE_SH_23B030700	Brick_040	Unassigned	Under review	Agriculture, Hydromorphology and Urban wastewater
IE_SH_060_0100	Cashen River Estuary	Poor	At risk	Agriculture and Urban wastewater
IE_SH_060_0200	Upper Feale Estuary	Poor	At risk	Agriculture, Hydromorphology and Urban wastewater
IE_SH_23F010800	Feale_090	Moderate	At risk	Agriculture, Hydromorphology and Urban Run-off

9.4.14.2 Grid Connection Route

A summary of the WFD status and risk result of SWBs in the vicinity of the proposed grid connection route is shown in Table 9-18 below.

The proposed grid route is drained by the Brick_030 and Mountcoal_010 SWBs which have not been assigned a status in the latest WFD round. Agriculture and hydromorphology have been identified as significant pressures impacting these rivers. In the vicinity of the site, the status of the Brick_040 SWB is described above.

Table 9-18: Summary WFD Information for Surface Waterbodies along Grid Route

SWB Code	Water Body	Overall Status	Risk Status	Pressures
IE_SH_23B03 0500	Brick_030	Unassigned	Under Review	Agriculture, Hydromorphology
IE_SH_23M4 40980	Mountcoal_0 10	Unassigned	Under Review	Agriculture and Hydromorphology
IE_SH_23B03 0700	Brick_040	Unassigned	Under Review	Agriculture, Hydromorphology and Urban wastewater

9.4.15 Designated Sites

9.4.15.1 Wind Farm Site

In the Republic of Ireland, designated sites include proposed National Heritage Areas (pNHAs), National Heritage Areas (NHAs), Special Areas of Conservation (SAC) and Special Protection Areas (SPAs).

Ecological surveys of the site have identified two small areas of uncut raised bog remaining in the study area. However these areas are not defined as active raised bog or classified as the Annex I habitat Degraded Raised bog still capable of natural regeneration. Due to the extensive drainage network outlined in Section 9.4.4 these areas do not support active peat formation and do not have have potential to revert to active peat forming systems within 30-years. Therefore the site does not contain any Annex I habitats and does not lie within the boundaries of a designated site.

The site borders the Cashen River Estuary pNHA (Site Code:001340) to the north and the Lower River Shannon SAC (Site Code: 002165) to the north and west, along the Feale and Brick Rivers.

The Lower River Shannon SAC is a very large site stretching from the Shannon valley in Killaloe, Co. Clare to Kerry Head. This designated site includes the Feale estuary and much of the freshwater stretches of the Feale catchment. The eastern sections of the Feale catchment flow through Namurian rocks while the western stretches flow through Carboniferous limestones. The Feale catchment is reported to exhibit all the aspects of a river from source to mouth. Semi-natural habitats such as wet grassland, wet woodland and marsh occur along the river however improved grassland is the most common habitat. Floating river vegetation is present along the major rivers within this SAC including the Feale. Five species of fish listed on Annex II of the Habitats Directive are found within the SAC. The Feale River is important for spring salmon and for grilse and is a designated Salmonid Water under the E.U., Freshwater Fish Directive. The Feale catchment has also been identified to contain populations of freshwater pearl mussel.

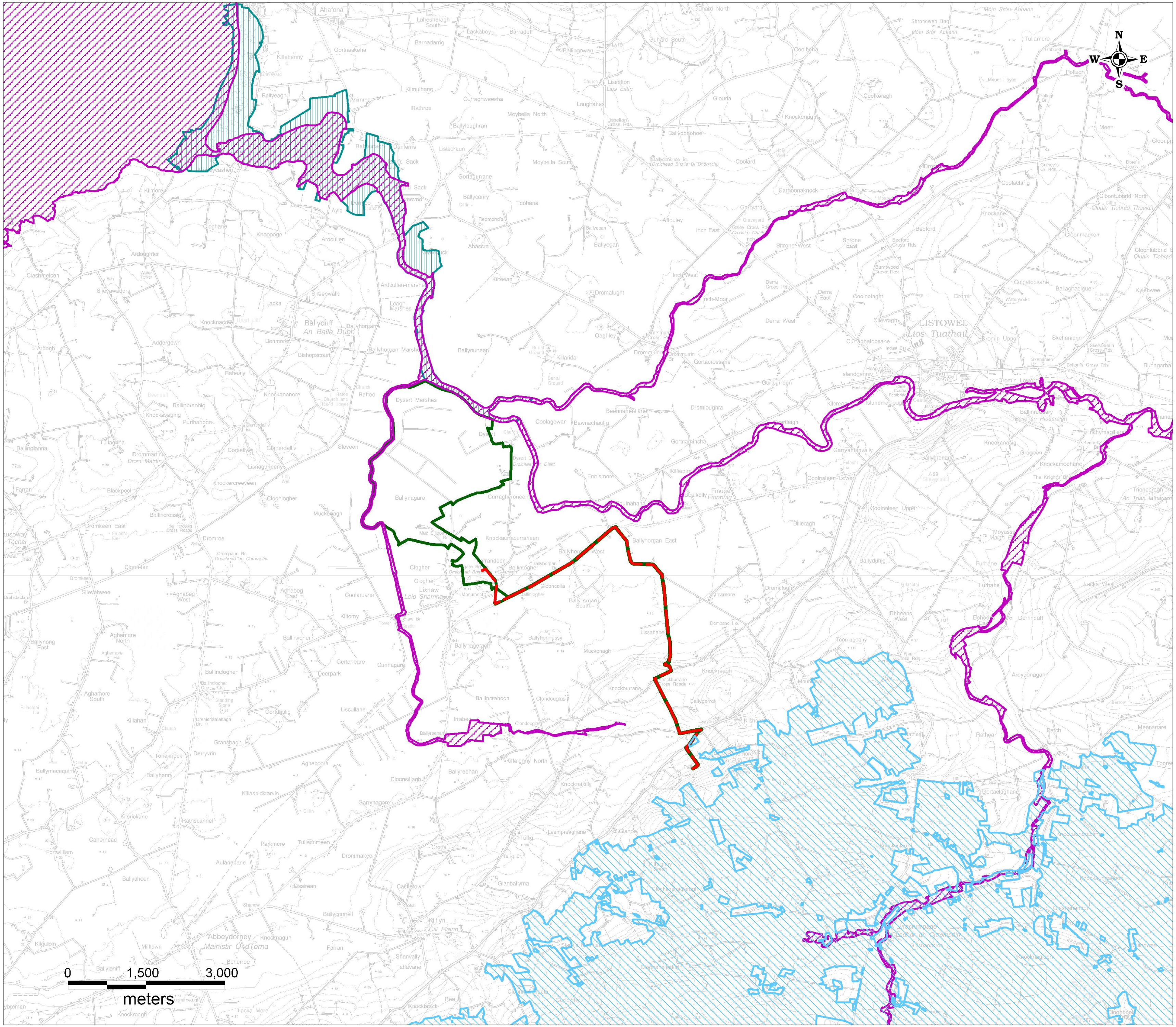
The site drains to the Lower River Shannon SAC via the Brick River. Therefore, the proposed wind farm site is hydraulically connected to this designated site. Refer to the Ecology Chapter for further details relating to these designated sites. A designated site map for the area is shown as Figure 9-8.

9.4.15.2 Grid Connection Routes

The proposed grid connection route encroaches onto the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (Site Code: 004161) along the N69. This site is an SPA under the E.U. Birds Directive of special conservation interest of Hen Harrier. The mix of forestry and open areas within this site provide an optimum habitat for the Hen Harrier, which is listed on Annex I of the Birds Directive. The proposed grid connection route is located within this designated site and therefore has the potential to adversely impact on the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA.

All surface waters draining the grid connection route flow downstream into the Lower River Shannon SAC and the Cashen River Estuary pNHA.

A map of local designated sites is shown as Figure 9-8.



Legend

EIAR Site Boundary

Clohane Grid Route

Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA

Lower River Shannon SAC

Cashen River Estuary pNHA

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Title: Designated Sites Map	
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9.4.16 Water Resources

9.4.16.1 Wind Farm Site

There are no mapped Public Water Supply Schemes (PWS) or National Federation Groundwater Schemes (NFGWS) in the area of the site. The closest mapped PWS is the Ballyheigue PWS, located approximately 9km southwest of the site.

A search of private well locations (accuracy of 1 – 50m only) was undertaken using the GSI well database (www.gsi.ie). The GSI maps several boreholes (GSI name: 0813SWW082, 0813SWW083 and 0813SWW105) in the centre of the site, in the townland of Ballynagare. Depth to rock in these boreholes is reported to range from 16m to 32m. Further south near the R557 and to the east of the proposed borrow pit, a GSI mapped borehole (GSI name: 0811NWW010) has a poor yield class and is used for agricultural and domestic purposes. Depth to bedrock at this locality is reported to be ~15m.

To overcome the poor accuracy problem of other GSI mapped wells it is assumed that every private dwelling in the area has a well supply and this impact assessment approach is described further below.

The private well assessment undertaken assumes the groundwater flow direction in the aquifer is towards the Brick and Feale Rivers. Using this conceptual model of groundwater flow, dwellings that are potentially located down-gradient of the proposed development footprint are identified. The groundwater flow direction in the area of the site is in a northerly direction towards the Upper Feale Estuary.

There are no private dwelling houses located down-gradient of the proposed turbine locations. Due to the relatively low bulk permeability of subsoils present on much of the site, the low recharge characteristics and the low groundwater gradients (flat topography), groundwater travel times are expected to be extremely slow. Several dwellings however are located downgradient of the substation, borrow pit and southern construction compound. Soils in this area are mapped as till derived from Namurian sandstones and shales. Despite the absence of peat in this area, these subsoils are still of low permeability, with an estimated groundwater recharge of only 22.5%.

It is also proposed that piling will take place on site and therefore this limits the potential for impact on groundwater levels, and groundwater quality as there will be no significant excavation dewatering. The piles themselves will be drilled into relatively low permeability anoxic environment, so their ability to leach and change local groundwater chemistry will be very low.

There are no surface water abstractions mapped downstream of the site. The closest mapped abstractions are located on the Feale_090 surface water body, upstream of the site and include the Dromin: Scartleigh and Listowel WTP abstractions.

9.4.16.2 Grid Connection Route

A total of 21 no. groundwater wells, were identified within 2 km of the proposed grid route. None of these wells are used as group water schemes but rather for private use.

Due to the shallow nature of the grid connection trench works impacts on groundwater flows and levels are not anticipated, however the potential for impacts on groundwater quality from fuels and other chemicals during the construction phase exists. This assessment applies to any groundwater wells that exist along the proposed grid connection route. All individual groundwater wells are not identified or audited, but this is not considered necessary considering the very shallow depth of the works and the lack of potential for any significant impact. The proposed grid connection trench is shallow in nature, and will not intercept the bedrock groundwater table, as excavations are within the carriageway of the existing public road network. The construction works along the grid connection trench are transient and temporary. The works are similar in nature to water pipe laying works, or underground electricity cable works which are completed along roads across the country. Standard mitigation measures in respect of normal construction site risks to groundwater quality are outlined in Section 9.6.2.

There are no surface water abstractions located along the proposed grid routes. The closest mapped surface water abstraction are the Dromin, Scartleigh and Listowel WTP abstractions located on the Feale_090 surface water body near Listowel. There is also an abstraction located upstream of the Trien Grid Route on the Smearlagh_030 SWB referred to as the Lyreacrompane RWSS. Meanwhile, the Cappagh River surface water abstraction is located upstream of Grid Route Option A on the Brick_010 SWB.

9.4.17 Receptor Sensitivity

Due to the nature of wind farm developments and grid connections, being near surface construction activities, effects on groundwater are generally negligible and surface water is generally the main sensitive receptor assessed during impact assessments. The primary risk to groundwater at the Proposed Development would be from cementitious materials, hydrocarbon spillage and leakages. These are common potential risks on all construction sites (such as road works and industrial sites), which can be omitted by way of mitigation. All potential contamination sources are to be carefully managed at the site during the construction, operational and decommissioning phases of the development and mitigation measures are proposed below to deal with these potential risks.

Based on criteria set out in Table 9-2 above, the Locally Important and Regionally Important Aquifers underlying the site can be classed as Sensitive to pollution. For the most part these aquifers are not classified as 'very sensitive' due to the low groundwater recharge occurring at the site. The site is covered by low permeability subsoils (cutover peat, alluvium and till) which act as a protective cover to the underlying bedrock aquifer. However in the area immediately to the south of the proposed borrow pit an area of bedrock outcrop is mapped, with higher recharge rates and extreme groundwater vulnerabilities. This area immediately to the south of the site is underlain by a Regionally Important Karstic Aquifer and can therefore be classified as Very Sensitive to pollution. Groundwater along much of the proposed grid routes are Not Sensitive to pollution because of the poor permeability of the underlying bedrock aquifer. However, the section of the grid routes overlying the Ballybunnion GWB can be classified as Very Sensitive, as this is a Regionally Important Aquifer with enhanced permeability. In general however, it is likely that any contaminants which may be accidently released during the construction works are more likely to travel to nearby streams within surface runoff.

Surface waters such as the Feale River and the Cashen River Estuary can be considered Very Sensitive to contamination. The Feale and its tributaries are known to be home to salmonids and grilse. The primary potential contamination is suspended solids and associated nutrients.

The designated sites that are hydraulically connected (surface water flow paths only) to the wind farm site and the proposed grid connection routes include the Cashen River Estuary pNHA and the Lower River Shannon SAC. Both of these sites are located in close proximity and immediately downstream of the Proposed Development. However due to the estuarine nature of these waters, they are significantly less sensitive (even without mitigation) compared to a freshwater habitat with regard to construction effects.

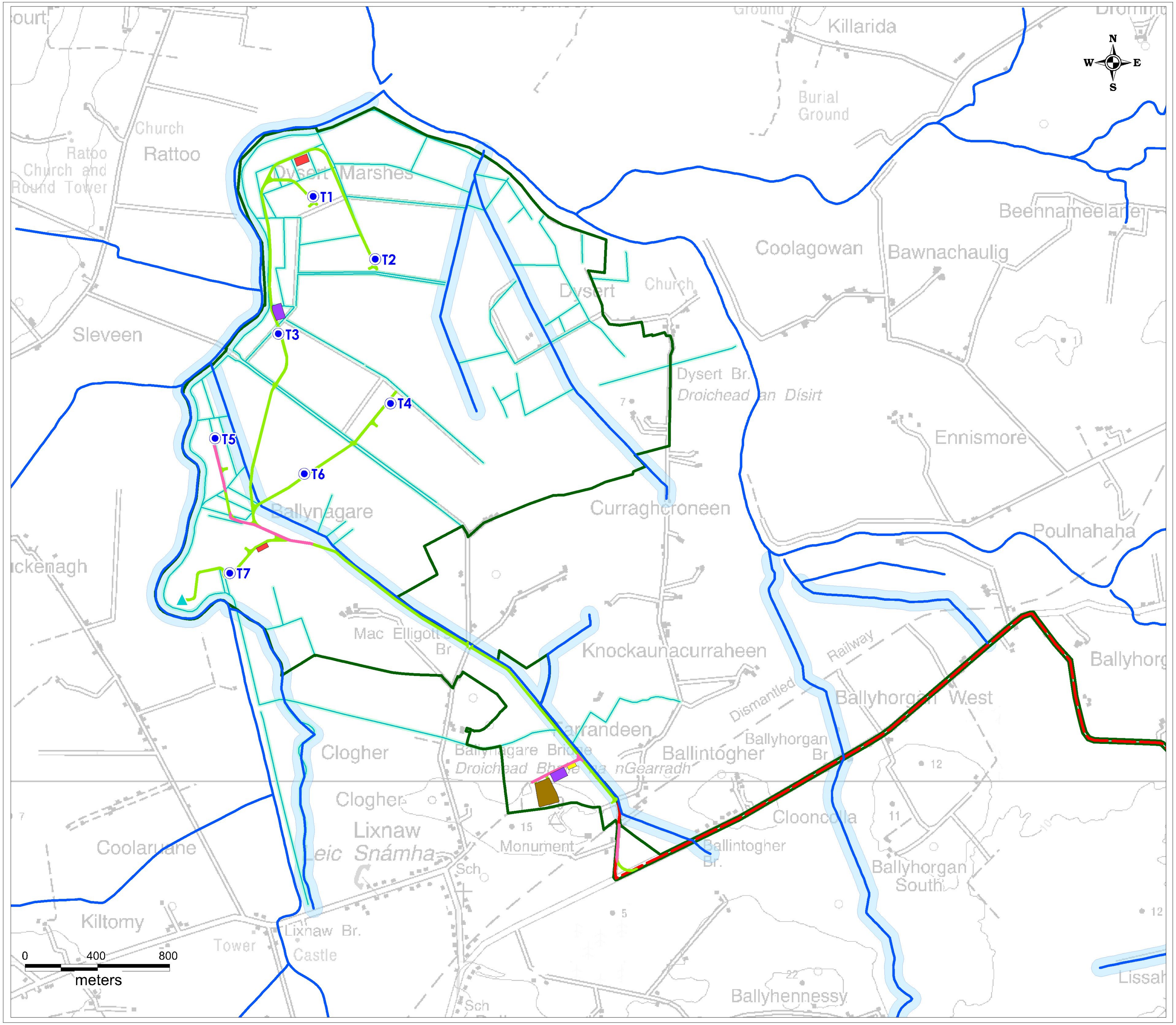
Comprehensive surface water mitigation and controls are outlined below to ensure protection of all downstream receiving waters. Mitigation measures will ensure that surface runoff from the developed areas of the site and the grid connection route will be of a high quality and will therefore not impact on the quality of downstream surface water bodies. Any introduced drainage works at the site will mimic the existing hydrological regime thereby avoiding changes to flow volumes leaving the site.

A hydrological constraints map for the site is shown as Figure 9-9. A self-imposed 50m buffer from EPA mapped streams was applied during the constraints mapping at the WF site, with a 10m buffer also applied to the main drains identified from site walkover surveys and inspection of aerial photography.

No key wind farm infrastructures (turbines, construction compounds or the substation) are located within 50m of EPA mapped surface waterbodies. In the south of the site, a proposed access road runs parallel with the Monument stream and is located within 50m of this waterbody. Towards the centre of the wind farm site, the proposed access roads are mapped to cross the Monument stream at 2 no. locations.

With respect to the main drains within the site, T5 and the northern construction compound located within the delineated 10m buffer zone. During site walkovers these drains were observed to have low flow volumes. The remainder of the key wind farm infrastructures are located outside of the 10m buffer zone. The large setback distance from sensitive hydrological features means they will not be impacted on by excavations/drains etc. It also allows adequate room for the proposed drainage mitigation measures (discussed below) to be properly installed up-gradient of primary drainage features within sub-catchments.

Based on EPA mapping, there will be a requirement for at least 5 no. watercourse crossings on both of the proposed grid routes. While no in-stream works are proposed, mitigation measures will ensure that surface runoff during the construction phase will be of a high quality and will not impact on the quality of downstream surface water bodies.



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Clohane Grid Route
- Proposed Met Mast
- Proposed Substation
- Proposed Borrow Pit
- Proposed Construction Compound
- Existing Roads to be Upgraded
- Proposed New Roads
- Temporary Peat Storage Area
- Watercourses
- 50m Watercourse Buffer
- Main Drains
- 10m Main Drain Buffer

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9.4.18 Development Interaction with the Existing Bog Drainage Network of the wind farm site

The general design approach to wind farm layouts in existing peat bogs and/or agricultural land is to utilise and integrate new drainage with the existing drainage infrastructure where possible.

9.4.19 Proposed Drainage Management

Runoff control and drainage management are key elements in terms of mitigation against effects on downstream surface water bodies (Brick and Feale Rivers).

There is an extensive land drainage network existing within the proposed development footprint. It is intended to integrate the proposed wind farm drainage with that existing drainage network. It also should be noted that drainage from the majority of the wind farm site is controlled by sluice gate outfalls to the River brick and the River Feale, i.e. surface water outfall can only occur at mid to low tide level within the Cashen Estuary.

Two distinct methods will be employed to manage drainage water within the proposed development. The first method involves 'keeping clean water clean' by avoiding disturbance to natural drainage features, minimising any works in or around existing artificial drainage features, and diverting clean surface water flow around excavations, construction areas and temporary storage areas. Where possible, the existing drainage network has been used to manage and divert clean water around the proposed wind farm footprint.

The second method involves collecting any drainage waters from works areas within the site that might carry silt or sediment, and nutrients, to route them towards settlement ponds (or stilling ponds) prior to controlled diffuse release downstream existing drains.

During the construction phase all runoff from wind farm works areas (i.e. dirty water) will be collected and treated to a high quality prior to being released to downstream drains. A detailed drainage plan showing the layout of the proposed drainage systems is shown in the design drawings included in Appendix 4-4 of the EIAR.

9.5 Characteristics of the Proposed Development

The proposed development comprises of the following:

- Construction of 7 no. wind turbines with the following maximum and minimum parameters:
  - Overall ground to blade tip height in the range of 170m maximum to 169.5m minimum
  - Hub height of 95m
  - Rotor diameter in the range of 150m maximum to 149m minimum
- Turbine hardstand areas;
- Provision of 1 no. permanent meteorological mast with a maximum height of 110 metres to 100 metres minimum110 metres;
- Upgrade of existing roads and access junctions;
- Provision of new site entrances, roads and hardstand areas;
- 2 no. peat storage areas;
- 2 no. construction compounds;
- 1no. borrow pit;
- All site drainage works;
- 1 no. onsite 38kV substation, control building and plant, associated security fencing and wastewater holding tank;
- All associated underground electrical and communication cabling connecting the turbines to the proposed on-site substation;
- Connection of the proposed 38kV on-site substation via underground cable in the public road network to the entrance of the existing Clahane 110kV substation at the junction with the N69 public road, in the townland of Pallas;
- All ancillary site and ground works, apparatus and signage.

The main characteristics of the proposed Ballynagare Wind Farm that could impact on water and hydrogeology are:

- Opening of the proposed borrow pit, which will involve the stripping of topsoil/subsoil and the rock breaking/ripping and/or blasting, and subsequent processing, of 144,000m^3 of suitable rock to create aggregate for use on-site in access tracks and hardstand construction. Runoff and discharge from the borrow pit has the potential to impact on surface water quality.
- Establishment of the northern site compound, which will involve minor regrading of peat and the placement of the construction compound using a floated technique where possible. Welfare facilities will be provided at the site compounds. Wastewater effluent will be collected in a wastewater holding tank and periodically emptied by a licenced contractor.
- Construction of the site access tracks and upgrade of existing tracks will use both founded and floated techniques. Floating tracks will be used at the site for the majority of new tracks, as well as upgrading of existing tracks. This will involve the use of aggregate, sourced from the on-site borrow pit and imported from local quarries where required. Construction of these access tracks has the potential to impact on surface water quality.
- Construction of the crane hardstand areas and turbine assemblage areas. This too will involve the use of aggregate, sourced from the onsite borrow pits and imported from local quarries where required. Construction of these areas has the potential to impact on surface water quality.

- With the exception of T7, all turbines and their associated crane hardstand areas are likely to require a piled foundation as a result of the depth of peat and soft lacustrine deposits present.
- Settlement ponds where constructed will be volume neutral, i.e. all material excavated will be used to form side bunds and landscaping around the ponds. There will be no excess material from settlement pond construction. The material will also be reinstated during decommissioning.
- Volumes of peat/subsoil to be removed at the 7 no. turbine locations is estimated to be 5,576m^3 peat and 6,013m^3 of non-peat subsoils.
- Construction of the on-site substation and parking area will likely be completed using a floated technique, and will also involve the use of approximately 695m^3 of concrete, aggregate and building materials. Welfare facilities will be provided at the substation. Wastewater effluent will be collected in an underground concrete holding tank and periodically emptied by a licenced contractor for the operational phase of the wind farm. Construction of the sub-station and associated parking area has the potential to impact on surface water quality.
- Grey water will be supplied by rainwater harvesting and water tankered to site where required. Bottled water will be used for potable supply.
- Construction of the turbine foundations, which will require large volumes of concrete (approximately 550m^3 per turbine foundation plus approximately 50m3 of lean-mix concrete for the blinding layer), placing demand on local concrete batching plants / quarries. Concrete could impact on surface water and groundwater quality.
- Cabling between turbine locations and the site substation. This will involve the excavation of a shallow trench (approximately 1.2m deep), placement of ducting and backfilling with aggregate, lean-mix concrete and excavated material, as appropriate (depending on the location of the cable trench). These works have the potential to impact on surface water quality.
- Cabling between the site substation and the Clahane 110 kV Substation. This will involve the excavation of a shallow trench along the public road, placement of ducting and backfilling with lean-mix concrete and compacted engineered fill. These works have the potential to impact on surface water quality.

9.6 Likely Significant Effects and Mitigation Measures

The potential impacts of the Proposed Development and mitigation measures that will be put in place to eliminate or reduce them are set out below.

9.6.1 Do Nothing Scenario

If the Proposed Development were not to proceed the proposed Ballynagare Wind Farm would not be able to supply the electricity generated to the national grid. The opportunity to generate renewable energy and electrical supply to the national grid would be lost. Local peat harvesting, agricultural activities and other existing land-use practices would continue at the site.

Surface water drainage carried out in the agricultural lands and the peat bog will continue to function and may be extended in some areas.

9.6.2 Construction Phase – Likely Significant Effects and Mitigation Measures

9.6.2.1 Earthworks (Removal of Vegetation Cover, Excavations and Stock Piling) Resulting in Suspended Solids Entrainment in Surface Waters

Construction phase activities including access road construction, construction compound, turbine base/hardstanding construction, met mast construction, substation construction and cable route works will require varying degrees of earthworks resulting in the excavation of peat, soil and mineral subsoil where present. Excavation of the grid route trench, ~2m (w) x 1.2m (h), will also require excavation of soils/subsoils.

Potential sources of sediment laden water include:

- Drainage and seepage water resulting from road and turbine base excavation;
- Stockpiled excavated material providing a point source of exposed sediment;
- Construction of the grid connection cable trench resulting in entrainment of sediment from the excavations during construction; and,
- Erosion of sediment from emplaced site drainage channels.

These activities, if unmitigated, will likely result in the release of suspended solids to surface water and could result in an increase in the suspended sediment load, resulting in increased turbidity which in turn could affect the water quality and fish stocks of downstream water bodies, including the Brick River, Feale River and the Cashen River Estuary. Potential effects on all watercourses draining the site and the proposed grid routes could be significant if left unmitigated.

Pathways: Drainage and surface water discharge routes.

Receptors: Down-gradient rivers (River Brick, River Feale, Smearlagh River) and the Cashen River Estuary and their associated dependent ecosystems. All the tributaries of the Brick and Feale rivers encountered along the proposed grid connection routes.

Pre-Mitigation Potential Impact: Indirect, negative, significant, temporary, medium probability impact.

Proposed Mitigation Measures:

Wind Farm Site: The key mitigation measure during the construction phase is the avoidance of sensitive aquatic areas, by application of suitable buffer zones (i.e. 50m to main watercourses, and 10m to main drains). With the exception of the met mast and the proposed substation location, all of the key proposed infrastructures within the site are located significantly away from the delineated 50m watercourse buffer zone. However many of the proposed access roads cross mapped drains/streams requiring control measures, which are outlined further on in this section. These control measures will be implemented at the proposed watercourse and drain crossings and where the roads run parallel and in close proximity to drains.

Grid Route: As stated in Section 9.4.5, the proposed grid connection route contains several watercourse crossings. It is proposed to limit any works in any areas located within 50m of any watercourse/waterbody including the stockpiling of excavated soils and subsoils.

There are a total of 5 no. culvert/bridge crossings along the proposed grid route to the Clahane 100kV substation. All the crossings along the proposed route are existing bridges and culverts along the public road. No in-stream works are required at any of these crossings, however due to the proximity of the streams to the construction work at the crossing locations, there is a potential for surface water quality impacts during trench excavation work.

Mitigation measures are outlined below.

A constraint/buffer zone will be maintained for all crossing locations, whereby all watercourses will be fenced off. In addition, measures which are outlined below will be implemented to ensure that silt laden or contaminated surface water runoff from the excavation work does not discharge directly to the watercourse.

The setback distance from sensitive hydrological features means that adequate room is maintained for the proposed drainage mitigation measures (discussed below) to be properly installed and operate effectively. The proposed buffer zone will:

- Avoid physical damage to watercourses, and associated release of sediment;
- Avoid excavations within close proximity to surface watercourses;
- Avoid the entry of suspended sediment from earthworks into watercourses; and,
- Avoid the entry of suspended sediment from the construction phase drainage system into watercourses and downstream drains.

Mitigation by Design:

- Source controls:
  - Interceptor drains, vee-drains, diversion drains, flume pipes, erosion and velocity control measures such as use of sandbags, oyster bags filled with gravel, filter fabrics, and other similar/equivalent or appropriate systems.
  - Small working areas, covering stockpiles, weathering off stockpiles, cessation of works in certain areas or other similar/equivalent or appropriate measures.
- In-Line controls:
  - Interceptor drains, vee-drains, oversized swales, erosion and velocity control measures such as check dams, sandbags, oyster bags, straw bales, flow limiters, weirs, baffles, silt bags, silt fences, sedimats, filter fabrics, and collection sumps, temporary sumps, sediment traps, pumping systems, settlement ponds, temporary pumping chambers, or other similar/equivalent or appropriates systems.
- Treatment systems:
  - Temporary sumps, temporary storage lagoons, sediment traps, and settlement ponds, and proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems.

It should be noted for the wind farm site, that an extensive network of peat management and agricultural drains already exists, and these will be integrated and enhanced as required and used within the wind farm development drainage system. The integration of the existing drainage network and the proposed wind farm network is relatively simple. The key elements being the upgrading and improvements to water treatment elements, such as in line controls and treatment systems, including silt traps, and settlement ponds.

The main elements of interaction with existing drains will be as follows:

- Apart from interceptor drains (using existing drains where possible), which will convey clean runoff water to the downstream drainage system there will be no direct discharge (without treatment for sediment reduction) of runoff from the proposed wind farm drainage into the existing site drainage network. This will reduce the potential for any increased risk of sediment transport/erosion;

- Silt traps will be placed in the existing drains upstream of any streams where construction works is taking place, and these will be diverted into proposed interceptor drains, or culverted under/across the works area; and,
- Drains running parallel to the existing roads requiring widening will be upgraded. Velocity and silt control measures such as check dams, sandbags, oyster bags, straw bales, flow limiters, weirs, baffles, silt fences will be used during the upgrade construction works.

Water Treatment Train:

If the discharge water from construction areas fails to be of a high quality, then a filtration treatment system (such as a 'siltbuster' or similar equivalent treatment train (sequence of water treatment processes) will be used to filter and treat all surface discharge water collected in the dirty water drainage system. This will apply for all of the construction phase.

Silt Fences:

Silt fences will be emplaced within drains down-gradient of all construction areas. Silt fences are effective at removing heavy settleable solids. This will act to prevent entry to watercourses of sand and gravel sized sediment, released from excavation of mineral sub-soils of glacial and glacio-fluvial origin, and entrained in surface water runoff. Inspection and maintenance of these structures during construction phase is critical to their functioning to stated purpose. They will remain in place throughout the entire construction phase. Double silt fences will be emplaced within drains down-gradient of all construction areas inside the hydrological buffer zones.

Silt Bags:

Silt bags will be used where small to medium volumes of water need to be pumped from excavations. As water is pumped through the bag, most of the sediment is retained by the geotextile fabric allowing filtered water to pass through.

Pre-emptive Site Drainage Management:

The works programme for the initial construction stage of the development will also take account of weather forecasts, and predicted rainfall in particular. Large excavations and movements of peat/subsoil or vegetation stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

The following forecasting systems are available and will be used on a daily basis at the site to direct proposed construction activities:

- General Forecasts: Available on a national, regional and county level from the Met Eireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates;
- MeteoAlarm: Alerts to the possible occurrence of severe weather for the next 2 days. Less useful than general forecasts as only available on a provincial scale;
- 3-hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3 hours but does not account for possible heavy localised events;
- Rainfall Radar Images: Images covering the entire country are freely available from the Met Eireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3-hour record is given and is updated every 15 minutes. Radar images are not predictive; and,

- Consultancy Service: Met Eireann provide a 24-hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest.

Using the safe threshold rainfall values will allow work to be safely controlled (from a water quality perspective) in the event of forecasting of an impending high rainfall intensity event.

Works will be suspended if forecasting suggests any of the following is likely to occur:

- >10 mm/hr (i.e. high intensity local rainfall events);
- >25 mm in a 24 hour period (heavy frontal rainfall lasting most of the day); or,
- >half monthly average rainfall in any 7 days.

Prior to works being suspended the following control measures will be completed:

- Secure all open excavations;
- Provide temporary or emergency drainage to prevent back-up of surface runoff; and,
- Avoid working during heavy rainfall and for up to 24 hours after heavy events to ensure drainage systems are not overloaded.

Management of Runoff from Peat and Subsoil Storage Areas:

It is proposed that excavated peat will be used for landscaping where required. Peat and subsoil excavation will occur at 7 no. turbine locations.

During the initial construction of floating roads, silt fences, straw bales and biodegradable geogrids will be used to control surface water runoff from works areas.

Where required temporary peat/subsoil storage areas will be sealed with a digger bucket and vegetated as soon possible to reduce sediment entrainment in runoff.

Management of Runoff from the Grid Connection Cable Route and existing road upgrade areas:

Where construction of the grid cable connection route is undertaken along sections of proposed access road or existing roads requiring upgrade, the proposed wind farm drainage infrastructure (as outlined above) will be in place to manage and control runoff from the trench excavation area. Where the cable trench is to be constructed along public roads surface water control measures such as silt fences will be employed when work is required within hydrological buffer zones.

Timing of Site Drainage Construction Works:

Construction of the wind farm site drainage system will only be carried out during periods of low rainfall, and therefore minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses.

Monitoring:

An inspection and maintenance plan for the on-site drainage system will be prepared in advance of commencement of any works. Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended. Inspections will also be undertaken after tree felling.

Any excess build-up of silt levels at dams, the settlement pond, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed.

During the construction phase field testing and laboratory analysis of a range of parameters with relevant regulatory limits and EQSs will be undertaken for each primary watercourse, and specifically following heavy rainfall events (i.e. weekly, monthly and event based).

Residual Impact: The potential for the release of suspended solids to watercourse receptors is a risk to water quality and the aquatic quality of the receptor. Proven and effective measures to mitigate the risk of releases of sediment have been proposed above and will break the pathway between the potential sources and the receptor. The residual effect is considered to be Negative, indirect, imperceptible, short term, low probability impact on downgradient rivers, water quality and dependent ecosystems.

Significance of Effects: For the reasons outlined above, and with the implementation of the above mitigation measures, no likely significant effects on surface water quality will occur.

9.6.2.2 Potential Impacts on Groundwater Levels during Excavation Works & from Proposed Borrow Pit

Dewatering of borrow pit and other deep excavations (i.e. turbines bases) have the potential to impact on local groundwater levels. However, temporary reductions in groundwater levels by short duration and transient dewatering works will be localised and of small magnitude due to the nature and permeability of the local subsoil and bedrock geology. Any effects will be temporary and will be contained within the development wind farm site boundary.

No groundwater level impacts will occur from the construction of the grid connection underground cabling trench due to the shallow nature of the excavation (~1.2m), the excavation of the trench within the existing road carriageway and the unsaturated nature of the subsoil to be excavated.

Pathway: Groundwater flow paths.

Receptor: Groundwater levels.

Pre-Mitigation Potential Impact: Indirect, negative, significant, temporary, imperceptible unlikely effects on local groundwater levels within the wind farm site boundary.

Impact Assessment

The proposed borrow pit is located in bedrock that has been classified as a Regionally Important Aquifer by the GSI. This is a karst bedrock aquifer with preferential groundwater flow paths through enlarged conduits which form along faults, bedding planes and/or fractures. Groundwater flow direction will be towards the Cashen River Estuary.

The topographical and hydrogeological setting of the proposed borrow pit means that some groundwater dewatering may be required during the construction phase of the development. In addition, direct rainfall and surface water runoff will inflow into the borrow pit and will require water volume and water quality control management. For the avoidance of doubt we would generally define dewatering as a requirement to permanently drawdown the local groundwater table by means of over pumping, e.g. as would be required for the operation of a bedrock quarry in a valley floor. We consider that a bedrock quarry is different in scale and operation from the proposed operation of a temporary shallow borrow pit.

The proposed borrow pit stands at an elevation of approximately 10mOD, on an area of ground which slopes to the north. An existing quarry, Lixnaw quarry, is located immediately to the south of the proposed borrow pit. Inspection of aerial photographs show that this quarry is subject to groundwater ingress, with the floor of the quarry often flooded, with large standing pools of water covering the quarry floor. Therefore some dewatering is likely to be required at the proposed borrow pit location but due to the shallow nature of the works, no significant dewatering will occur. The pit will be shallow, and the potential for any groundwater level impacts to extend significant distances from the pit is negligible. The GSI do not map any major fault lines, which may act as large scale regional flow paths, within the vicinity of the proposed borrow pit. A well in the townland of Ballintogher to the east of the proposed borrow pit is reported to have a poor yield class.

Any groundwater level impact resulting from potential dewatering at the borrow pit will be small in relation to any changes to the local hydrogeological regime which resulted from dewatering at Lixnaw Quarry.

Relevant environmental management guidelines from the EPA quarry 2006 guidance document – "Environmental Management in the Extractive Industry" in relation to groundwater issues will be implemented during the construction phase.

The proposed underground cable trench depth will only be approximately 1.2 m in depth and therefore no impacts on the local groundwater table or flows will occur.

Residual Effects: Due to separation distances between proposed development works and water wells and local stream and rivers, and the relatively shallow nature of the proposed borrow pit works, and also the prevailing geology of the proposed development site the potential for water level drawdown impacts at receptor locations is considered negligible. The residual effect is considered to be – Negative, imperceptible, direct, short term, unlikely impact on groundwater levels.

Significance of Effects: : For the reasons outlined above, and with the implementation of the above mitigation measures, no likely significant effects on groundwater levels will occur.

9.6.2.3 Excavation Dewatering and Potential Impacts on Surface Water Quality

Due to the low topography of the site and its proximity to the Cashen River Estuary, groundwater seepages will likely occur in turbine base excavations and the borrow pit. This will create additional volumes of water to be treated by the drainage management system.

Inflows will likely require management and treatment to reduce suspended sediments. No contaminated land was noted at the wind farm site or along the grid routes therefore pollution issues (resulting from previously contaminated soils/subsoils) will not occur in this respect. The main potential significant effects are as a result of turbidity and suspended solids on downstream surface water in the Brick River, Feale River and the Cashen River Estuary.

Due to the shallow nature of the grid trench within the carriageway of public roads, no inflows of significance will occur.

Pathway: Overland flow and site drainage network.

Receptor: Down-gradient surface water bodies (River Brick, River Feale, Smearlagh River) and the Cashen River Estuary and their associated dependent ecosystems.

Pre-Mitigation Potential Impact: Indirect, negative, significant, temporary, low probability impact to surface water quality.

Proposed Mitigation Measures

Mitigation by Design:

Management of excavation seepage and subsequent treatment prior to discharge into the drainage network will be undertaken as follows:

- Appropriate interceptor drainage, to prevent upslope surface runoff from entering excavations will be put in place;
- If required, pumping of excavation inflows will prevent build-up of water in the excavation;
- The interceptor drainage will be discharged to the site constructed drainage system or onto natural vegetated surfaces and not directly to surface waters;
- The pumped water volumes will be discharged via sedimentation ponds adjacent to excavation areas, or via specialist treatment systems such as a Siltbuster unit;
- There will be no direct discharge to surface watercourses, and therefore no risk that hydraulic loading or contamination will occur; and,
- Daily monitoring of excavations by a suitably qualified person will occur during the construction phase. If high levels of seepage inflow occur, excavation work will be immediately stopped and a geotechnical assessment undertaken.

Residual Effects: The potential for the release of suspended solids to watercourse receptors is a risk to water quality and the aquatic quality of the receptor. Proven and effective measures to mitigate the risk of releases of sediment have been proposed above and will break the pathway between the potential sources and the receptor. The residual effect is considered to be - Negative, indirect, imperceptible, short term, unlikely impact on surface and groundwater quality.

Significance of Effects: For the reasons outlined above, and with the implementation of the above mitigation measures, no likely significant effects on the surface water quality will occur.

9.6.2.4 Potential Release of Hydrocarbons during Construction and Storage

Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a significant pollution risk to groundwater, surface water and associated ecosystems, and to terrestrial ecology. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Hydrocarbon has a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. It is also a nutrient supply for adapted micro-organisms, which can rapidly deplete dissolved oxygen in waters, resulting in death of aquatic organisms.

Hydrocarbon storage will not occur during grid route construction as the works are transient. Vehicles will be refuelled before reaching the grid route site.

Pathway: Groundwater flowpaths and wind farm site drainage network.

Receptor: Groundwater below the site and below the grid route. Downgradient surface water bodies (River Brick, River Feale, Smearlagh River) and the Cashen River Estuary and their associated dependent ecosystems. All the tributaries of the Brick and Feale rivers encountered along the proposed grid connection routes.

Pre-Mitigation Potential Impact: Indirect, negative, slight, short term, medium probability impact to local groundwater quality. Indirect, negative, significant, short term, low probability impact to surface water quality.

Proposed Mitigation Measures:

Mitigation by Design

- Onsite re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site (wind farm site and grid route), and will be towed around the site by a 4x4 jeep to where machinery is located. The 4x4 jeep will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations;
- Refuelling or maintenance of machinery will not occur within 100m of a watercourse;
- Fuels stored on site will be minimised;
- Any diesel or fuel oils stored at the temporary site compound will be bunded. The bund capacity will be sufficient to contain 110% of the storage tank's maximum capacity;
- The electrical control building will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage of any associated chemicals and to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used will be regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages will be contained within the Environmental Management Plan. Spill kits will be available to deal with accidental spillages.

Residual Effects: The potential for the release of hydrocarbons to groundwater and watercourse receptors is a risk to surface water and groundwater quality, and also the aquatic quality of the surface water receptors. Proven and effective measures to mitigate the risk of releases of hydrocarbons have been proposed above and will break the pathway between the potential source and each receptor. The residual effect is considered to be – Negative, indirect, imperceptible, short term, unlikely impact on surface water quality and groundwater quality.

Significance of Effects: For the reasons outlined above, and with the implementation of the above mitigation measures, no likely significant effects on surface water or groundwater quality will occur.

9.6.2.5 Groundwater and Surface Water Contamination from Wastewater Disposal

Release of effluent from welfare wastewater treatment systems on-site (wind farm and along the grid route) has the potential to impact on groundwater and surface waters if site conditions are not suitable for an on-site percolation unit. Impacts on surface water quality could affect fish stocks and aquatic habitats.

Pathway: Groundwater flowpaths and wind farm site drainage network.

Receptor: Down-gradient (of wind farm site) well supplies, groundwater quality and surface water quality in the River Brick, River Feale and associated tributaries encountered along the grid connection route.

Pre mitigation Potential Impact

Indirect, negative, significant, temporary, low probability impact to surface water quality.

Indirect, negative, slight, temporary, low probability impact to local groundwater.

Proposed Mitigation Measures

- During the construction phase, a self-contained port-a-loo with an integrated waste holding tank will be used at the wind farm site compound, will be maintained by the providing contractor, and removed from site on completion of the construction works. A self-contained port-a-loo will also be used during the construction of the grid route and will be maintained by the providing contractor;
- Water supply for the wind farm site office and other sanitation will be brought to the wind farm site and wastewater will be removed from site by a licensed contractor; and,
- No water or wastewater will be sourced on the wind farm site, nor discharged to the wind farm site.

Residual Effects: The potential for contamination resulting from wastewater disposal is a risk to surface water and groundwater quality. This is a risk is common across all construction sites containing welfare facilities. Proven and effective measures to mitigate the release of wastewater on site have been proposed above and will break the pathway between the potential source and each receptor. The residual effect is considered to be - Negative, imperceptible, indirect, short term, unlikely impact to surface water quality.

Significance of Effects: For the reasons outlined above, no likely significant effects on surface water or groundwater quality will occur.

9.6.2.6 Release of Cement-Based Products

Concrete and other cement-based products are highly alkaline and corrosive and can have significant negative impacts on water quality. They generate very fine, highly alkaline silt (pH 11.5) that can physically damage fish by burning their skin and blocking their gills. A pH range of $\geq 6 \leq 9$ is set in S.I. No. 293 of 1988 Quality of Salmonid Water Regulations, with artificial variations not in excess of $\pm$ 0.5 of a pH unit. Entry of cement-based products into the site drainage system, into surface water runoff, and hence to surface watercourses or directly into watercourses represents a risk to the aquatic environment.

Peat ecosystems are dependent on low pH hydrochemistry. They are extremely sensitive to introduction of high pH alkaline waters into the system. Batching of wet concrete at the wind farm site/along the grid route and washing out of transport and placement machinery are the activities most likely to generate a risk of cement-based pollution. Placed concrete in turbine bases and foundations can have minor local impacts on groundwater quality over time. However, due to limited surface area of exposed concrete, the anoxic conditions below ground, and the high rate of dilution from the wider groundwater system relative to the small volumes of groundwater that would come in contact with the concrete, the potential for impacts are low.

Pathway: Wind farm site and grid route drainage network.

Receptor: Surface water hydrochemistry in downgradient surface water bodies including the River Brick, River Feale and the Cashen River Estuary and their associated dependent ecosystems. All the tributaries of the Brick and Feale rivers encountered along the proposed grid connection routes.

Pre-Mitigation Potential Impact: Indirect, negative, moderate, short term, medium probability impact to surface waters such as the River Brick, Feale River and Cashen River Estuary. Indirect, negative, imperceptible, long term, low probability impact to local groundwater quality.

Proposed Mitigation Measures

Mitigation by Avoidance:

- No batching of wet-cement products will occur on site/along the grid route works or near other ancillary construction activities. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place;
- Pre-cast elements for culverts and concrete works will be used;
- No washing out of any plant used in concrete transport or concreting operations will be allowed on-site;
- Where concrete is delivered on site, only the chute need be cleaned, using the smallest volume of water possible. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water is to be directed into a dedicated concrete wash out pit. Decommissioning of this pit will occur at the end of the construction phase and water and solids will be tanked and removed from the site to a suitable, non-polluting, discharge location;
- All concrete will be placed in shuttering and will not be in contact with soils or groundwater until after it has set;
- Use weather forecasting to plan dry days for pouring concrete; and,
- Ensure pour site is free of standing water and plastic covers will be ready in case of sudden rainfall event.

No mitigation required for potential groundwater impacts as these are imperceptible at the outset.

Residual Effects: The potential for the release of cement-based products to groundwater and watercourse receptors is a risk to surface water and groundwater quality, and also the aquatic quality of the surface water receptors. Proven and effective measures to mitigate the risk of releases of cement-based products have been proposed above and will break the pathway between the potential source and each receptor. This will ensure that surface water runoff from the site will be equivalent to baseline conditions and will therefore have no potential impact on the status or ecology of downstream waters. The residual effect is considered to be - Negative, imperceptible, indirect, short term, unlikely impact to surface water quality and Negative, imperceptible, indirect, long term, unlikely impact to local groundwater quality.

Significance of Effects: For the reasons outlined above, and with the implementation of the above mitigation measures, no likely significant effects on surface water or groundwater quality will occur.

9.6.2.7 Morphological Changes to Surface Watercourses and Drainage Patterns

Diversion, culverting, road and grid cable crossing of surface watercourses can result in morphological changes, changes to drainage patterns and alteration of aquatic habitats. Construction of structures over watercourses has the potential to significantly interfere with water quality and flows during the construction phase.

Several drain and stream crossings are proposed within the wind farm site to facilitate the proposed and existing access roads.

There are a total of 5 no. culvert/bridge crossings along the proposed Grid route Option A to Clahane 100kV substation all of which will be subject to Horizontal Directional Drilling. Along the Trien Grid Route Option there are a total of 9 no. culverts/bridge crossings according to EPA mapping, 5 of which will be subject to Horizontal Directional Drilling. All the crossings along both potential grid routes are existing bridges and culverts along the public road and will avoid in-stream works.

Pathway: Site drainage network.

Receptor: Surface water flows and stream morphology in local watercourses encountered with the wind farm site (Monument Stream) and the tributaries of the Brick and Feale rivers encountered along the proposed grid connection routes.

Pre-mitigation Potential Impact: Negative, direct, slight, long term, high probability impact.

Proposed Mitigation Measures

Mitigation by Design

- All proposed crossings on the grid route will use existing bridges and culverts along the public road network. No in-stream excavation works are proposed and therefore there will be no impact on the stream at the proposed crossing locations;
- Within the wind farm site all proposed new stream crossings will be bottomless or clear span culverts and the existing banks will remain undisturbed. No in-stream excavation works are proposed and therefore there will be no direct impact on the stream at the proposed crossing locations;
- Any guidance / mitigation measures proposed by the OPW or the Inland Fisheries Ireland will be incorporated into the design of any proposed crossings. A 10m buffer is applied to main drains to allow for future OPW maintenance;
- As a further precaution near stream construction work will only be carried out during the period permitted by Inland Fisheries Ireland for in-stream works according to the Eastern Regional Fisheries Board (2004) guidance document "Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites", that is, May to September inclusive. This time period coincides with the period of lowest expected rainfall, and therefore minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses;
- During the near stream construction work double row silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase. There will be no batching or storage of cement allowed in the vicinity of the crossing construction areas; and,
- All access road river/stream crossings will require a Section 50 application (Arterial Drainage Act, 1945, as amended). The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent.

Residual Effects: With the application of the best practice mitigation outlined above, we consider the residual effect to be Negative, imperceptible, direct, long term, low probability impact on stream flows, stream morphology and surface water quality.

Significance of Effects: For the reasons outlined above, and with the implementation of the above mitigation measures, no likely significant effects on stream morphology or stream water quality will occur at crossing locations.

9.6.2.8 Surface Water quality Impacts during Excavations along the Grid Route

Based on the EPA mapping, there will be a requirement for at least 5 no. watercourse crossings along both of the proposed grid connection routes. No in-stream works are required at any of these crossings, however due to the proximity of local streams to the construction work at these crossing locations, there is a potential for surface water quality impacts during trench excavation work due to runoff from the road surface.

Pathway: Runoff and Surface water flows.

Receptor: The Brick and Feale Rivers downstream of the grid connection routes and the tributaries encountered along both proposed grid routes.

Pre-Mitigation Potential Effect: Negative, moderate, indirect, temporary, likely effect on surface water quality.

Proposed Mitigation Measures

Mitigation by Design:

- Silt Fences/Roadside Drain Blocking: Silt fences will be placed down-gradient of the proposed cable route and directional drilling works during construction work. Silt fences are effective at removing larger particle sized solids. This will act to prevent entry to water courses of sand and gravel sized sediment released from excavation of mineral sub-soils of glacial and glacio-fluvial origin and entrained in surface water runoff. Inspection and maintenance of these structures during the construction phase is critical to their functioning to stated purpose. They will remain in place throughout the entire construction phase.
- Double silt fences will be placed down-gradient of all construction areas inside the hydrological buffer zones (i.e. near stream crossings).
- Any roadside drains will be temporarily blocked using sandbags in the area where trenching works is taking place.
- Surplus Excavated Spoil: Excavated spoil emanating from the cut for the trenches, where appropriate (i.e. when trenching within private tracks or the public road verge) will be used to backfill the trenches. Any excess will be disposed at an appropriate licenced facility. All excavated material emanating from trenches within the public road will be disposed at an appropriate licenced facility.
- Timing of Site Construction Works: Excavation of cable trench will not be undertaken during periods of high rainfall. This will minimise the risk of entrainment of suspended sediment in surface water runoff and transport via this pathway to surface watercourses.

Residual Effect: Due to the nature of the proposed grid route being within the corridor of public roads, the transient, spread out nature of the works, the requirement for no new watercourse crossings and the absence of instream works along with the proposed mitigation measures the effect will be negative, imperceptible, indirect, temporary, likely effect on surface water in the Brick and Feale Rivers and their associated tributaries.

Significance of Effects: For the reasons outlined above, and with the application of the mitigation measures no likely significant effects on surface water quality will occur.

9.6.2.9 Potential Impacts on Hydrologically Connected Designated Sites

Possible effects include water quality impacts which could be significant if mitigation is not put in place.

The Lower River Shannon SAC and Cashen River Estuary pNHA are located immediately downstream of the proposed wind farm site and the proposed grid route options. The wind farm site drains towards a deep perimeter drain which in-turn discharges into the Brick River which forms part of the Lower Shannon River SAC. To the north of the site, the Brick River discharges into the Cashen River Estuary pNHA. One proposed watercourse crossing along the Trien Grid Route Option crosses the Smearlagh River, which forms part of the Lower River Shannon SAC. All other watercourses along both grid route options drain into the Lower River Shannon SAC and the Cashen River Estuary further downstream.

In addition, along the N69, the Grid Route Option A travels through the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (Site Code: 004161). This site is a SPA under the E.U. Birds Directive of special conservation interest for Hen Harrier. The mix of forestry and open areas within this site provide an optimum habitat for the Hen Harrier, which is listed on Annex I of the Birds Directive. The proposed grid connection route is located within this designated site and may adversely impact on the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA.

As stated above, without mitigation the construction activities at both the wind farm site and the along the grid connection route have the potential to adversely impact surface water quality and could affect the water quality and aquatic habitats within these sites of national and international conservation importance.
Pathway: Surface water flowpaths.

Receptor: Down-gradient water quality and designated sites (Lower River Shannon SAC and Cashen River Estuary pNHA) and the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA.

Pre-Mitigation Potential Impact: Indirect, negative, negligible, temporary, low probability.

Proposed Mitigation Measures

Mitigation measures implemented to protect downstream designated sites are the same as those implemented to protect surface water quality. These are outlined in Section 9.6.2.1 through to Section 9.6.2.8and include 9.6.2.3buffer zones and drainage control measures (i.e. interceptor drains, swales, settlement ponds) will ensure that the quality of runoff from proposed development areas will be very high.

Residual Effect: Construction activities at the wind farm site and along the grid connection route pose a threat to designated sites hydrologically linked with the proposed development. Proven and effective measures to mitigate the risk of surface and groundwater contamination have been proposed which will break the pathway between the potential source and the downstream receptor. These mitigation measures will ensure that surface water runoff from the site and the grid connection route will be equivalent to baseline conditions and will therefore have no impact on the status or ecology of the protected species and habitats within the designated sites. The residual effect is considered to be Negative, imperceptible, indirect, short term, unlikely impact to surface water quality.

Significance of Effects: For the reasons outlined above, and with the implementation of the above mitigation measures, no likely significant effects on designated sites will occur.

9.6.2.10 Potential Groundwater and Surface Water Impacts due to Directional Drilling works

Due to the shallow nature of the grid connection works, there will be no impacts on groundwater flows and levels, however there is a potential for impacts on groundwater quality from fuels and other chemicals during the construction phase. Directional drilling may be required along public roads for the grid connection.

Horizontal Directional Drilling (HDD) methods may be required on four of the 5 no. major watercourse crossings identified along the proposed grid route. Mitigation measures are outlined below.

Pathway: Surface water and groundwater flow paths.

Receptor: Down-gradient water quality in the Brick and Feale Rivers downstream of the grid connection routes and the tributaries encountered along both proposed grid routes.

Pre Mitigation Potential Impact: Indirect, negative, slight, temporary, low probability impact on surface water quality. Indirect, negative, slight, temporary, low probability impact on groundwater quality.

Proposed Mitigation Measures

The following mitigation measures are proposed:

Mitigation by Avoidance:

A constraint/buffer zone will be maintained for all upgrade works locations, whereby all watercourses will be fenced off. In addition, measures which are outlined below will be implemented to ensure that silt laden or contaminated surface water runoff from the excavation work does not discharge directly to the watercourse.

The purpose of the constraint zone is to:

- Avoid physical damage to surface water channels;
- Provide a buffer against hydraulic loading by additional surface water run-off;
- Avoid the entry of suspended sediment and associated nutrients into surface waters from excavation and earthworks;
- Provide a buffer against direct pollution of surface waters by pollutants such as hydrocarbons; and,
- Provide a buffer against construction plant and materials entering any watercourse.

General Best Practice Pollution Prevention Measures will also include:

- Protection of the riparian zone watercourses by implementing a constraints zone around stream crossings, in which construction activity will be limited to the minimum, i.e. works solely in connection with duct laying at the stream crossing;
- No stock-piling of construction materials will take place within the constraints zone;
- No refuelling of machinery or overnight parking of machinery is permitted in this area;
- No concrete truck chute cleaning is permitted in this area;
- Works shall not take place at periods of high rainfall, and shall be scaled back or suspended if heavy rain is forecast;
- Plant will travel slowly across bare ground at a maximum of 5km/hr;
- Machinery deliveries shall be arranged using existing structures along the public road;
- All machinery operations shall take place away from the stream and ditch banks, although no instream works are proposed or will occur;
- Any excess construction material shall be immediately removed from the area and taken to a licensed waste facility;
- No stockpiling of materials will be permitted in the constraint zones;
- Spill kits shall be available in each item of plant required to complete the stream crossing; and,
- Silt fencing will be erected on ground sloping towards watercourses at the stream crossings if required.

Mitigation Measures relating to the use of a mixture of a natural, inert and fully biodegradable drilling fluid such as Clear Bore™ and water for directional drilling if required:

- The area around the Clear Bore™ batching, pumping and recycling plants shall be bunded using terram and sandbags in order to contain any spillages;
- One or more lines of silt fences shall be placed between the works area and adjacent rivers and streams on both banks;
- Accidental spillage of fluids shall be cleaned up immediately and transported off site for disposal at a licensed facility; and,

- Adequately sized skips will be used for temporary storage of drilling arisings during directional drilling works. This will ensure containment of drilling arisings and drilling flush.

Mitigation Measures relating to the use and storage of fuels and chemicals in terms of groundwater protection:

- Onsite re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser, as described in Section 9.6.2.4. No maintenance of construction vehicles or plant will take place along the grid connection or temporary junction works areas;
- The plant used will be regularly inspected for leaks and fitness for purpose; and,
- Spill kits will be available to deal with accidental spillage.

Residual Effect: Due to the avoidance of instream works, the works being mainly carried out in the corridor of a public road along with the proposed mitigation measures the effect will be negative, imperceptible, indirect, temporary, likely effect on surface waters. The residual effects are considered to be indirect, negative, imperceptible, temporary, low probability impact on surface water quality and indirect, negative, imperceptible, temporary, low probability impact on groundwater quality.

Significance of Effects: For the reasons outlined above, and with the application of the mitigation measures no likely significant effects on surface water quality will occur.

9.6.2.11 Potential Effects on Local Groundwater Well Supplies

A baseline definition of groundwater flow at the study site is outlined in Section 9.4.9. Using this conceptual model of groundwater flow an impact assessment for local wells is undertaken below. This assessment is completed in accordance with “Wind farms and groundwater impacts - A guide to EIA and Planning considerations” (DoE/NIEA, 2015).

There are no public or group scheme groundwater supplies down-gradient of the wind farm site that can be impacted by the prosed wind farm development.

We have also completed an assessment of private wells within 1km of the wind farm site boundary, following the assumption that all dwellings are likely to have a private groundwater well. A number of private dwelling houses were identified along the local roads within the wind farm site. Some of these dwellings are located down-gradient (i.e., downslope) of the proposed wind farm infrastructure development (and in the proposed borrow pit and substation locations).

The biggest risk to wells will be from where deep excavations are required such as the borrow pits and turbines bases. Construction of the Wind Farm Site access road, Underground Cable Route trench and substation will not have the potential to effect local wells due to the shallow nature of the works.

Pathway: Groundwater flow paths.

Receptor: Down-gradient water supplies (groundwater wells).

Pre-Mitigation Potential Effects: Negative, indirect, negligible, short term, unlikely effect on down-gradient water supplies.

Impact Assessment:

The risk to any potential well source down-gradient of a key wind farm infrastructure from potential contaminant release (i.e., sediment, hydrocarbons, and cement-based compounds) within any excavation at this separation distance is negligible (i.e., >0.4k m). Due to the local hydrogeological regime at this site, with high rates of surface runoff and a high drainage density, it is unlikely that a pollutant will reach groundwater wells in the vicinity of the site.

Therefore, the risk posed to potential well sources at this distance from potential spills and leaks from excavations at the wind farm site is negligible.

Due to the shallow and transient nature of the grid cable works within the carriageway of public roads no effects on private groundwater well supplies will occur.

In addition, there are proposed mitigation measures (outlined above) that will minimise and prevent potential groundwater contamination from hydrocarbons and other chemicals (refer to Sections 9.6.2.4 (Controls for Hydrocarbons), 9.6.2.5 (Controls for Temporary Wastewater Facilities) & 9.6.2.6 (Controls for Cement Use).

Residual Effect: For the reasons outlined in the impact assessment above (separation distances, and prevailing geology, topography and groundwater flow directions), it has been assessed there is no potential to impact on local groundwater wells and water supplies.

Significance of Effects: For the reasons outlined above, and with the implementation of the above mitigation measures, no likely significant effects on local groundwater well supplies will occur.

9.6.3 Operational Phase – Likely Significant Effects and Mitigation Measures

9.6.3.1 Progressive Replacement of Natural Surface with Lower Permeability Surfaces

Progressive replacement of the peat and vegetated surfaces with impermeable surfaces could potentially result in an increase in the proportion of surface water runoff reaching the surface water drainage network. The footprint comprises 7 no. turbine hardstandings, new and upgraded access roads, and the substation. During storm rainfall events, additional runoff coupled with increased velocity of flow could increase hydraulic loading, resulting in erosion of watercourses and impact on aquatic ecosystems.

The emplacement of the proposed permanent development footprint within the wind farm site, assuming emplacement of impermeable materials as a worst-case scenario, could result in an average total site increase in surface water runoff of 342m^3/month at the wind farm site. This represents a potential increase of 4.1% in the average daily/monthly volume of runoff from the study area in comparison to the baseline pre-development site runoff conditions. This is a very small increase in average runoff and results from a relatively small area of the site being developed, the proposed total permanent development footprint being approximately 7.13ha, representing ~1.2 % of the total wind farm site area of 594ha.

Table 9-19: Baseline Site Runoff V Development Runoff

Development Type	Wind Farm
Site Baseline Runoff/month (m^3)	678,942
Baseline Runoff/day (m^3)	21,901
Permanent Hardstanding Area (m^2)	71,300
Hardstanding Area 100% Runoff (m^3)	8,491
Hardstanding Area 95% Runoff (m^3)	8,149

Development Type	Wind Farm
Net Increase/month (m^3)	342
Net Increase/day (m^3)	11
% Increase from Baseline Conditions (m^3)	4.1

The additional volume in all outfall sub-catchments is low due to the fact that the runoff potential from the site is naturally high (96%). Also, the calculation assumes that all hardstanding areas will be impermeable which will not be the case as access tracks will be constructed of permeable stone aggregate. Therefore the increase in runoff from the proposed development will be negligible. This is even before mitigation measures will be put in place. Therefore, there will be no risk of exacerbated flooding down-gradient of the site.

Pathway: Site drainage network.

Receptor: Down-gradient rivers (River Brick, River Feale, Smearlagh River) and the Cashen River Estuary and their associated dependent ecosystems.

Pre-Mitigation Potential Impact: Direct, negative, moderate, permanent, moderate probability impact on downstream surface water bodies (River Brick, River Feale, Cashen River Estuary).

Impact Assessment

As determined in Table 9-19 above there could be a potential increase in runoff of 4.1% in the average daily/monthly volume of runoff from the study area in comparison to the baseline pre-development site runoff conditions. This is a very small increase in average runoff and results from a relatively small area of the study area being developed, the proposed total permanent development footprint being approximately 7.13ha (within wind farm site), representing ~1.2% of the total study area of 594ha.

The increase in runoff from the development will therefore be negligible. This is even before drainage mitigation measures will be put in place. Therefore, there will be no risk of exacerbated flooding down-gradient of the site.

It should also be noted that downstream flood risk is largely controlled by coastal flooding of infinite volume (from the sea), so the finite volume of surface water contribution to drainage from the site has only a very minor role to play in flood risk downstream of the site.

Proposed Mitigation Measures

Mitigation by Design:

The operational phase drainage system will be installed and constructed in conjunction with the road and hardstanding construction work as described below:

- Runoff from individual turbine hardstanding areas will be not be discharged into the existing drain network but discharged locally at each turbine location through settlement ponds and drainage swales;
- Interceptor drains will be installed up-gradient of all proposed infrastructure to collect clean surface runoff (or existing drains will be utilised), in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained;

- Swales/roadside drains will be used to collect runoff from access roads and turbine hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to settlement ponds for sediment settling;
- Check dams will be used along sections of access road drains to intercept silts at source. Check dams will be constructed from a 4/40mm non-friable crushed rock; and,
- Settlement ponds, emplaced downstream of road swale sections and at turbine locations, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to existing drains.

Residual Effects: With the implementation of the proposed wind farm drainage measures as outlined above runoff from the site will be treated and discharged in accordance with prevailing drainage conditions at the proposed wind farm site. We consider that the residual effect is Negative, direct, negligible, long term, moderate probability impact.

Significance of Effects: For the reasons outlined above, and with the implementation of the above mitigation measures, no likely significant effects on surface water quality or quantity will occur.

9.6.3.2 Drainage at Sub-Station

A surface water drainage system will be installed at the proposed substation. This has the potential to discharge silt laden water to the receiving environment. A water supply for the substation will also be required. Rainwater will be harvested at the site to cater for water supply needs during operation. This has the potential to reduce water flows to local streams/rivers. An on-site wastewater system will be required during the operation of the substation. Effluent from this system could leak to ground or overflow and enter surface water at the site.

Pathway: Site drainage network, surface water quality, groundwater quality.

Receptor: Down-gradient rivers (River Brick, River Feale, Smearlagh River) and the Cashen River Estuary and their associated dependent ecosystems and the karstic Ballybunnion groundwater body.

Pre-Mitigation Potential Impact: Indirect, negative, slight, permanent, low probability impact.

Impact Assessment

Surface water drainage from the sub-station area will be managed in a dedicated drainage system. Rainwater will be harvested at the site to cater for water supply needs during operation, and wastewater will be held in a sealed on-site tank, and there will be no proposed discharge to ground at the sub-station site.

Proposed Mitigation Measures

The proposed new sub-station will be located in the south of the proposed wind farm site. It is proposed to drain the substation using shallow swales, with a stilling pond at the end of the swale run. The stilling pond will remain in place following the construction period. At the upslope side of the sub-station overland flows will be intercepted in channels and discharged diffusely over vegetated areas. A suitable permanent petrol and oil interceptor will be installed to deal with all substation surface water drainage.

A rainwater harvesting system will be used for toilet flushing at the Substation Control Building in Ballynagare Wind Farm. There will be a very small net loss of water to local drains but this will be imperceptible over the course of a year.

It is proposed to install a sealed underground holding tank for effluent (wastewater) from the substation building. The tank shall be routinely emptied by a licensed contractor. A level sensor will be installed in the tank which shall be linked to the on-site SCADA system. Should the level of the tank rise to a predetermined 'high' level a warning shall appear on the overall SCADA system for the site and automatic notification shall be sent to the facility manager. A formal service agreement will be entered into with a suitably permitted waste contractor, in relation to the servicing and de-sludging of the wastewater holding tank on site. There will be no discharge of wastewater to ground at the site, and therefore there is no potential to impact groundwater or surface water quality.

Residual Effects: With the implementation of the drainage regime at the substation, the pathway between the potential contamination source and the downstream receptors will be broken. These mitigation measures will ensure that no wastewater from the substation enters local surface waterbodies or groundwater flowpaths. We consider the residual effect to be indirect, negative, imperceptible, permanent, low probability impact on surface water and groundwater quality.

Significance of Effects: For the reasons outlined above, and with the implementation of the above mitigation measures, no significant effects on surface water quality or quantity, or groundwater quality will occur.

9.6.4 Decommissioning Phase – Likely Significant Effects

The potential impacts on the water environment during the decommissioning stage will be similar to those during the construction phase, and as such the proposed mitigation for the Decommissioning Phase are similar to those outlined in Section 9.6.2. Moreover, due to the relative long life of the wind farm infrastructure, it is likely that a revised/updated environmental assessment will be required at the time of decommissioning to account for any changes in baseline conditions at the wind farm site, and potential changes in assessment guidelines and legislation.

Potential impacts would be similar to the construction phase but to a lesser degree. There would be increased trafficking and an increased risk of disturbance to underlying soils at the wind farm site, during the decommissioning phase, in this instance, leading to the potential for silt laden run-off entering receiving watercourses from the wheels of vehicles. Any such potential impacts would be likely to be less than during the construction stage as the drainage swales would be fully mature and would provide additional filtration of runoff. Any diesel or fuel oils stored on site would be bunded. In the event of decommissioning of the Ballynagare Wind Farm, the proposed access tracks may be used in the decommissioning process.

Following decommissioning of the wind farm, turbine foundations, hardstanding areas and site tracks will be rehabilitated, i.e. left in place, covered over with local peat soil/scraw (i.e. peat vegetation sod) and allowed to re-vegetate naturally, if required. The internal site access tracks may be left in place, subject to agreement with Kerry County Council and the landowner. It is considered that leaving these areas in-situ will cause less environmental damage than removing and recycling them.

Removal of this infrastructure would result in considerable disturbance to the local environment in terms of disturbance to underlying soils and an increased sedimentation (if turbine foundations, access tracks and hardstandings are being reinstated there is a risk of silt laden run-off entering the receiving watercourses), erosion, dust, noise, traffic and an increased possibility of contamination of the local water table. However, if removal is deemed to be required all infrastructure will be removed with mitigation measures similar to those during construction being employed.

The substation will remain in place as it will be under the ownership of the ESB. There are no impacts associated with this.

The cabling along the grid route will also remain in place and as such there will be no impacts associated with this.

9.6.5 Do-Nothing Scenario

Commercial peat harvesting and local agricultural activities will continue at the proposed wind farm site. Surface water drainage carried out in areas of peat extraction and agriculture will continue to function and may be extended in some areas. Junction works areas would remain the same. The impact on hydrology and water quality would remain largely unaltered as a result.

9.6.6 Cumulative Impacts

Both the proposed wind farm site and the grid connection route are located in the Tralee Bay-Feale surface water catchment. However, in terms of hydrological cumulative impacts arising from the proposed wind farm infrastructure and the grid connection route, there will be no impacts as the proposed grid connection route is along the carriageway of public roads and there are no proposed in-stream works at any of the watercourse crossing locations as all the proposed crossing locations are at existing bridges or culverts.

A hydrological cumulative impact assessment regarding other wind farm developments within the Tralee Bay-Feale surface water catchment within a 25km radius of the proposed wind farm site was also undertaken. There are 160 no. turbines within 25km of the proposed site and within the Tralee Bay-Feale Catchment. A list of these other wind farm developments is shown in Table 9-20 below.

Table 9-20: Wind Farm Developments in the Tralee Bay-Feale surface water catchment (within 25km of the proposed Ballynagare wind farm site)

Catchment Area	Wind Farm Name	Status	No. of Turbines in Tralee Bay-Feale Catchment
Tralee Bay-Feale	Pallas WF	Operational	20
	Beenageeha WF	Operational	6
	Knocknagoum WF	Commissioning	26
	Ballincollig Hill WF	Operational	16
	Tursillagh WF	Operational	23
	Muingnaminnane WF	Operational	18
	Cloghboola WF	Operational	16
	Athea WF	Operational	16
	Dromada WF	Operational	19
Total			160

Therefore, the total number of turbines that could potentially be operating inside a 25km radius within the Tralee Bay-Feale surface water catchment, including the proposed 7 no. turbines at the proposed Ballynagare wind farm is 167.

The catchment area within a 25km radius of the site is ~950km^2 and therefore this equates to one turbine for approximately every ~6km^2 which is considered imperceptible in terms of potential cumulative hydrological impacts.

In relation to non-wind farm developments, the majority of local developments relate to the provision and/or alteration of one-off housing and agricultural developments. These developments are small scale and localised in nature and impacts on water quality or flows (surface water or groundwater) are not expected. Therefore, hydrological cumulative impacts with respect to the proposed Ballynagare wind farm are also not expected.

Regardless, implementation of the proposed drainage mitigation will ensure there will be no cumulative significant adverse impacts on the water environment during construction from the proposed development and the Ballynagare wind farm, and other wind farm developments and non-wind farm developments within the Tralee Bay-Feale surface water catchment.

During the operational phase of the proposed development all excavation and construction related work will have ceased and therefore there is no potential for water quality impacts from these sources. The proposed wind farm drainage system will retain rainwater within the proposed drainage system and therefore will improve overall surface water runoff quality prior to discharge. No cumulative adverse impacts on the water environment due to the proposed development are expected during the operational phase.

No significant cumulative impacts on the hydrology and hydrogeology environment are envisaged during the decommissioning stage.

9.7 Conclusion

As part of the baseline assessment, a comprehensive desk study has been undertaken as well as hydrological monitoring involving measurement of water quality and field chemistry and river and stream flows at the wind farm site and along the proposed grid connection routes.

Within the wind farm site, there are numerous manmade drains that are in place predominately to facilitate peat extraction and agricultural activities. The integration of the proposed wind farm infrastructure with the existing drainage, and natural drainage of the wind farm site, in a manner that avoids water quality and flooding impacts in downstream rivers and streams is a key component of the wind farm design. According to the WFD, surface water quality of the local rivers and the Cashen River Estuary is typically moderate to poor.

During each phase of the wind farm development (construction, operation and decommissioning) a number of construction related activities will take place on the proposed Ballynagare wind farm site which will have the potential to affect the hydrological regime or water quality at the site or its vicinity. These potential effects generally arise from sediment input from runoff and other pollutants such as hydrocarbons and cement-based compounds, with the former having the most potential for impact. These potential effects are similar to any construction site.

Surface water drainage measures, pollution control and other preventative measures have been incorporated into the project design to minimise significant adverse effects on water quality and downstream designated sites.

The surface water drainage plan will be the principal means of significantly reducing sediment runoff arising from construction activities and to control runoff rates. The drainage plan involves collecting any drainage waters from works areas within the site that might carry silt or sediment, and nutrients, to route them towards new proposed silt traps and settlement ponds (or stilling ponds) prior to controlled diffuse release into the existing field drainage network. There will be no direct discharges to any existing natural watercourse from the wind farm construction, operation or decommissioning works.

Preventative pollution measures which also include fuel and concrete management and a waste management plan have been incorporated into the Construction and Environmental Management Plan, which is presented in Appendix 4.2 of this EIAR.

Overall the proposal presents no likely significant effects to surface water (quality or flows) and groundwater (quality or quantity) provided the proposed mitigation measures are implemented.

No significant construction, operational or decommissioning stage cumulative effects on any of the regional surface water catchment or groundwater bodies will result from the proposed Ballynagare wind farm (including haul route works), the on-site substation, its associated grid connection route and other local developments.

BIBLIOGRAPHY

CIRIA, 2006: Guidance on ‘Control of Water Pollution from Linear Construction Projects’ (CIRIA Report No. C648, 2006).

CIRIA, 2006: Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2006.

DoHLG, 2006: Wind Farm Development Guidelines for Planning Authorities.

DoE/NIEA, 2015. Wind farms and groundwater impacts - A guide to EIA and Planning considerations.

EPA (2017) Guidelines on the Information to be contained in Environmental Impact Assessment Reports – Draft.

EPA (September 2015): Draft - Advice Notes on Current Practice (in the preparation of Environmental Impact Statements).

EPA (September 2015): Draft – Revised Guidelines on the Information to be contained in Environmental Impact Statements.

EPA, 2003: Advice Notes on Current Practice (in the preparation of Environmental Impact Statements).

Gavin and Doherty Geosolutions (GDG) (2021). Peat and overburden management plan for Ballynagare Renewable Energy Development.

Gavin and Doherty Geosolutions (GDG) (2021). Peat Stability Risk Assessment (PSRA) and Peat Managing Plan (PMP) for Ballynagare wind farm.

Geological Survey of Ireland (GSI). (2005) Geology of Shannon Estuary, 1:100,000 scale Bedrock Geology Series, Sheet 17.

Geological Survey of Ireland. (2003) Groundwater Body Characterization Reports.

IFI, 2016: Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters, Inland Fisheries Ireland (2016).

IGI, 2013: Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements, (Institute of Geologists Ireland, 2013).

NRA, 2008: Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, (National Roads Authority, NRA, 2008).

PPG1 - General Guide to Prevention of Pollution (UK Guidance Note).

PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note).

OPW, 2009 – The Planning System and Flood Risk Management. Guidelines for Planning Authorities.

SNH, 2010: Scottish Natural Heritage report (SNH): Good Practice During Wind Farm Construction.

SNH, 2013: Scottish Natural Heritage report (SNH): Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms.

10. AIR AND CLIMATE

10.1 Introduction

10.1.1 Background

The site of the proposed development is located approximately 2km north of the village of Lixnaw and approximately 8.8km southwest of the town of Listowel, Co. Kerry. The townlands in which the proposed development is located, including the underground cable route, are listed in Table 1.1 in Chapter 1 of this EIAR.

The primary land-uses within and in the vicinity of the site comprise turbary and agriculture. Due to the non-industrial nature of the proposed development and the general character of the surrounding environment, air quality sampling was deemed to be unnecessary for this EIAR. It is expected that air quality in the existing environment is good, since there are no major sources of air pollution (e.g. heavy industry) in the vicinity of the site.

The production of energy from wind turbines has no direct emissions as is expected from coal or oil-based power stations. Harnessing more energy by means of wind farms will reduce dependency on oil, gas and coal power stations, thereby resulting in a reduction in harmful emissions that can be damaging to human health and the environment. Some minor indirect emissions associated with the construction of the proposed development include vehicular and dust emissions.

10.2 Air Quality

10.2.1 Introduction

This chapter identifies, describes and assesses the potential significant direct and indirect effects on air quality and climate arising from the construction, operation and decommissioning of the proposed Ballynagare Wind Farm project.

The proposed development is located approximately 9 kilometres (km) west of Listowel, Co. Kerry and approximately 2km north of Lixnaw, Co. Kerry. The townlands in which the proposed development is located, including the underground cable route, are listed in Table 1.1 in Chapter 1 of this EIAR.

The primary land-uses within and in the vicinity of the proposed development comprise agriculture, forestry and peat cutting. Due to the non-industrial nature of the proposed development and the general rural character of the surrounding environment, air quality monitoring was deemed to be unnecessary for this EIAR. It is expected that air quality in the existing environment is good, since there are no major sources of air pollution (e.g. heavy industry) in the vicinity of the proposed development.

The production of energy from wind turbines has no direct emissions as is expected from fossil fuel-based power stations. Harnessing more energy by means of wind farms will reduce dependency on fossil fuels, thereby resulting in a reduction in harmful emissions that can be damaging to human health and the environment. Some minor short term or temporary indirect emissions associated with the construction of the wind farm include vehicular and dust emissions. Emissions from the construction, operation and decommissioning phases of the project are addressed in Section 10.1.5.

10.2.1.1 Relevant Guidance

The air quality and climate section of this EIAR is carried out in accordance with the 'EIA Directive' as amended by Directive 2014/52/EU and having regard, where relevant, to guidance listed in Sections 1.6.2 and 1.6.7 of Chapter 1: Introduction.

10.2.1.2 Statement of Authority

This section of the EIAR has been prepared by Eoin Hurst and reviewed by Michael Watson, of MKO. Eoin Hurst is a Project Environmental Engineer with MKO with over 12 years of progressive experience in civil and environmental engineering consultancy. Eoin holds a BE in Civil Engineering from NUI Galway and a MSc in Environmental Technology from Imperial College London. Prior to starting with MKO in September 2019, Eoin worked as an Environmental Engineer with Tetra Tech in the United States and has held previous positions with consulting firms in the US, UK and Ireland.

Michael Watson is Project Director and head of the Environment Team in MKO. Michael has over 18 years' experience in the environmental sector. Following the completion of his Master's Degree in Environmental Resource Management, Geography, from National University of Ireland, Maynooth he worked for the Geological Survey of Ireland. Between them, they have completed Air and Climate EIAR chapters for over twenty wind energy projects.

10.2.2 Air Quality Standards

In 1996, the Air Quality Framework Directive (96/62/EC) was published. This Directive was transposed into Irish law by the Environmental Protection Agency (EPA) Act 1992 (Ambient Air Quality Assessment and Management) Regulations 1999. The Directive was followed by four Daughter Directives, which set out limit values for specific pollutants:

- The first Daughter Directive (1999/30/EC) addresses sulphur dioxide, oxides of nitrogen, particulate matter and lead.
- The second Daughter Directive (2000/69/EC) addresses carbon monoxide and benzene. The first two Daughter Directives were transposed into Irish law by the Air Quality Standards Regulations, 2002 (SI No. 271 of 2002).
- The third Daughter Directive (2002/3/EC) relating to ozone in ambient air was published in 2002 and was transposed into Irish law by the Ozone in Ambient Air Regulations, 2004 (SI No. 53 of 2004).
- The fourth Daughter Directive, published in 2007, relates to polycyclic aromatic hydrocarbons (PAH), and arsenic, nickel, cadmium and mercury in ambient air and was transposed into Irish law by the Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations, 2009 (S.I. No. 58 of 2009).

The Air Quality Framework Directive and the first three Daughter Directives have been replaced by the Clean Air for Europe (CAFE) Directive (Directive 2008/50/EC on ambient air quality), which encompasses the following elements:

- The merging of most of the existing legislation into a single Directive (except for the Fourth Daughter Directive) with no change to existing air quality objectives.
- New air quality objectives for particulate matter less than 2.5 micrometers (µm) referred to as $PM_{2.5}$ including the limit value and exposure concentration reduction target.
- The possibility to discount natural sources of pollution when assessing compliance against limit values.

- The possibility for time extensions of three years for particulate matter less than 10µm (PM_{10}) or up to five years (nitrogen dioxide, benzene) for complying with limit values, based on conditions and the assessment by the European Commission.

Table 10-1 below sets out the limit values of the CAFE Directive, as derived from the Air Quality Framework Daughter Directives. Limit values are presented in micrograms per cubic metre (µg/m^3) and parts per billion (ppb). The notation PM_{10} is used to describe particulate matter or particles of 10µm or less (coarse particles) in aerodynamic diameter. $PM_{2.5}$ represents particles measuring less than 2.5µm (fine particles) in aerodynamic diameter.

The CAFE Directive was transposed into Irish legislation by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011). These Regulations supersede the Air Quality Standards Regulations, 2002 (S.I. No. 271 of 2002), the Ozone in Ambient Air Regulations, 2004 (S.I. No. 53 of 2004) and the Ambient Air Quality Assessment and Management Regulations, 1999 (S.I. No. 33 of 1999).

Table 10.1 Limit Values of Directive 2008/50/EC, 1999/30/EC and 2000/69/EC (Source: https://www.epa.ie/air/quality/standards/)

Pollutant	Limit Value Objective	Averaging Period	Limit Value (µg/m3)	Limit Value (ppb)	Basis of Application of Limit Value	Attainment Date
Sulphur dioxide (SO_2)	Protection of Human Health	1 hour	350	132	Not to be exceeded more than 24 times in a calendar year	1st Jan 2005
Sulphur dioxide (SO_2)	Protection of human health	24 hours	125	47	Not to be exceeded more than 3 times in a calendar year	1st Jan 2005
Sulphur dioxide (SO_2)	Upper assessment threshold for the protection of Human Health	24 hours	75	28	Not to be exceeded more than 3 times in a calendar year	1st Jan 2005
Sulphur dioxide (SO_2)	Lower assessment threshold for the protection of human health	24 hours	50	19	Not to be exceeded more than 3 times in a calendar year	1st Jan 2005
Sulphur dioxide (SO_2)	Protection of vegetation	Calendar year	20	7.5	Annual mean	19th Jul 2001

Pollutant	Limit Value Objective	Averaging Period	Limit Value (µg/m3)	Limit Value (ppb)	Basis of Application of Limit Value	Attainment Date
Sulphur dioxide (SO_2)	Protection of vegetation	1st Oct to 31st Mar	20	7.5	Winter mean	19th Jul 2001
Nitrogen dioxide (NO_2)	Protection of human health	1 hour	200	105	Not to be exceeded more than 18 times in a calendar year	1st Jan 2010
Nitrogen dioxide (NO_2)	Protection of human health	Calendar year	40	21	Annual mean	1st Jan 2010
Nitrogen dioxide (NO_2)	Upper assessment threshold for the protection of human health	1 hour	140	73	Not to be exceeded more than 18 times in a calendar year	1st Jan 2010
Nitrogen dioxide (NO_2)	Lower assessment threshold for the protection of human health	1 hour	100	52	Not to be exceeded more than 18 times in a calendar year	1st Jan 2010
Nitrogen dioxide (NO_2)	Lower assessment threshold for the protection of human health	Calendar year	26	-	Annual mean	1st Jan 2010
Nitrogen monoxide (NO) and nitrogen dioxide (NO_2)	Protection of ecosystems	Calendar year	30	16	Annual mean	19th Jul 2001
Particulate matter 10 (PM_{10})	Protection of human health	24 hours	50	-	Not to be exceeded more than 35 times in	1st Jan 2005

Pollutant	Limit Value Objective	Averaging Period	Limit Value (µg/m3)	Limit Value (ppb)	Basis of Application of Limit Value	Attainment Date
					a calendar year	
Particulate matter 10 (PM_{10})	Annual limit value for the protection of human health	Calendar year	40	-	Annual mean	1st Jan 2005
Particulate matter 10 (PM_{10})	Upper assessment threshold for the protection of human health	24 hours	30	-	Not to be exceeded more than 7 times in a calendar year	Based on the indicative limit values for 1 January 2010
Particulate matter 10 (PM_{10})	Lower assessment threshold for the protection of human health	24 hours	20	-	Not to be exceeded more than 7 times in a calendar year	Based on the indicative limit values for 1 January 2010
Particulate matter 2.5 ($PM_{2.5}$)	Protection of human health	Calendar year	40	-	Annual mean	1st Jan 2005
Particulate matter 2.5 ($PM_{2.5}$) Stage 1	Protection of human health	Calendar year	25	-	Annual mean	1st Jan 2015
Particulate matter 2.5 ($PM_{2.5}$) Stage 2	Protection of human health	Calendar year	20	-	Annual mean	1st Jan 2020
Lead (Pb)	Protection of human health	Calendar year	0.5	-	Annual mean	1st Jan 2005
Carbon Monoxide (CO)	Protection of human health	8 hours	10,000	8,620	-	1st Jan 2005
Benzene (C_6H_6)	Protection of human health	Calendar Year	5	1.5	-	1st Jan 2010

The Ozone Daughter Directive 2002/3/EC is different from the other Daughter Directives in that it sets target values and long-term objectives for ozone rather than limit values. Table 10-2 presents the limit and target values for ozone.

Table 10.2 Target Values for Ozone Defined in Directive 2008/50/EC

Objective	Parameter	Target Value for 2010	Target Value for 2020
Protection of human health	Maximum daily 8-hour mean	120 mg/m^3 not to be exceeded more than 25 days per calendar year averaged over 3 years	120 mg/m^3
Protection of vegetation	AOT40* calculated from 1-hour values from May to July	18,000 mg/m^3.h averaged over 5 years	6,000 mg/m^3.h
Information Threshold	1-hour average	180 mg/m^3	-
Alert Threshold	1-hour average	240 mg/m^3	-

*The sum of the differences between hourly ozone concentration and 40ppb for each hour when the concentration exceeds 40ppb during a relevant growing season, e.g. for forest and crops.

10.2.2.1 Air Quality and Health

The EPA report '*Air Quality in Ireland 2019'* noted that in Ireland, the premature deaths attributable to poor air quality as a result of the burning of fossil fuels are estimated at 1,300 people. A more recent European Environmental Agency (EEA) Report, '*Air Quality in Europe – 2019 Report'* highlights the negative effects of air pollution on human health. The report concluded that poor air quality accounted for premature deaths of approximately 412,000 people in Europe in 2016, with regards to deaths relating to $PM_{2.5}$. The estimated impacts on the population in Europe of exposure to NO_2 and O_3 concentrations in 2016 were approximately 71,000 and 15,100 premature deaths per year, respectively. From this, 1,100 Irish deaths were attributable to $PM_{2.5}$, 50 Irish deaths were attributable to nitrogen oxides (NO_x) and 30 Irish deaths were attributable to Ozone (O_3) (Source: *Air Quality in Europe – 2019 Report',* EEA, 2019). These emissions, along with others including sulphur oxides (SO_x) are produced in variable concentrations during fossil fuel-based electricity generation, depending on the fuel and technology used.

10.2.3 Air Quality Zones

The EPA has designated four Air Quality Zones for Ireland:

- Zone A: Dublin City and environs
- Zone B: Cork City and environs
- Zone C: 24 other cities and large towns including Limerick, Galway and Waterford
- Zone D: Remainder of the country, rural areas outside Zones A to C.

These zones were defined to meet the criteria for air quality monitoring, assessment and management described in the Framework Directive and Daughter Directives. The site of the proposed development lies within Zone D, which represents rural areas located away from large population centres.

10.2.4 Existing Environment

The air quality in the vicinity of the proposed development site is typical of that of rural areas in the West of Ireland, i.e. Zone D. Prevailing south-westerly winds carry clean, unpolluted air from the Atlantic Ocean onto the Irish mainland. The ambient air quality monitoring carried out closest to the proposed development site is at Tralee, Co. Kerry, located approximately 18 km south-southwest of the proposed development site.

The EPA publishes Air Monitoring Station Reports for monitoring locations in all four Air Quality Zones. EPA air quality data is available for Tralee in the report '*Ambient Air Monitoring in Tralee 17th November 2003 to 30th June 2004*,' as detailed below. This monitoring location lies within Zone C. Values lower than those reported at the Tralee location for all air quality parameters would be expected for the proposed development site, as it lies in a rural location, within Zone D.

10.2.4.1 Sulphur Dioxide (SO_2)

Sulphur dioxide data for the 2003/2004 monitoring period in Tralee is presented in Table 10.3. Neither the hourly limit value nor the lower assessment threshold as set out in the CAFE Directive were exceeded during this monitoring period.

Table 10.3 Sulphur Dioxide Data Tralee Nov. 2003 – June 2004

Parameter	Reported Daily Values
No. of monitoring hours	5,399 hrs
No. of measured values	2,733
Percentage Coverage	50.6%
Maximum hourly value	63.6 $\mu g/m^3$
98 percentile for hourly values	21.1 $\mu g/m^3$
Mean hourly value	6.1 $\mu g/m^3$
Maximum 24-hour mean	17.7 $\mu g/m^3$
98 percentile for 24-hour mean	14.7 $\mu g/m^3$

It would be expected that SO_2 values at the proposed development site (Zone D) would be lower than those recorded at the Tralee monitoring site (Zone C).

10.2.4.2 Particulate Matter (PM_{10} and $PM_{2.5}$)

Coarse particulate matter (PM_{10}) data reported by the EPA for the 2003/2004 monitoring period in Tralee is presented in Table 10.4. The 24-hour limit value for the protection of human health (50 $\mu g/m^3$) was not exceeded during the measurement period. The upper assessment threshold was exceeded on 14 days and the lower assessment threshold was exceeded on 52 days. The CAFE Directive stipulates that these assessment thresholds should not be exceeded more than 35 times in a calendar year. The mean of the daily values during the measurement period is below the annual limit value for the protection of human health (40 $\mu g/m^3$).

Table 10.4 Particulate Matter (PM_{10}) Data Tralee 2003/2004

Parameter	Reported Daily Values
No. of days	225
No. of measured values	154
Percentage Coverage	68.4%
Maximum daily value	40.1 µg/m^3
98 percentile for daily values	36.0 µg/m^3
Mean daily value	16.9 µg/m^3

In addition to the 2004 EPA Tralee report data for PM_{10}, the EPA conduct continuous monitoring for both coarse and fine particulate matter (PM_{10} and $PM_{2.5}$) at 90 stations throughout Ireland as part of the National Ambient Air Quality Network. The monitoring station located at Tralee Library is the nearest to the proposed development, approximately 18km to the south-southwest. Provisionally reported monitoring data (not validated) is presented below for the month of January 2020. This time period was chosen as it represents a recent normal emissions scenario, pre implementation of Covid-19 restrictions. Minimum, maximum and mean values are presented in Table 10-5. The mean of the reported daily values for both PM_{10} and $PM_{2.5}$ for January 2020 are below the annual limit values for the protection of human health, of 40 µg/m^3 and 25 µg/m^3 respectively.

It would be expected however that particulate matter values at the proposed development site (Zone D) would be significantly lower than those recorded at the Tralee monitoring site (Zone C), based on typical rural versus urban emissions scenarios.

Table 10.5 Particulate Matter in Ambient Air, Tralee, January 2020 (Source: EPA, https://airquality.ie)

Parameter	Reported Daily Values, January 2020 (µg/m^3)		
	Minimum	*Maximum*	*Mean*
PM_{10}	5.19	74.01	17.60
$PM_{2.5}$	2.61	68.80	12.66

10.2.4.3 Nitrogen Dioxide (NO_2)

Nitrogen dioxide (NO_2) and oxides of nitrogen (NO_x) data for the 2003/2004 monitoring period at Tralee is presented in Table 10-6. The EPA report states that the lower assessment thresholds for the protection of human health and for the protection of ecosystems were not exceeded during the measurement period. Similarly, the limit values for the protection of human health and for the protection of ecosystems were not exceeded. The mean hourly NO_2 value of 9.6 µg/m^3 was below the annual lower assessment threshold for the protection of human health, which is 26 µg/m^3.

It would be expected that NO_2 and NO_x values at the proposed development site (Zone D) would be lower than those recorded at the Tralee monitoring site (Zone C), based on typical rural versus urban emissions scenarios.

Table 10.6 Nitrogen Dioxide and Oxides of Nitrogen Data, Tralee 2003/2004

Parameter	Reported Daily Values
No. of hours	5,399 hrs
No. of measured values	5,375
Percentage Coverage	99.5%
Maximum hourly value (NO_2)	70.3 µg/m^3
99.8 percentile for hourly values (NO_2)	43.9 µg/m^3
Mean hourly value (NO_2)	9.6 µg/m^3
Mean hourly value (NOx)	13.8 µg/m^3

10.2.4.4 Carbon Monoxide (CO)

Carbon monoxide (CO) data for the 2003/2004 monitoring period at Tralee is presented in Table 10-7. The mean hourly concentration of carbon monoxide recorded was 0.3 mg/m^3. The carbon monoxide limit value for the protection of human health is 10 mg/m^3. The lower Assessment Threshold is 5 mg/m^3. The EPA report states that the lower assessment threshold was not exceeded during the measurement period. It would be expected that carbon monoxide values at the proposed development site (Zone D) would be lower than those recorded at the Tralee monitoring site (Zone C), based on typical rural versus urban emissions scenarios.

Table 10.7 Carbon Monoxide Data Tralee 2003/2004

Parameter	Reported Daily Values
No. of hours	5,399 hrs
No. of measured values	5,372
Percentage Coverage	99.5%
Maximum hourly value	3.5 mg/m^3
98 percentile for hourly values	0.9 mg/m^3
Mean hourly value	0.3 mg/m^3
Maximum 8-hour mean	1.9 mg/m^3
98 percentile for 8-hour mean	0.9 mg/m^3

10.2.4.5 Dust

There are no statutory limits for dust deposition in Ireland. However, EPA guidance suggests that a deposition rate of 10 mg/m^2/hour can generally be considered as posing a soiling nuisance. This equates to 240 mg/m^2/day. The EPA recommends a maximum daily deposition rate of 350 mg/m^2/day when measured according to the adopted German Technical Instructions on Air Quality Control Standard 2002, commonly referred to as the 'TA Luft Standard'.

Construction dust has the potential to be generated from on-site activities such as excavation and backfilling. The extent of dust generation at any site depends on the type of activity undertaken, the location, the nature of the dust, i.e. soil, sand, peat, etc., and the weather. In addition, dust dispersion is influenced by external factors such as wind speed and direction and/or, periods of dry weather. Construction traffic movements also have the potential to generate dust as they travel along the haul route.

The potential dust-related effects on local air quality and the relevant associated mitigation measures are presented in Sections 10.1.5.2.2 and 10.1.5.3.2 below.

10.2.5 Likely Significant Effects and Associated Mitigation Measures

10.2.5.1 'Do-Nothing' Effect

If the proposed development were not to proceed, there would be no exhaust emissions from construction plant and vehicles, nor would there be dust emissions due to the movement of the same. However, the opportunity to further reduce emissions of carbon dioxide, nitrogen oxides (NO_x), and sulphur dioxide (SO_2) to the atmosphere would be lost resulting in a continued dependence on electricity derived from fossil fuels, rather than renewable energy sources, such as the proposed wind farm. This will result in an indirect negative impact on air quality.

10.2.5.2 Construction Phase

10.2.5.2.1 *Exhaust Emissions*

Turbines and Other Infrastructure

The construction of turbine bases and hardstands, site roads, site entrances, junction accommodation works, met mast bases, and other on-site infrastructure will require the operation of construction vehicles and plant on-site. Exhaust emissions associated with vehicles and plant will arise as a result of construction activities. This potential effect will not be significant and will be restricted to the duration of the construction phase and localised to works locations. Therefore, this is considered a short-term slight negative impact. Mitigation measures to reduce this impact are presented below.

Substation and Grid Connection Cable

The construction of the 38kV substation and grid connection cable route will require the operation of construction vehicles and plant. Exhaust emissions associated with vehicles and plant will arise as a result of construction activities. This potential effect will not be significant and will be restricted to the duration of the construction phase and localised to works locations. Therefore, this is considered a short-term slight negative impact. Mitigation measures to reduce this impact are presented below.

Borrow Pit

The proposed borrow pit will also require the use of construction machinery and plant, thereby giving rise to exhaust emissions. This is also a short-term slight negative impact, which will be reduced through use of the best practice mitigation measures as presented below.

Transport to Site

The transport of turbines and construction materials to the site, which will occur on specified routes only (see Section 4.4 in Chapter 4 of this EIAR), will also give rise to exhaust emissions associated with the transport vehicles. This constitutes a slight negative impact in terms of air quality. Mitigation measures in relation to exhaust emissions are presented below.

Waste Disposal

Construction waste will arise on the project mainly from excavation and unavoidable construction waste including material surpluses and damaged materials and packaging waste. Waste management will be carried out in accordance with *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects* (2006) produced by the Department of Environment, Community and Local Government (DoECLGs). The expected waste volumes generated on site are unlikely to be large enough to warrant source segregation at the proposed development site. Therefore, all wastes streams generated on site will be deposited into a single waste skip which will be covered. This waste material will be transferred to a licensed /permitted Materials Recovery Facility (MRF) by a fully licensed waste contractor where the waste will be sorted into individual waste streams for recycling, recovery or disposal. The facility will be local to the proposed development site to reduce the amount of emissions associated with vehicle movements.

Mitigation

- All construction vehicles and plant will be maintained in good operational order while onsite, thereby minimising any emissions that arise.
- Machinery will be switched off when not in use.
- Turbines and construction materials will be transported to the site on specified routes only, unless otherwise agreed with the Planning Authority.
- Aggregate materials for the construction of site access tracks and all associated infrastructure will all be locally sourced, where possible, which will further reduce potential emissions.
- The MRF facility will be local to the proposed development site to reduce the amount of emissions associated with vehicle movements.

Residual Impact

Short-term Imperceptible Negative impact. The residual impact will be the same for any combination of turbine that is within the range for which planning permission is sought.

Significance of Effects

Based on the assessment above there will be no significant direct or indirect effects.

10.2.5.2.2 Dust Emissions

Turbines and Other Infrastructure

The construction of turbine bases and hardstands, site roads, site entrances, junction accommodation works, met mast bases, and other on-site infrastructure will give rise to dust emissions during the construction phase. The potential for impacts on on-site or off-site receptors is limited due to the isolated nature of the site and the vegetative screening that exists surrounding the site. This potential effect will not be significant and will be restricted to the duration of the construction phase. Therefore, this is a short-term slight negative impact. Dust suppression mitigation measures to reduce this impact are presented below.

Borrow Pits

Development of the proposed borrow pits and the extraction of material from this location will give rise to localised dust emissions. This is a short-term moderate negative impact. Mitigation measures to reduce this impact are presented below

Substation and Grid Connection Cable

The construction of the substation and excavation of the associated underground cable route connection to the National Grid will give rise to localised dust emission during their construction. The potential for impacts to on-site or off-site receptors is limited due to the isolated nature of the site and the vegetative screening that exists surrounding the site. This is a short-term slight negative impact. Mitigation measures to reduce this impact are presented below.

Transport to Site

The transport of turbines and construction materials to the proposed development site will also give rise to some localised dust emissions during periods of dry weather. This is a short-term slight negative impact. Mitigation measures to reduce the significance of this effect are presented below.

Mitigation

- Sporadic wetting of loose stone surface will be carried out during the construction phase to minimise movement of dust particles to the air. In periods of extended dry weather, dust suppression may be necessary along haul roads to ensure dust does not cause a nuisance. If necessary, water will be taken from stilling ponds in the site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and site compound to prevent the generation of dust where required. Water bowser movements will be carefully monitored to avoid, insofar as reasonably possible, increased runoff.
- All plant and materials vehicles shall be stored in dedicated areas (on-site).
- Areas of excavation will be kept to a minimum, and stockpiling will be minimised by coordinating excavation, spreading and compaction.
- Turbines and construction materials will be transported to the site on specified haul routes only.
- The agreed haul route roads adjacent to the site will be regularly inspected for cleanliness and cleaned as necessary.
- The transport of construction materials to the site that have significant potential to cause dust, will be undertaken in tarpaulin or similar covered vehicles where necessary.
- A Construction and Environmental Management Plan (CEMP) will be in place throughout the construction phase (see Appendix 4-2). The CEMP includes dust suppression measures.

Residual Impact

Short-term Imperceptible Negative Impact. The residual impact will be the same for any combination of turbine that is within the range for which planning permission is sought.

Significance of Effects

Based on the assessment above there will be no significant direct or indirect effects.

10.2.5.3 Operational Phase

10.2.5.3.1 *Exhaust Emissions*

Exhaust emissions associated with the operational phase of the proposed development will arise from machinery and vehicles that are intermittently required on-site for maintenance. This will give rise to a long-term imperceptible negative impact.

Mitigation

Any vehicles or plant brought onsite during the operational phase will be maintained in good operational order that comply with the Road Traffic Acts 1961 as amended, thereby minimising any emissions that arise.

Residual Impact

Long-term Imperceptible Negative Impact.

Significance of Effects

Based on the assessment above there will be no likely significant direct or indirect effects.

10.2.5.3.2 *Air Quality*

Although exhaust emissions will arise during the construction phase, the proposed development, by providing an alternative to electricity derived from coal, oil or gas-fired power stations, will result in emission savings of CO_2, NO_x and SO_2. The production of renewable energy from the proposed development will have a long-term significant positive impact on air quality. Further details on the carbon dioxide savings associated with the proposed development are presented in Section 10.2.3 below.

Residual Impact

Long-term Significant Positive Impact.

Significance of Effects

Based on the assessment above there will be a significant positive direct and indirect effect.

10.2.5.3.3 *Human Health*

Long-term exposure to chemicals such as SO_2, NO_x, Pb, benzene and O_3 are harmful to human health. The production of clean, renewable energy from the proposed development will offset the emission of these harmful chemicals by fossil fuel powered sources of electricity and, therefore, will have a long-term slight positive impact on human health. Further information on the impact of the proposed development on human health is contained in Chapter 5: Population and Human Health.

Residual Impact

Long-term Slight Positive Impact.

Significance of Effects

Based on the assessment above there will be no likely significant direct or indirect effects.

10.2.5.4 Decommissioning Phase

Any impact and consequential effects that occurs during the decommissioning phase are similar to that which occur during the construction phase, albeit of less impact. The mitigation measures prescribed for the construction phase of the proposed development will also be implemented during the decommissioning phase, thereby minimising any potential impacts.

10.3 Climate

All relevant legislation and policy in relation to climate is outlined in detail in Chapter 2 of this EIAR. A summary of the same is provided in the following sections.

10.3.1 Climate Change and Greenhouse Gases

Although variation in climate is thought to be a natural process, the rate at which the climate is changing has been accelerated rapidly by human activities. Climate change is one of the most challenging global issues facing us today and is primarily the result of increased levels of greenhouse gases in the atmosphere. These greenhouse gases come primarily from the combustion of fossil fuels in energy use. Changing climate patterns are thought to increase the frequency of extreme weather conditions such as storms, floods and droughts. In addition, warmer weather trends can place pressure on animals and plants that cannot adapt to a rapidly changing environment. Moving away from our reliance on coal, oil and other fossil fuel-driven power plants is essential to reduce emissions of greenhouse gases and combat climate change.

10.3.1.1 Greenhouse Gas Emission Targets

Ireland is a Party to the Kyoto Protocol, which is an international agreement that sets limitations and reduction targets for greenhouse gases for developed countries. It is a protocol to the United Nations Framework for the Convention on Climate Change (UNFCCC). The Kyoto Protocol came into effect in 2005, as a result of which, emission reduction targets agreed by developed countries, including Ireland, are now binding.

Under the Kyoto Protocol, the EU agreed to achieve a significant reduction in total greenhouse gas emissions in the period 2008 to 2012. Ireland's contribution to the EU commitment for the period 2008 – 2012 was to limit its greenhouse gas emissions to no more than 13% above 1990 levels.

10.3.1.1.1 *Doha Amendment to the Kyoto Protocol*

In Doha, Qatar, on 8th December 2012, the 'Doha Amendment to the Kyoto Protocol' was adopted. The amendment includes:

- New commitments for Annex I Parties to the Kyoto Protocol who agreed to take on commitments in a second commitment period from 1 January 2013 to 31 December 2020;
- A revised list of greenhouse gases (GHG) to be reported on by Parties in the second commitment period; and,
- Amendments to several articles of the Kyoto Protocol which specifically referenced issues pertaining to the first commitment period and which needed to be updated for the second commitment period.

During the first commitment period, 37 industrialised countries and the European Community committed to reduce GHG emissions to an average of five percent against 1990 levels. During the second commitment period, Parties committed to reduce GHG emissions by at least 18 percent below 1990 levels in the eight-year period from 2013 to 2020; however, the composition of Parties in the second commitment period is different from the first.

Under the protocol, countries must meet their targets primarily through national measures, although market-based mechanisms such as international emissions trading can also be utilised.

10.3.1.1.2 COP21 Paris Agreement

COP21 was the 21st session of the Conference of the Parties (COP) to the United Nations Convention. Every year since 1995, the COP has gathered the 196 Parties (195 countries and the European Union) that have ratified the Convention in a different country, to evaluate its implementation and negotiate new commitments. COP21 was organised by the United Nations in Paris and held from 30th November to 12th December 2015.

COP21 closed on 12th December 2015 with the adoption of the first international climate agreement (concluded by 195 countries and applicable to all). The twelve-page text, made up of a preamble and 29 articles, provides for a limitation of the temperature rise to below 2 degrees Celsius (°C) above pre-industrial levels and even to tend towards 1.5°C. It is flexible and takes into account the needs and capacities of each country. It is balanced as regards adaptation and mitigation, and durable, with a periodical ratcheting-up of ambitions.

10.3.1.1.3 COP25 Climate Change Conference

The 25th United Nations Climate Change conference COP25 was held in Madrid and ran from December 2nd to December 13th, 2019. While largely regarded as an unsuccessful conference, the European Union launched its most ambitious plan, 'The European Green New Deal' which aims to lower CO_2 emissions to zero by 2050. The deal includes proposals to reduce emissions from the transport, agriculture and energy sectors and will affect the technology, chemicals, textiles, cement and steel industries. Measures such as fines and pay-outs by member states who rely on coal power will be in place to encourage the switch to renewable clean energies such as wind. The European Commission draft laws for the new deal to the EU in January of 2020 and if accepted will likely be implemented in 2021. Decisions regarding the global carbon market were postponed until the next Climate Conference (COP26) which will be held in Glasgow in November 2021.

10.3.1.1.4 United Nations Sustainable Development Summit 2015

Transforming our World: the 2030 Agenda for Sustainable Development which includes 17 Sustainable Development Goals (SDGs) and 169 targets was adopted by all UN Member States at a UN summit held in New York in 2015. The Agenda is universally applicable with all countries having a shared responsibility to achieve the goals and targets. Coming into effect on January 1st, 2016, the goals and targets are to be actions over the 15-year period, are integrated and indivisible i.e. all must be implemented together by each Member State.

The Sustainable Development Goals National Implementation Plan 2018-2020 was published by the Department of Communications, Climate Action & Environment in partnerships with OSI, ESRI Ireland and the Central Statistics Office in 2018. The Plan sets out how Ireland will work to achieve the goals and targets of the Agenda for Sustainable Development both domestically and internationally. Relevant SDGs and how they are implemented into Irish National plans and policies can be found in Table 10.8.

Table 10.8 United Nations Sustainable Development Goals adopted in 2015. https://sustainabledevelopment.un.org/sdgs

SDG	Targets	International Progress to Date (2020)	National Relevant Policy
SDG 7 Affordable and Clean Energy: *Ensure access to affordable, reliable, sustainable and modern energy for all*	› By 2030, ensure universal access to affordable, reliable and modern energy services › By 2030, increase substantially the share of renewable energy in the global energy mix › By 2030, double the global rate of improvement in energy efficiency › By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology › By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support	The renewable energy share of total final energy consumption gradually increased from 17 per cent in 2015 to 17.3 per cent in 2017, though much faster change is required to meet climate goals. Global primary energy intensity (ratio of energy used per unit of GDP) was 5.0 in 2017, which is a 1.7% annual improvement from 2016, but the lowest annual improvement since 2010. Meeting the SDG target for 2030 will require an improvement rate of at least 3% per year from now until 2030. Development Goal 7.	*Ireland's Transition to a Low Carbon Energy Future 2015-2030* *Strategy to Combat Energy Poverty in Ireland* *Ireland's Transition to a Low Carbon Energy Future 2015-2030* *National Mitigation Plan* *National Energy Efficiency Action Plan for Ireland # 4 2017-2020* *Better Energy Programme* *One World, One Future* *The Global Island*
SDG 13 Climate Action: *Take urgent action to combat climate change and its impacts**	Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries Integrate climate change measures into national policies, strategies and planning Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of	In 2017, greenhouse gas concentrations reached new highs, with globally averaged mole fractions of CO_2 at 405.5 parts per million (ppm), up from 400.1 ppm in 2015, and at 146 per cent of pre-industrial levels. Moving towards 2030 emission objectives compatible with the 2°C and 1.5°C pathways requires a peak to be achieved as soon as	*National Adaptation Framework* *Building on Recovery: Infrastructure and*

SDG	Targets	International Progress to Date (2020)	National Relevant Policy
**Acknowledging that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change.*	mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible	possible, followed by rapid reductions. During the period 1998–2017, direct economic losses from disasters were estimated at almost $3 trillion. Climate-related and geophysical disasters claimed an estimated 1.3 million lives. As of March 2020, 189 parties had ratified the Paris Agreement. Parties to the Paris Agreement are expected to prepare, communicate and maintain successive nationally determined contributions, and 186 parties had communicated their first nationally determined contributions to the secretariat of the United Nations Framework Convention on Climate Change, while three parties had communicated its second. Under the Agreement, all parties are required to submit new nationally determined contributions, containing revised and much more ambitious targets, by 2020. Global climate finance flows increased by 17 per cent in the period 2015–2016 compared with the period 2013–2014. As of December 2019, 81 countries are seeking support from the Green Climate Fund for national adaptation plans and other adaptation planning processes, with a	*Capital Investment 2016-2021* *National Mitigation Plan* *National Biodiversity Action Plan 2017-2021* *National Policy Position on Climate Action and Low Carbon Development*

SDG	Targets	International Progress to Date (2020)	National Relevant Policy
		combined value of $203.8 million.	

10.3.1.1.5 Climate Action Network Europe Off Target Report 2018

The June 2018 '*Off Target Report'* published by the Climate Action Network (CAN) Europe which ranks EU countries' ambition and progress in fighting climate change listed Ireland as the second worst performing EU member state in tackling climate change.

In March 2019, the Minister for Communications, Climate Action, and the Environment, Richard Bruton, announced a renewable electricity target of 70% by 2030 for Ireland. Furthermore, the release of the Climate Action Plan in June 2019 has noted a 30% reduction in greenhouse gases by 2030. Considering only renewable energy from electricity and as part of this plan and to meet the required level of emissions reduction by 2030, Ireland will:

- Reduce CO_2 eq. emissions from the sector by 50–55% relative to 2030 NDP projections;
- Deliver an early and complete phase-out of coal- and peat-fired electricity generation
- Increase electricity generated from renewable sources to 70%, indicatively comprised of:
    - at least 3.5 GW of offshore renewable energy;
    - up to 1.5 GW of grid-scale solar energy;
    - up to 8.2 GW total of increased onshore wind capacity
- Meet 15% of electricity demand by renewable sources contracted under Corporate PPAs

Achieving 70% renewable electricity by 2030 will involve phasing out coal- and peat-fired electricity generation plants, increasing our renewable electricity, reinforcing our grid (including greater interconnection to allow electricity to flow between Ireland and other countries), and putting systems in place to manage intermittent sources of power, especially from wind.

In September 2021, the SEAI published the 2020 Provisional Energy Balance for the country stating that 42% of electricity generated in 2020 was from renewable sources, and 36.1% of this was generated from wind. With a renewable share of electricity generation at 70% in mind for 2030, it is now more critical than ever that we continue to progress renewable energy development in Ireland so as we are successful in meeting our 2030 target.

The Climate Action Plan noted specific sectors which are required to step-up in order to help Ireland achieve its EU targets. The renewable energy sector was cited alongside the country's commitment to increase onshore wind capacity by up to 8.2 GW. The proposed development will help contribute towards this target.

The proposed development is compatible with the relevant provisions as set out in the Climate Action Plan 2019, relating to the harnessing of renewable energy. In summary, the proposed development will contribute the following:

- Production of 128,772 MWh of electricity which would be sufficient to supply 27,824 Irish households with electricity per year. Please refer to Section 4.3.1.6 of this EIAR.
- Helping to meet the target that 70% of our electricity needs will come from renewable sources by 2030.
- Helping to reduce carbon emissions and improving Ireland's security of energy supply.
- Provision of grid connection infrastructure to support the renewable energy output from the proposed development.

10.3.1.1.6 Climate Action Plan 2019

The *Climate Action Plan* (DCCAE, 2019) which features 183 action plans sets out how Ireland will meet its EU targets to reduce its carbon emissions by 30% between 2021 and 2030 and lay the foundations for achieving net zero carbon emissions by 2050. The CAP sets out an ambitious course of action over the coming years to address the impacts which climate may have on Irelands environment, society, economic and natural resources. This Plan clearly recognises that Ireland must significantly step up its commitments to tackle climate disruption.

Chapter 1 of the CAP sets out the nature of the challenge which Ireland faces over the coming years. The CAP notes that the evidence for warming of our climate system is beyond dispute with observations showing that global average temperatures have increased by more than 1°C since pre-industrial times. These changes will cause extensive direct and indirect harm to Ireland and its people, as well as to other countries more exposed and less able than we are to withstand the associated impacts, which are predicted to include:

- Rising sea-levels threatening habitable land and particularly coastal infrastructure,
- Extreme weather, including more intense storms and rainfall affecting our land, coastline and seas;
- Further pressure on our water resources and food production systems with associated impacts on fluvial and coastal ecosystems;
- Increased chance and scale of river and coastal flooding;
- Greater political and security instability;
- Displacement of population and climate refugees;
- Heightened risk of the arrival of new pests and diseases;
- Poorer water quality; and
- Changes in the distribution and time of lifecycle events of plant and animal species on land and in the oceans.

It is also recognised within the Plan that in addition to the above many of the pollutants associated with climate change are also damaging to human health.

It is the ambition of the CAP to deliver a step-change in our emissions performance over the coming decade, so that we will not only meet our EU targets for 2030, but will also be well placed to meet our mid-century decarbonisation objectives.

Chapter 7 of the CAP details the plans surrounding electricity. Within Ireland electricity accounting for 19.3% of Irelands greenhouse gases in 2017, the following is noted:

> *"It is important that we decarbonise the electricity that we consume by harnessing our significant renewable energy resources by doing this we will also become less dependent on imported fossil fuels."*

In 2017 within Ireland a total of 30.1% of electricity produced came from renewable sources, the target to be achieved by 2020 is set at 40%. The CAP goes on to note that 'given our 40% target is based on a percentage of total energy demand, this rising demand makes meeting our 2020 target even more challenging and latest forecasts indicate we may miss this target by 3 to 4 percentage points'. Further to this, while decarbonising electricity is a key aspect of the strategy it is noted that this is against the background of rapid projected growth in electricity demand. It is expected that demand for electricity is forecast to increase by 50% above existing capacity in the next decade. Generation electricity builds of a renewable nature rather than fossil fuels has been marked as essential.

The CAP goes on to note that with regards to policy measures to date that they will not achieve the level of decarbonisation required in the electricity sector to meet the 2030 emissions reduction targets, as such it is listed that 'we must 'reduce our electricity sector emissions to 4-5 Mt in 2030'. In relation to emissions the following is noted:

> *"In 2017, emissions from electricity were 12 Mt and in 2030, despite implementation of Project Ireland 2040 measures, emissions are projected to be 8 Mt. This clearly demonstrates the need for a significant step-up in ambition over existing policy, not only to meet our 2030 targets, but to set us on course to deliver substantive decarbonisation of our economy and society by 2050."*

In the electricity sector, reaching a 70% share of renewable electricity would require 50-55% emissions reduction by 2030.

Under section 7.2 the following targets have been set out to meet the required level of emissions by 2030:

- *"Reduce CO_2 eq. emissions from the sector by 50–55% relative to 2030 Pre-NDP projections*
- *Deliver an early and complete phase-out of coal- and peat-fired electricity generation*
- *Increase electricity generated from renewable sources to 70%, indicatively comprised of:*
    - *at least 3.5 GW of offshore renewable energy*
    - *up to 1.5 GW of grid-scale solar energy*
    - *up to 8.2 GW total of increased onshore wind capacity*
- *Meet 15% of electricity demand by renewable sources contracted under Corporate PPAs"*

Achieving 70% renewable electricity by 2030 will involve phasing out coal- and peat-fired electricity generation plants, increasing our renewable electricity, reinforcing our grid (including greater interconnection to allow electricity to flow between Ireland and other countries), and putting systems in place to manage intermittent sources of power, especially from wind.

Section 7.2 of the CAP notes the 'Measures to deliver targets' in which efforts to meet the 2030 ambitions which includes increased harnessing of renewable energy. CAP identifies a need for 8.2GW of onshore wind generation and states that in 2017 there was 3.3GW in place, therefore Ireland needs to more than double its installed capacity of wind generation. Accordingly, the CAP presents clear and unequivocal support for the provision of additional renewable energy generation, and presents yet further policy support for increased wind energy.

One of the key targets in relation to forestry is the delivery of '*..an average of 8,000 ha per annum of newly planted forest, and sustainable forest management of existing forests (21 $MtCO_2$eq. cumulative abatement)'.* Ongoing and proposed measures to deliver the target include:

- The investment of nearly €3 billion in forestry, since the late 1980s, which through ongoing sustainable forest management will contribute to delivering abatement of 21 $MtCO_2$eq over the period 2021 to 2030.
- Review of the current afforestation programme to enhance participation rates, and inform land use policy to increase the benefits for climate, the environment, and rural communities.
- Commitment by Coillte to replant or restock a total of 34,770 hectares between 2016 and 2020.
- Bord na Móna's estate extends to a little under 80,000 ha. To date a little over 18,000 ha of the cut-away and cut-over peatland has been rehabilitated and the target for 2019 is to complete a further 3,000 ha. By way of additional context, as much as 50,000 ha of the overall estate is currently under consideration for a wide variety of commercial future uses of which renewable energy projects constitute the greatest proportion by far.
- Hedgerows are estimated to cover 3.9% of the Irish landscape or 660,000 km length. The total area of hedgerow and non-forest woodland patches across the landscape could possibly represent a significant carbon sink and could potentially be used as a mitigation option.

10.3.1.1.7 Climate Change Performance Index

Established in 2005, the Climate Change Performance Index (CCPI) is an independent monitoring tool which tracks countries climate protection performance. It assesses individual countries based on: climate policies, energy usage per capita, renewable energy implementation and Greenhouse Gas Emissions (GHG) and ranks their performance in each category and overall. The 2021 CCPI was published in December 2020. While the CCPI 2021 indicated signs of potential reductions in global emissions, no country achieved its Paris Climate targets and therefore the first three places of the ranking system remain unoccupied.

Ireland, ranked 41st in 2019, has climbed 2 places to 39th for 2020, and remains as a "low" performer in international performance. However, it remains at "very low" at a national performance level. The CCPI report states that while some improvements have been made, GHG per capita emissions are at a high level and "significant challenges lie ahead in closing Ireland's emission gap, meeting the current (2030) target and aligning Ireland's emission trajectory with a net zero goal for 2050. Ireland is one of the worst performing countries in the GHG Emissions category. Recognising Ireland's Climate Action Plan (2019), the CCPI states:

"*the government must go much further in implementing policies across all sectors that drive sustained emissions reductions over the next decade. Near-term ambition needs to be ratcheted up quickly by specifying deep cuts in fossil fuel and reactive nitrogen usage to put Ireland on a net zero emissions pathway aligned with the Paris temperature goals".*

10.3.1.1.8 Programme for Government

The Programme for Government was published in October 2020 and last updated April 2021. In relation to climate change the programme recognises that the next ten years are a critical period in addressing the climate crisis. It is an ambition of the programme to more than halve carbon emissions over the course of the decade (2020-2030). The programme notes that the government are committed to reducing greenhouse gas emissions by an average 7% per annum over the next decade in a push to achieve a net zero emissions by the year 2050. The programme also recognises the severity of the climate challenge as it clarifies that:

> *"Climate change is the single greatest threat facing humanity"*

With regards to energy the programme notes that the government will implement a new National Energy Efficiency Action Plan to reduce energy use, including behavioural and awareness aspects of energy efficiency such as building and data management. Further, the government are also committed to the rapid decarbonisation of the energy sector, along with this it is noted that the necessary steps will be taken to deliver at least 70% of renewable electricity by the year 2030. Some of the measures to achieve this will include the following:

- Hold the first Renewable Electricity Support Scheme (RESS) auction by the end of 2020, with auctions held each year thereafter, including the first RESS auction for offshore wind in 2021.
- Produce a whole-of-government plan setting out how at least 70% renewable electricity generation by 2030 will be delivered and how the necessary skills base, supply chains, legislation, and infrastructure to enable it will be delivered. This new plan will make recommendations for how the deployment of renewable electricity can be sped.
- Finalise and publish the Wind Energy Guidelines, having regard to the public consultation that has taken place.
- Continue Eirgrid's programme 'Delivering a Secure, Sustainable Electricity System' (DS3).
- Strengthen the policy framework to incentivise electricity storage and interconnection.
- Support the clustering of regional and sectoral centres of excellence in the development of low-carbon technologies.

10.3.1.1.9 *Climate Action and Low Carbon Development (Amendment) Act 2021*

The Climate Action and Low Carbon Amendment Bill 2021, entitled an Act, is a piece of legislation which commits the country to move to a climate resilient and climate neutral economy by 2050. This Bill was passed into law in July 2021.

The Programme for Government has committed to a 7% average yearly reduction in overall greenhouse gas emissions over the next decade, and to achieving net zero emissions by 2050. This Bill will manage the implementation of a suite of policies to assist in achieving this target.

The Bill includes the following key elements, among others:

- Places on a statutory basis a 'national climate objective', which commits to pursue and achieve no later than 2050, the transition to a climate resilient, biodiversity-rich, environmentally -sustainable and climate-neutral economy.
- Embeds the process of carbon budgeting into law, Government are required to adopt a series of economy-wide five-year carbon budgets, including sectoral targets for each relevant sector, on a rolling 15-year basis, starting in 2021.
- Actions for each sector will be detailed in the Climate Action Plan, updated annually.
- A National Long Term Climate Action Strategy will be prepared every five years.
- Government Ministers will be responsible for achieving the legally-binding targets for their own sectoral area with each Minister accounting for their performance towards sectoral targets and actions before an Oireachtas Committee each year.
- Strengthens the role of the Climate Change Advisory Council, tasking it with proposing carbon budgets to the Minister.
- Provides that the first two five-year carbon budgets proposed by the Climate Change Advisory Council should equate to a total reduction of 51% emissions over the period to 2030, in line with the Programme for Government commitment.

10.3.1.1.10 *Emissions Projections*

Ireland's 2020 target under the EU Effort Sharing Decision (ESD[1]) is to achieve a 20% reduction on 2005 levels of non-Emissions Trading Scheme (non-ETS) sector emissions (agriculture, transport, residential, commercial, non-energy intensive industry, and waste). Ireland is set to miss its target for compliance with the ESD as our non-ETS emissions are projected to be 7% below 2005 levels in 2020 under both projected scenarios compared to the target of 20% below 2005 levels by 2020. This projection includes the impact of COVID on the 2020 emissions which due to national lockdowns saw Transport emissions decline but Agriculture emissions largely unaffected. Ireland is projected to exceed the 2020 ESD targets despite the impact of the pandemic.

The Environmental Protection Agency (EPA) publish Ireland's Greenhouse Gas Emission Projections and at the time of writing, the most recent report, *'Ireland's Greenhouse Gas Emissions Projections 2020–2040'* was published in June 2021. The report includes an assessment of Ireland's progress towards achieving its emission reduction targets out to 2020, 2030 and 2040 set under the EU ESD and Effort Sharing Regulation (ESR[2]).

The EPA has produced two scenarios in preparing these greenhouse gas emissions projections: a "With Existing Measures" (WEM) scenario and a "With Additional Measures" (WAM) scenario. These scenarios forecast Irelands greenhouse gas emissions in different ways. The WEM scenario assumes that no additional policies and measures, beyond those already in place by the end of 2019 (latest national greenhouse gas emission inventory), are implemented. The WAM scenario assumes that in addition to

[1] DECISION No 406/2009/EC of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020
[2] REGULATION (EU) 2018/1999 on the Governance of the Energy Union and Climate Action

the existing measures, there is also full implementation of planned government policies and measures to reduce emissions such as those in the 2019 Climate Action Plan.

The EPA Emission Projections Update notes the following key trends:

- Total greenhouse gas emissions are projected to decrease from the latest 2019 levels by 3% by 2030 under the "With Existing Measures" scenario.
- Under the "With Additional Measures" scenario, emissions are estimated to decrease by 20% by 2030.
- Ireland's Non ETS emissions are projected to be 7% below 2005 levels in 2020 under both the 'With Existing Measures' and 'With Additional Measures' scenarios. The target for Ireland is a 20% reduction.
- Ireland exceeded its annual binding limits in 2016, 2017, 2018 and 2019.
- Over the period 2013 – 2020, Ireland is projected to cumulatively exceed its compliance obligations by 12.2 Mt CO_2 (metric tonnes of Carbon Dioxide) equivalent under the 'With Existing Measures' scenario and the 'With Additional Measures' scenario.

The report concludes:

- *"Projections indicate that Ireland will exceed the carbon budget over the period 2021-2030 by 51.3 Mt CO_2 equivalent assuming LULUCF flexibilities described in the Regulation are fully utilised."*
- *"To determine compliance under the Effort Sharing Decision, any overachievement of the binding emission limit in a particular year (between 2013 and 2020) can be banked and used towards compliance in a future year. However, even using this mechanism Ireland will still be in non-compliance according to the latest projections."*
- *"A significant reduction in emissions over the longer term is projected as a result of the expansion of renewables (e.g. wind), assumed to reach 55% by 2030 under the 'With Existing Measures' scenario and 70% by 2030 under the 'With Additional Measures' scenario"*
- *"The projects reflect plans to bring Ireland onto a lower carbon trajectory in the longer term. However, Ireland still faces significant challenges in meeting EU 2030 targets in the non-ETS sector and national 2050 reduction targets in the electricity generation, built environment and transport sectors. Progress in achieving targets is dependent on the level of implementation of current and future plans."*

In November 2020 the EPA also published '*Ireland's Provisional Greenhouse Gas Emissions 1990-2019*'. The provisional estimates of Ireland's greenhouse gas figures for the years 1990-2019 are based on the SEAI's final energy balances released in November 2020. The key findings from the report are as follows:

- *"In 2019, Ireland's total national greenhouse gas emissions are estimated to have declined by 4.5% on 2018 levels to 59.9 Mt CO2 equivalent"*
- *The Provisional estimates of greenhouse gas emissions for the period 1990- 2019 indicate that Ireland will exceed its 2019 annual limit set under the EU's Effort Sharing Decision (ESD) by 6.98 Mt CO2eq.*
- *Emissions in the Energy Industries sector show a decrease of 11.2% or 1.19 Mt CO2eq in 2019, which is attributable to a 69% decrease in coal and an 8% decrease in peat used in electricity generation. Electricity generated from wind increased by 16.0% in 2019.*

10.3.2 Climate and Weather in the Existing Environment

Ireland has a temperate, oceanic climate, resulting in mild winters and cool summers. The Met Éireann weather station at Shannon Airport, Co. Clare, is the nearest weather and climate monitoring station to the proposed development site that has meteorological data recorded for the 30-year period from 1981-2010. The monitoring station is located approximately 54 km northeast of the site. Meteorological data recorded at Shannon over the 30-year period from 1981-2010 is shown in Table 10-9. The wettest months were October and December, and the driest month on average was April. July was the warmest month with a mean temperature of 16.4° Celsius.

Table 10.9 Data from Met Éireann Weather Station at Shannon Airport 1981-2010, Monthly and Annual Mean and Extreme Values

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
TEMPERATURE (degrees Celsius)													
mean daily max	8.8	9.2	11.1	13.3	16.0	18.3	19.8	19.6	17.7	14.3	11.1	9.0	14.0
mean daily min	3.2	3.2	4.5	5.7	8.2	10.9	12.9	12.7	10.8	8.2	5.5	3.6	7.4
mean temperature	6.0	6.2	7.8	9.5	12.1	14.6	16.4	16.2	14.2	11.2	8.3	6.3	10.7
absolute max.	14.8	15.5	18.3	23.5	27.2	30.2	30.6	29.8	26.1	22.3	17.6	15.3	30.6
min. maximum	-2.4	0.9	3.5	5.4	8.0	11.8	13.8	13.0	11.1	7.0	0.8	-6.0	-6.0
max. minimum	11.8	12.3	11.7	13.0	15.3	17.8	19.4	19.3	17.8	16.3	13.4	12.9	19.4
absolute min.	-11.2	-5.5	-5.8	-2.3	0.2	3.6	6.7	4.4	1.7	-2.0	-6.6	-11.4	-11.4
mean num. of days with air frost	5.3	5.1	2.1	0.7	0.0	0.0	0.0	0.0	0.0	0.5	2.3	4.8	20.8
mean num. of days with ground frost	13.7	12.6	11.0	8.3	3.3	0.3	0.0	0.1	1.2	3.8	9.5	12.5	76.3
mean 5cm soil	4.5	4.6	6.3	8.9	12.7	15.9	17.2	16.4	13.8	10.2	7.1	5.2	10.2
mean 10cm soil	4.8	4.8	6.3	8.5	12.1	15.1	16.6	16.1	13.6	10.3	7.4	5.5	10.1
mean 20cm soil	5.5	5.6	7.0	9.2	12.3	15.1	16.8	16.6	14.5	11.4	8.4	6.3	10.7
RELATIVE HUMIDITY (%)													
mean at 0900UTC	87.1	87.0	85.0	79.8	76.3	76.8	80.0	82.1	84.7	87.0	88.9	88.4	83.6
mean at 1500UTC	80.5	74.6	70.5	64.4	63.3	65.1	68.0	68.2	69.2	75.2	80.5	83.1	71.9
SUNSHINE (hours)													
mean daily duration	1.6	2.3	3.2	5.1	5.8	5.2	4.5	4.5	3.9	2.9	2.0	1.4	3.5
greatest daily duration	8.1	10.2	11.0	13.6	15.6	15.8	15.7	14.4	12.2	10.1	8.3	7.1	15.8
mean no. of days with no sun	9.2	6.4	5.7	2.4	1.9	2.0	2.4	2.3	2.9	5.5	7.8	11.1	59.8
RAINFALL (mm)													
mean monthly total	102.3	76.2	78.7	59.2	64.8	69.8	65.9	82.0	75.6	104.9	94.1	104.0	977.6
greatest daily total	38.2	29.4	28.1	40.2	25.0	40.6	39.5	51.0	52.3	36.9	26.9	41.2	52.3
mean num. of days with >= 0.2mm	20	16	19	16	16	15	16	18	16	20	20	19	211
mean num. of days with >= 1.0mm	16	12	14	11	12	11	12	13	12	16	15	15	159

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
mean num. of days with >= 5.0mm	8	5	5	4	4	4	4	5	4	7	6	7	63
WIND (knots)													
mean monthly speed	10.3	10.2	10.0	9.0	8.9	8.5	8.5	8.2	8.4	9.2	9.1	9.4	9.1
max. gust	75	80	65	62	59	51	52	55	62	71	66	83	83
max. mean 10-minute speed	52	46	44	40	37	37	38	35	40	47	41	57	57
mean num. of days with gales	1.7	0.9	0.8	0.3	0.2	0.1	0.0	0.1	0.1	0.6	0.7	1.2	6.7
WEATHER (mean no. of days with)													
snow or sleet	2.3	2.3	1.4	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.3	8.0
snow lying at 0900UTC	0.6	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.9
hail	3.6	3.3	3.4	2.2	1.2	0.1	0.1	0.1	0.3	0.9	1.1	2.4	18.6
thunder	0.9	0.5	0.4	0.3	0.5	0.5	0.8	0.4	0.2	0.4	0.4	0.5	5.7
fog	3.3	2.0	2.1	1.9	1.5	1.4	1.4	2.0	2.9	2.9	3.9	4.2	29.6

10.3.3 Calculating Carbon Losses and Savings from the Proposed Development

10.3.3.1 Background

In addition to the combustion of fossil fuels, GHGs are also released through natural processes such as the decomposition of organic material (which is composed of carbon). Bogs and peatlands are known to store large amounts of carbon. Due to the waterlogged nature of these habitats, stored carbon is not broken down and released into the atmosphere. The construction of wind farms on bog and peat habitats may affect the natural hydrological regime, thus exposing and drying out the peat and allowing the decomposition of carbon. It is necessary therefore to demonstrate that any wind farm constructed on such sites saves more carbon than is released. The site of the proposed development is primarily situated on peat soils. For this reason, the carbon balance between the use of renewable energy and the loss of carbon stored in the peat is assessed in this section of the EIAR.

CO_2 emissions occur naturally in addition to being released with the burning of fossil fuels. All organic material is composed of carbon, which is released as CO_2 when the material decomposes. Organic material acts as a store of carbon. Peatland habitats are significant stores of organic carbon. The vegetation on a peat bog slowly absorbs CO_2 from the atmosphere when it is alive and converts it to organic carbon. When the vegetation dies, in the acidic waterlogged conditions of bogs and peatlands, the organic material does not decompose fully and the organic carbon is retained in the ground.

The carbon balance of proposed wind farm developments in peatland habitats has attracted significant attention in recent years. When development such as wind farms are proposed for peatland areas, there will be direct impacts and loss of peat within the development footprint. There may also be indirect impacts where it is necessary to install drainage in certain areas to facilitate construction. The works can either directly or indirectly allow the peat to dry out, which permits the full decomposition of the stored organic material with the associated release of the stored carbon as CO_2. It is essential therefore that any wind farm development in a peatland area saves more CO_2 than is released.

10.3.3.2 Methodology for Calculating Losses

A methodology was published in June 2008 by the University of Aberdeen and the Macauley Land Use Research Institute (Macauley Institute), with support from the Rural and Environment Research and Analysis Directorate of the Scottish Government, Science Policy and Co-ordination Division. The document, '*Calculating Carbon Savings from Wind Farms on Scottish Peat Lands*', was developed to calculate the impact of wind farm developments on the soil carbon stocks held in peat. This methodology was refined and updated in 2011 based on feedback from users of the initial methodology and further research in the area. The web-based version of the carbon calculator, which supersedes the excel based versions of the tool, was released in 2016. The tool provides a transparent and easy to follow method for estimating the impacts of wind farms on the carbon dynamics of peatlands. Previously guidance produced by Scottish Natural Heritage (SNH) in 2003 had been widely employed to determine carbon payback in the absence of any more detailed methods.

Although the loss of carbon fixing potential from plants on peat land is not substantial, it is nonetheless calculated for areas from which peat is removed and the areas affected by drainage. This calculation takes account of the annual gains due to the carbon fixing potential of the peat land and the time required for any habitat restoration. The carbon sequestered in the peat itself represents a much more substantial potential source of carbon loss. During wind farm construction, carbon is lost as a result of peat excavation and peat drainage. The amount of carbon lost is estimated using default values from the Intergovernmental Panel on Climate Change (IPCC, 1997) as well as by more site-specific equations derived from the scientific literature. Carbon gains due to habitat improvements and site restoration are calculated in a similar fashion.

Peatlands are essentially unbalanced systems. When flooded, peat soils emit less carbon dioxide but more methane than when drained. In waterlogged soils, carbon dioxide emissions are usually exceeded by plant fixation, so the net exchange of carbon with the atmosphere is negative and soil carbon stocks increase. When soils are aerated, carbon emissions usually exceed plant fixation, so the net exchange of carbon with the atmosphere is positive. In order to calculate the carbon emissions resulting from the removal or drainage of the peat, the Macauley Institute method accounts for emissions occurring if the peat had been left in-situ, and subtracts these from the emissions occurring after removal and drainage.

The Macauley Institute methodology states that the total volume of peat impacted by the construction of the wind farm is strongly correlated to the extent of the peatland affected by drainage at the site.

The drainage of peat soils leads to continual loss of soil carbon until a new steady state is reached, when inputs are approximately equal to losses. For peats, this steady state approximates 0% carbon, so 100% carbon loss from drained peats is assumed if the site is not restored after decommissioning of the wind farm. The amount of carbon lost is calculated on the basis of the annual emissions of methane and carbon dioxide, the area of drained peat, and the time until the site is restored. However, the restoration proposal should demonstrate a high probability that the hydrological regime will be restored across the site, disturbance of the remaining peat will be minimised, and peat-forming vegetation will develop in areas from which peat was removed or drained. In the case of the proposed wind farm site, the model has been prepared based on two scenarios, one where restoration of the wind farm areas will occur on decommissioning, and another where restoration will not occur.

The effects of drainage may also reduce dissolved and particulate organic carbon retention within the peat. Losses of carbon dioxide due to leaching of dissolved and particulate organic carbon are calculated as a proportion of the gaseous losses of carbon from the peat. The Macauley Institute method assumes that published good practice is employed in relation to avoiding the risk of peat landslides. This is certainly the case in respect of the proposed development, which has been the subject of a peat stability risk assessment, as described in the *Peat Stability Risk Assessment Report* in Appendix 8-1 of this EIAR. Therefore, this potentially large carbon loss pathway is omitted from the calculations.

Clear-felling of existing forestry surrounding turbine locations may often be necessary to avoid reductions in the wind energy yield of the wind farm proposal and to protect local bat populations. Forestry may be felled earlier than originally planned due to the wind farm development, so limiting the nature and longevity of the resulting timber produced. If a forestry plantation was due to be felled with no plan to replant, the effect of the land use change is not attributable to the wind farm development and is omitted from the calculation. If, however, the forestry is felled for the development, the effects are judged to be attributable to the wind farm development. Carbon losses as a result of felling are calculated from the area to be felled, the average carbon sequestered annually, and the lifetime of the wind farm. Alterations in soil carbon levels following felling are calculated using the equations for drainage and site restoration already described.

10.3.3.3 Calculating Carbon Losses and Savings

10.3.3.3.1 *Carbon Losses*

The Scottish Government's on-line carbon calculator was used to assess the impacts of the proposed development in terms of potential carbon losses and savings taking into account peat removal, drainage, habitat improvement, and site restoration.

A copy of the outputs is provided as Appendix 10-1 of this EIAR. Where available and relevant, site-specific information was inserted into the worksheet. Otherwise, default values were used.

The worksheet was pre-loaded with information specific to the CO_2 emissions from the United Kingdom's electricity generation plant, which is used to calculate emissions savings from proposed wind farm projects in the UK. Similar data to that used in the worksheet to calculate the CO_2 emissions from the UK electricity generation plant, was not available for the Irish electricity generation plant, and so the CO_2 emissions savings from the proposed development were calculated separately from the worksheet.

The main CO_2 losses due to the proposed development are summarised in Table 10-10. CO_2 losses have been calculated based on the proposed Layout.

Table 10.10 CO_2 losses from the Proposed Development

Origin of Losses	CO_2 Losses (tonnes CO_2 equivalent)	
	Expected	Maximum
Losses due to turbine life (e.g. due to production, transportation, erection, operation and dismantling of the wind farm)	40,710	42,290
Losses due to backup fossil fuel generation?	28,974	28,974
Losses due to reduced carbon fixing potential	1,224	2,138
Losses from soil organic matter (CO_2 loss from removed and drained peat)	34,889	55,116
Losses due to felling forestry for wind farm	n/a	n/a
Total	105,798	128,522

The worksheet model calculates that the proposed development will give rise to 105,798 tonnes of CO_2 equivalent losses over its 35-year life. Of this total figure, the proposed wind turbines directly account for 40,710 tonnes, or 38%. Losses due to backup account for 28,974 tonnes, or 27%. Losses from soil organic matter, leaching of dissolved and particulate carbon, and reduced carbon fixing potential accounting for the remaining 35% or 36,114 tonnes. The figure of 105,798 tonnes of CO_2 arising from ground activities associated with the proposed development is calculated based on the entire development footprint being "Acid Bog", as this is one of only two choices the model allows (the other being Fen). The habitat that will be impacted by the development footprint comprises a mix of bog and agricultural land rather than solely the acid bog assumed by the model that gives rise to the 105,798 tonnes and therefore the actual CO_2 losses are expected to be lower than this value.

The figures discussed above are based on the assumption that the hydrology of the site and habitats within the site are restored on decommissioning of the proposed wind farm after its expected 35-year useful life. As a worst-case scenario, the model was also used to calculate the CO_2 losses from the wind farm if the hydrology and habitats of the site were not to be restored, as may be the case if the turbines were replaced with newer models, rather than decommissioned entirely and taking account of the future peat cutting activities. This worst-case scenario would increase the expected carbon losses by an additional 22,724 tonnes, or by 21% to 128,522 tonnes. Any failure to restore the site habitats or hydrology for the reasons outlined above would be further offset by the carbon-neutral renewable energy that the new turbines would generate.

10.3.3.3.2 Carbon Savings

According to the model described above, the proposed wind farm development will give rise to total losses of 105,798 tonnes of carbon dioxide.

A simple formula can be used to calculate carbon dioxide emissions reductions (in tonnes CO_2) resulting from the generation of electricity from wind power rather than from carbon-based fuels such as peat, coal, gas and oil. The formula is:

$$t\,CO2 = \frac{A * B * C * D}{1000}$$

where: A = The rated capacity of the wind energy development in MW

B = The capacity or load factor, which takes into account the intermittent nature of the wind, the availability of wind turbines and array losses etc.

C = The number of hours in a year

D = Carbon load in grams per kWh (kilowatt hour) of electricity generated and distributed via the national grid.

For the purposes of this calculation, the rated capacity of the proposed wind farm is assumed to be approximately 42MW. This represents a maximum output for modern turbines within the proposed size envelope.

A load factor of 0.35 (or 35%) has been used for the proposed development.

The number of hours in a year is 8,760.

The most recent data for the carbon load of electricity generated in Ireland is for 2017 and was published in Sustainable Energy Authority Ireland's (SEAI) December 2018 report, '*Energy in Ireland, 2018 Report.*' The emission factor for electricity in Ireland in 2017 was 436.6 g CO_2/kWh.

The calculation for carbon savings associated with the proposed development is therefore as follows:

$$\text{CO2 (in tonnes)} = \frac{(42 \times 0.35 \times 8{,}760 \times 436.6)}{1000}$$

$$= 56{,}222 \text{ tonnes per annum}$$

Based on this calculation, approximately 56,222 tonnes of carbon dioxide will be displaced per annum from the largely carbon-based traditional energy mix by the proposed development. Over the proposed 35-year lifetime of the wind farm, therefore, 1,967,770 tonnes of carbon dioxide will be displaced from traditional carbon-based electricity generation.

In total, it is estimated that **1,967,770** tonnes of carbon dioxide will be displaced over the proposed 35-year lifetime of the wind farm.

Based on the Scottish Government's carbon calculator as presented above 105,798 tonnes of CO_2 will be lost to the atmosphere due to changes in the peat environment and due to the construction and operation of the proposed development. This represents 5.4% of the total amount of carbon dioxide emissions that will be offset by the proposed wind farm project. The 105,798 tonnes of CO_2 that will be lost to the atmosphere due to changes in the peat environment and due to the construction and operation of the proposed development will be offset by the proposed development in approximately **23 months** of operation.

10.3.4 Likely Significant Effects and Associated Mitigation Measures

10.3.4.1 'Do-Nothing' Effect

If the proposed development were not to proceed, greenhouse gas emissions, e.g. carbon dioxide (CO_2), carbon monoxide (CO) and nitrogen oxides (NO_x), associated with construction vehicles and plant would not arise. However, the opportunity to further significantly reduce emissions of greenhouse gas emissions, including CO_2, NO_x and SO_2 to the atmosphere would be lost. The opportunity to contribute to Ireland's commitments under the Kyoto Protocol and EU law would also be lost. This would be a long-term, indirect, slight negative impact.

10.3.4.2 Construction Phase

10.3.4.2.1 Greenhouse Gas Emissions

Construction of Turbines and Other Infrastructure

The construction of turbine bases and hardstands, site roads, site entrances, junction accommodation works, mast bases, and all associated infrastructure will require the operation of construction vehicles and plant. GHG emissions associated with vehicles and plant will arise as a result of the construction activities. The construction of a 38 kV substation and excavation of associated grid connection cable trenches will also require the use of construction machinery giving rise to greenhouse gas emissions. This potential impact will be slight, given the insignificant quantity of greenhouse gases that will be emitted, and will be restricted to the duration of the construction phase. Therefore, this is a short-term slight negative impact. Mitigation measures to reduce this impact are presented below.

Transport to Site

The transport of turbines and construction materials to the site, which will occur on specified routes only (see Section 4.4.2 in Chapter 4 of this EIAR), will also give rise to greenhouse gas emissions associated with the transport vehicles. This constitutes a slight negative impact in terms of air quality. Mitigation measures in relation to greenhouse gas emissions are presented below.

Mitigation

- All construction vehicles and plant will be maintained in good operational order while onsite, thereby minimising any emissions that arise.
- Turbines and construction materials will be transported to the site on specified routes only unless otherwise agreed with the Planning Authority.
- Aggregate materials for the construction of site access tracks and all associated infrastructure will all be locally sourced, where possible, which will further reduce potential emissions.

Residual Impact

Short-term Imperceptible Negative Impact on Climate as a result of greenhouse gas emissions. The residual impact will be the same for any combination of turbine that is within the range for which planning permission is sought.

Significance of Effects

Based on the assessment above there will be no likely significant direct or indirect effects.

10.3.4.3 Operational Phase

10.3.4.3.1 *Greenhouse Gas Emissions*

The proposed development will generate energy from a renewable source. This energy generated will offset energy and the associated GHG emissions from electricity-generating stations dependent on fossil fuels, thereby having a net positive effect on climate. As detailed in Table 10-10 above, the proposed development will displace carbon dioxide from fossil fuel-based electricity generation, over the proposed 35-year lifespan of the proposed wind farm. The proposed project will assist in reducing CO_2 emissions that would otherwise arise if the same energy that the proposed wind farm will generate were otherwise to be generated by conventional fossil fuel plants. This is a long-term significant positive effect.

Some potential long-term slight negative impacts that may occur during the operational phase of the proposed development include the release of relatively low volumes of carbon dioxide to the atmosphere due to the potential alteration of the site drainage and the removal of carbon fixing vegetation. These impacts will be slight and will be offset by the quantity of carbon dioxide displaced by the generation of renewable energy from the proposed development. In addition, the design and layout of the proposed development has incorporated the utilisation of as much of the existing site road network as possible to gain access to the proposed turbine locations, thus minimising the need for construction of additional roads through peat-based habitats.

Residual Impact

Long-term Slight Positive Impact on Climate as a result of reduced greenhouse gas emissions.

Significance of Effects

Based on the assessment above there will be a direct long-term slight, positive effect.

10.3.4.4 Decommissioning Phase

Any impacts and consequential effects likely to occur during the decommissioning phase are similar to those which occur during the construction phase, be it of less impact. The mitigation measures prescribed for the construction phase of the proposed development will be implemented during the decommissioning phase, thereby minimising any potential impacts.

10.4 Cumulative Assessment

Potential cumulative effects on air quality and climate between the proposed development and other projects in the vicinity were also considered as part of this assessment. The projects considered as part of the cumulative effect assessment are described in Section 2.7 of this EIAR.

The nature of the proposed development is such that, once operational, it will have a long-term, slight, positive impact on the air quality and climate.

During the construction phase of the proposed development and other projects described in Section 2.7 that are yet to be constructed, there will be minor emissions from construction plant and machinery and potential dust emissions associated with the construction activities. However, once the mitigation proposals, as outlined in this chapter are implemented, during the construction phase of the proposed development, there will be no cumulative negative effect on air and climate. Likewise, during the decommissioning phase there will be minor emissions from construction plant and machinery and potential dust emissions associated with the construction activities. However, the use of best construction practices will ensure that there will be no cumulative negative effect on air and climate during the decommissioning phase.

There will be no net CO_2 emissions from operation of the Ballynagare Wind Farm. Emissions of CO_2, NO_x, SO_2 and dust during the operational phase of the proposed development will be minimal, relating to the use of operation and maintenance vehicles on-site, and therefore there will be no measurable negative cumulative effect with other projects on air quality and climate.

11. NOISE AND VIBRATION

11.1 Introduction

11.1.1 Background and Objectives

This chapter of the EIAR describes the assessment undertaken of the potential noise and vibration impacts associated with the proposed Ballynagare Wind Farm Development (the 'Proposed Development'). The Proposed Development will encompass 7 no. wind turbines having a maximum ground to blade tip height of between 169.5 and 170 metres, associated hardstands, site access tracks, upgrades to existing roads, 1 no. met mast, 1 no. on-site electrical substation, 1 no. borrow pit, 2 no. temporary construction compounds, 2 no. peat repositories, and underground cable works. A full description of the proposed development is provided in Chapter 4 of this EIAR.

Noise and vibration impact assessments have been prepared for the operational, construction and decommissioning phases of the Proposed Development at identified noise sensitive location (NSLs) in the vicinity. To inform this assessment, background noise levels have been measured at five representative NSLs in the vicinity of the proposed development site.

A proposed wind farm development with the potential for cumulative noise impacts was identified and included in the assessment. This is the proposed Ballyhorgan wind farm which consists of 10 no. turbines. In line with best practice guidance the cumulative impact of these other developments has been included in the operational noise impact assessment. Further details on these other developments are provided in Chapter 2 of this EIAR.

11.1.2 Statement of Authority

This chapter has been prepared by Leo Williams of AWN Consulting Ltd. He holds a BAI and MAI in Mechanical Engineering and has completed the Institute of Acoustics (IOA) Diploma in Acoustics and Noise Control. He has been working in the field of acoustics since 2014 and is a member of the Institute of Acoustics (MIOA). He is experienced in relation to commissioning noise monitoring and impact assessment of wind farms as well as a detailed knowledge of acoustic standards and proprietary noise modelling software packages. He has commissioned noise surveys and completed noise impact assessments for numerous wind farm projects within Ireland.

The chapter has been reviewed by Dermot Blunnie of AWN Consulting Ltd:

Dermot Blunnie (Senior Acoustic Consultant) holds a BEng (Hons) in Sound Engineering, MSc in Applied Acoustics and has completed the Institute of Acoustics (IOA) Diploma in Acoustics and Noise Control. He has been working in the field of acoustics since 2008 and is a member of the Institute of Engineers Ireland (MIEI) and the Institute of Acoustics (MIOA). He has extensive knowledge and experience in relation to commissioning noise monitoring and impact assessment of wind farms as well as a detailed knowledge of acoustic standards and proprietary noise modelling software packages. He has commissioned noise surveys and completed noise impact assessments for numerous wind farm projects within Ireland.

11.2 Fundamentals of Acoustics

A sound wave travelling through the air is a regular disturbance of the atmospheric pressure. These pressure fluctuations are detected by the human ear, producing the sensation of hearing. To take account of the vast range of pressure levels that can be detected by the ear, it is convenient to measure sound in terms of a logarithmic ratio of sound pressures. These values are expressed as Sound Pressure Levels (SPL) in decibels (dB).

The audible range of sounds expressed in terms of Sound Pressure Levels (SPL) is 0dB (for the threshold of hearing) to 120dB (for the threshold of pain). In general, a subjective impression of doubling of loudness corresponds to a tenfold increase in sound energy which conveniently equates to a 10dB increase in SPL. It should be noted that a doubling in sound energy (such as may be caused by a doubling of traffic flows) increases the SPL by 3 dB.

The frequency of sound, being the rate at which a sound wave oscillates, is expressed in Hertz (Hz). The sensitivity of the human ear to different frequencies in the audible range is not uniform. For example, hearing sensitivity decreases markedly as frequency falls below 250Hz. In order to rank the SPL of various noise sources, the measured level is adjusted to give comparatively more weight to the frequencies that are readily detected by the human ear. The 'A-weighting' system defined in the international standard, BS ISO 226:2003 Acoustics. Normal Equal-loudness Level Contours has been found to provide the best correlations with human response to perceived loudness. SPL's measured using 'A-weighting' are expressed in terms of dB(A).

An indication of the level of some common sounds on the dB(A) scale is presented in Figure 11.1.

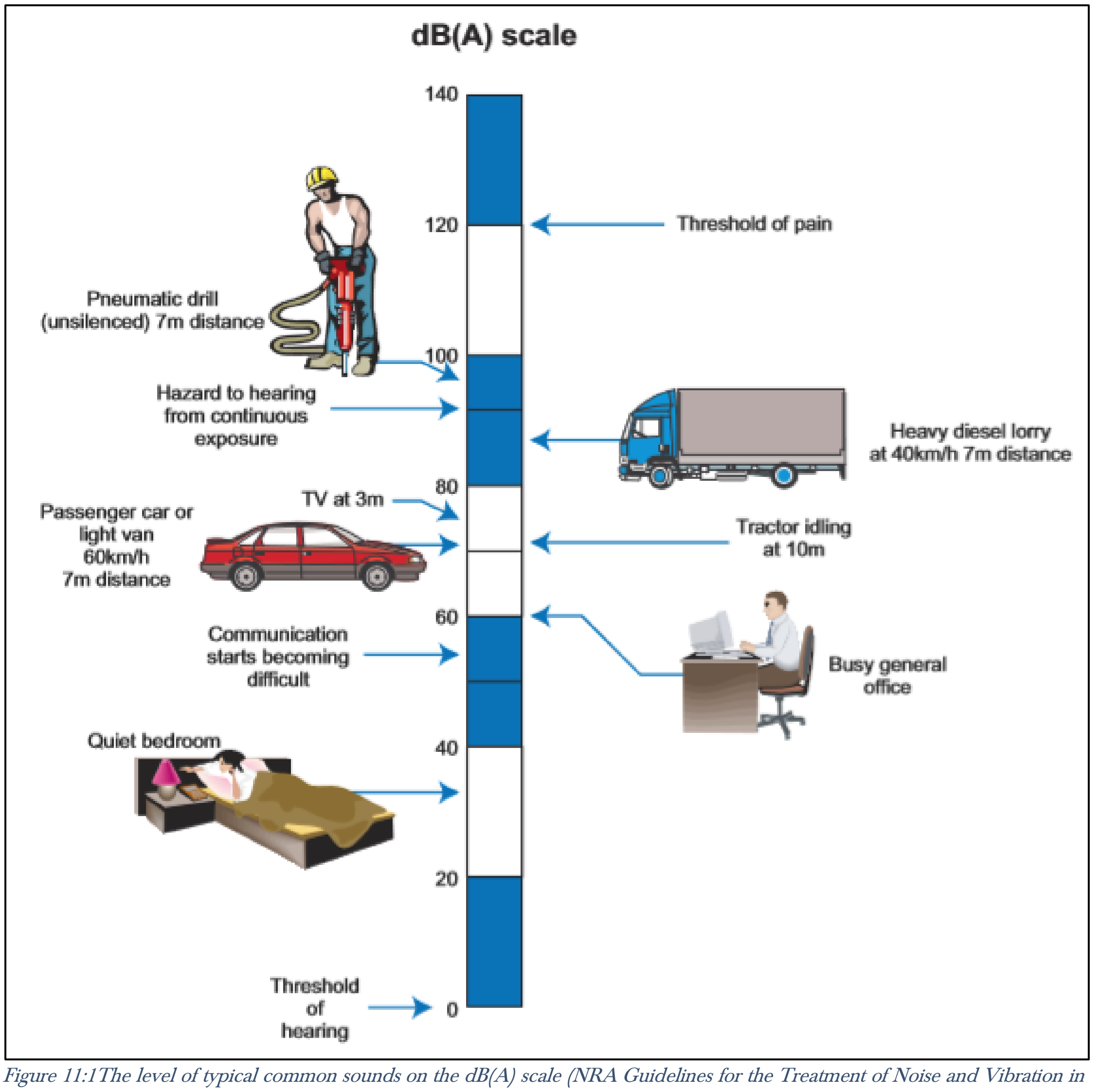

Figure 11:1The level of typical common sounds on the dB(A) scale (NRA Guidelines for the Treatment of Noise and Vibration in National Road Schemes, 2004)

For a glossary of terms used in this chapter please refer to Appendix 11.1.

11.3 Assessment Methodology

The assessment of impacts for the Proposed Development have been undertaken with reference to the most appropriate guidance documents relating to environmental noise and vibration which are set out in Section 11.3.2.

In addition to the specific guidance documents outlined in this chapter, the Environmental Impact Assessment (EIA) guidelines listed in Chapter 1 of this EIAR were considered and consulted for the purposes of preparing this EIAR chapter.

The methodology adopted for this noise impact assessment is summarised as follows:

- Review of appropriate guidance to identify appropriate noise and vibration criteria for both the construction, and operational phases;
- Characterise the receiving environment through baseline noise surveys at various NSL's surrounding the proposed development;
- Undertake predictive calculations to assess the potential impacts associated with the construction phase of the proposed development at the nearest NSL's;
- Undertake predictive noise calculations to assess the potential impacts associated with the operational phase of the proposed development at NSL's;
- evaluate the potential noise and vibration impacts and effects
- Specify mitigation measures to reduce, where necessary, the identified potential outward impacts relating to noise and vibration from the proposed development; and
- Describe the significance of the residual noise and vibration effects associated with the proposed development.

11.3.1 EPA Description of Effects

The significance of effects of the proposed development shall be described in accordance with the EPA guidance document Draft *Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR), (EPA, 2017)*. Details of the methodology for describing the significance of the effects are provided in Table 1.2 of Chapter 1: Introduction.

The effects associated with the proposed development are described with respect to the EPA guidance in the relevant sections of this chapter.

11.3.2 Guidance Documents and Assessment Criteria

The following sections review best practice guidance that is commonly adopted in relation to developments such as the one under consideration here.

11.3.2.1 Construction Phase

11.3.2.1.1 *Construction Noise*

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Local authorities normally control construction activities by imposing limits on the hours of operation and may consider noise limits at their discretion.

In the absence of specific noise limits, appropriate criteria relating to permissible construction noise levels for a development of this scale may be found in the British Standard 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise.*

The approach adopted here calls for the designation of a noise sensitive location into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded at the facade of residential receptors, (construction noise only), indicates a potential significant noise impact is associated with the construction activities.

Table 11.1 sets out the values which, if exceeded, potentially signify a significant effect as classified by BS 5228 – 1. These levels relate to construction noise only.

Table 11.1 Example Threshold of Potential Significant Effect at Dwellings

Assessment category and threshold value period (T)	Threshold values, $L_{Aeq,T}$ dB		
	Category A Note A	Category B Note B	Category C Note C
Night-time (23:00 to 07:00hrs)	45	50	55
Evenings and weekends Note D	55	60	65
Daytime (07:00 – 19:00hrs) and Saturdays (07:00 – 13:00hrs)	65	70	75

Note A Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.
Note B Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.
Note C Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.
Note D 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

This assessment method is only valid for residential properties. For the appropriate period (e.g. daytime) the ambient noise level is determined and rounded to the nearest 5 dB. In this instance, with the rural nature of the site, properties near the development have daytime ambient noise levels that typically range from 40 to 50 dB $L_{Aeq,1hr}$. Therefore, all properties will be afforded a Category A designation.

See Section 11.5.2 for the detailed assessment in relation to the proposed development. If the specific construction noise level exceeds the appropriate category value (e.g. 65 dB $L_{Aeq,T}$ during daytime periods) then a significant effect is deemed to have occurred.

11.3.2.1.2 Additional Vehicular Activity

For the assessment of potential noise impacts from construction related traffic along public roads and haul routes it is proposed to adopt guidance from Design Manual for Roads and Bridges (DMRB), Highways England, Transport Scotland, The Welsh Government and The Department of Infrastructure 2020.

Table 11.2, taken from Section 13.7 of DMRB presents guidance as to the likely impact associated with any change in the background noise level ($L_{Aeq,T}$) at a noise sensitive receiver from construction traffic.

Section 3.19 of DMRB states that construction noise and construction traffic noise shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:

- 10 or more days or nights in any 15 consecutive days or nights;
- A total number of days exceeding 40 in any 6 consecutive months.

Table 11.2 Likely Impacts Associated with Change in Traffic Noise Level (Source DMRB, 2020)

Change in Sound Level	Magnitude of Impact
0	No Change
0.1 – 0.9	Negligible
1.0 – 2.9	Minor
3.0 – 4.9	Moderate
>5	Major

The DMRB guidance outlined will be used to assess the predicted increases in traffic noise levels on public roads associated with the proposed development and comment on the likely impacts during the construction phase.

11.3.2.1.3 Construction Vibration

Vibration standards come in two varieties: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. With respect to this development, the range of relevant criteria used for building protection is expressed in terms of Peak Particle Velocity (PPV) in mm/s.

Guidance relevant to acceptable vibration within buildings is contained in the following documents:

- BS 7385 – *Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration* (BSI, 1993); and
- BS 5228 – *Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration* (BSI, 2009+A1:2014).

BS 7385 states that there should typically be no cosmetic damage if transient vibration does not exceed 15 mm/s at low frequencies rising to 20 mm/s at 15 Hz and 50 mm/s at 40 Hz and above.

BS 5228 recommends that, for soundly constructed residential property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak particle velocity of 15 mm/s for transient vibration at frequencies below 15 Hz and 20 mm/s at frequencies above than 15 Hz. Below these vibration magnitudes minor damage is unlikely, although where there is existing damage these limits may be reduced by up to 50%. In addition, where continuous vibration is generated, the limits discussed above may need to be reduced by 50%.

The Transport Infrastructure Ireland (TII) (formerly National Roads Authority (NRA)) document *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* (NRA, 2004) also contains information on the permissible construction vibration levels during the construction phase as shown in Table 11.3.

Table 11.3 Allowable Transient Vibration at Properties

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of		
Less than 10Hz	10 to 50Hz	50 to 100Hz (and above)
8 mm/s	12.5 mm/s	20 mm/s

11.3.2.2 Operational Phase

11.3.2.2.1 *Noise*

The noise assessment in this chapter has been based on guidance in relation to acceptable levels of noise from wind farms as contained in the document *Wind Energy Development Guidelines for Planning Authorities* published by the Department of the Environment, Heritage and Local Government in 2006. These guidelines are in turn based on detailed recommendations set out in the Department of Trade and Industry (UK) Energy Technology Support Unit (ETSU) publication *The Assessment and Rating of Noise from Wind Farms* (1996). The ETSU document has been used to supplement the guidance contained within the *Wind Energy Development Guidelines* publication where necessary.

11.3.2.2.2 *Wind Energy Development Guidelines*

Section 5.6 of the Wind Energy Development Guidelines published by the Department of the Environment, Heritage and Local Government (2006) addresses noise and outlines the appropriate noise criteria in relation to wind farm developments.

The following extracts from this document should be considered:

> "*An appropriate balance must be achieved between power generation and noise impact.*"

While this comment is noted it should be stated that the Guidelines give no specific advice in relation to what constitutes an 'appropriate balance'. In the absence of this, guidance will be taken from alternative and appropriate publications.

> "*In the case of wind energy development, a noise sensitive location includes any occupied house, hostel, health building or place of worship and may include areas of particular scenic quality or special recreational importance. Noise limits should apply only to those areas frequently used for relaxation or activities for which a quiet environment is highly desirable. Noise limits should be applied to external locations and should reflect the variation in both turbine source noise and background noise with wind speed.*"

As will be seen from the calculations presented later in this chapter, the various issues identified in this extract have been incorporated into our assessment.

> "*In general, a lower fixed limit of 45dB(A) or a maximum increase of 5dB(A) above background noise at nearby noise sensitive locations is considered appropriate to provide protection to wind energy development neighbours.*"

This represents the commonly adopted daytime noise criterion curve in relation to wind farm developments. However, an important caveat should be noted as detailed in the following extract.

"*However, in very quiet areas, the use of a margin of 5dB(A) above background noise at nearby noise sensitive properties is not necessary to offer a reasonable degree of protection and may unduly restrict wind energy developments which should be recognised as having wider national and global benefits. Instead, in low noise environments where background noise is less than 30dB(A), it is recommended that the daytime level of the LA90, 10min of the wind energy development be limited to an absolute level within the range of 35 – 40dB(A).*"

In relation to night time periods the following guidance is given:

"*A fixed limit of 43dB(A) will protect sleep inside properties during the night.*"

This limit is defined in terms of the $L_{A90,10min}$ parameter. This represents the commonly adopted night time lower limit noise criterion curve in relation to wind farm developments.

In summary, the Wind Energy Development Guidelines outlines the following guidance to identify appropriate wind turbine noise criteria curves at noise sensitive locations:

- an appropriate absolute limit level for quiet daytime environments with background noise levels of less than 30 dB $L_{A90,10min}$;
- 45 dB $L_{A90,10min}$ for daytime environments with background noise levels of greater than 30 dB $L_{A90,10min}$ or a maximum increase of 5 dB above background noise (whichever is higher), and;
- 43 dB $L_{A90,10min}$ for night time periods.

While the caveat of an increase of 5 dB(A) above background for night-time operation is not explicit within the current guidance it is commonly applied in noise assessments prepared and is detailed in numerous examples of planning conditions issued by local authorities and An Bord Pleanála. Therefore, a night time 5 dB(A) above background allowance has also been adopted in the criteria for this assessment.

The criteria have been chosen as it is in line with the intent of the relevant Irish guidance. The proposed operational noise criteria curves for wind turbine noise at various noise sensitive locations are presented in Section 11.4.2.

11.3.2.2.3 *The Assessment and Rating of Noise from Wind Farms – ETSU-R-97*

As stated previously the core of the noise guidance contained within the *Wind Energy Development Guidelines* is based on the 1996 ETSU publication *The Assessment and Rating of Noise from Wind Farms* (ETSU-R-97).

ETSU-R-97 calls for the control of wind turbine noise by the application of noise limits at the nearest noise sensitive properties. ETSU-R-97 considers that absolute noise limits applied at all wind speeds are not suited to wind turbine developments and recommends that noise limits should be set relative to the existing background noise levels at noise sensitive locations. A critical aspect of the noise assessment of wind energy proposals relates to the identification of baseline noise levels through on-site noise surveys.

ETSU-R-97 states on page 58, "*...absolute noise limits and margins above background should relate to the cumulative effect of all wind turbines in the area which contribute to the noise received at the properties in question...*". Therefore, the noise contribution from all wind turbine development in the area should be included in the assessment.

11.3.2.2.4 *Institute of Acoustics Good Practice Guide*

The guidance contained within the institute of Acoustics (IoA) document *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise* (2013) (IOA GPG) and Supplementary Guidance Notes are considered to represent best practice and have been adopted for this assessment. The IOA GPG states, that at a minimum continuous baseline noise monitoring should be carried out at the nearest noise sensitive locations for typically a two-week period and should capture a representative sample of wind speeds in the area (i.e. cut in speeds to wind speed of rated sound power of the proposed turbine). Background noise measurements (i.e. $L_{A90,10min}$) should be related to wind speed measurements that are collated at the site of the wind turbine development. Regression analysis is then conducted on the data sets to derive background noise levels at various wind speeds to establish the appropriate day and night time noise criterion curves.

Noise emissions associated with the wind turbine can be predicted in accordance with ISO 9613: *Acoustics – Attenuation of sound outdoors, Part 2: General method of calculation* (1996). This is a noise prediction standard that considers noise attenuation offered, amongst others, by distance, ground absorption, directivity, and atmospheric absorption. Noise predictions and contours are typically prepared for various wind speeds and the predicted levels are compared against the relevant noise criterion curve to demonstrate compliance with the appropriate noise criteria.

Where noise predictions indicate that reductions in noise emissions are required to satisfy any adopted criteria, consideration can be given to detailed downwind analysis and operating turbines in low noise mode, which is typically offered by modern wind turbine units.

For guidance on the methodology for the background noise survey and operation impact assessment for wind turbine noise the IOA GPG has been adopted.

Assessment of Cumulative Turbine Noise Impacts

The IOA GPG states that cumulative noise exceedances should be avoided and where existing or permitted development is at the noise limit any new turbine noise sources should be designed to be 10 dB below the limit value.

Section 5.1 of the relevant IOA GPG states the following:

> *"5.1.1 ETSU-R-97 states at page 58, "...absolute noise limits and margins above background should relate to the cumulative effect of all wind turbines in the area which contribute to the noise received at the properties in question..."*
>
> *5.1.2 The HMP[1] Report states that "If an existing wind farm has permission to generate noise levels up to ETSU-R-97 limits, planning permission noise limits set at any future neighbouring wind farm would have to be at least 10 dB lower than the limits set for the existing wind farm to ensure there is no potential for cumulative noise impacts to breach ETSU-R-97 limits (except in such cases where a higher fixed limit could be justified)". Such an approach could prevent any further wind farm development in the locality, and a more detailed analysis can be undertaken on a case by case basis.*
>
> *5.1.3 As with the assessment of noise for all wind farm developments, sequential steps need to be taken, but such steps require more detailed attention due to the added complexity of cumulative noise impacts. The advice of the EHO[2] could be invaluable to this part of the assessment."*
>
> *Cumulative impact assessment necessary*
>
> *5.1.4 During scoping of a new wind farm development consideration should be given to cumulative noise impacts from any other wind farms in the locality. If the proposed wind farm*

1 HMP: Hayes McKenzie Partnership Ltd. Report on "Analysis of How Noise Impacts are considered in the Determination of Wind Farm Planning Applications" Ref HM: 2293/R1 dated 6th April 2011.
2 Environmental Health Officer

produces noise levels within 10 dB of any existing wind farm/s at the same receptor location, then a cumulative noise impact assessment is necessary.

5.1.5 Equally, in such cases where noise from the proposed wind farm is predicted to be 10 dB greater than that from the existing wind farm (but compliant with ETSU-R-97 in its own right), then a cumulative noise impact assessment would not be necessary."

11.3.2.2.5 Future Potential Guidance Change

In December 2019, the Draft Revised Wind Energy Development Guidelines were published for consultation. Revised guidelines have yet to be finalised and at the time of writing there is no indication as to when any final revision to the guidelines will be published. It is important to note that as part of the public consultation, a number of concerns in relation to the proposed approach have been expressed by various parties and it is the opinion of the authors' of this assessment that the document does not outline a best practice approach in terms of the assessment of wind turbine noise. Specific concerns expressed by a cross party group of interested professionals can be reviewed at:

https://www.ioa.org.uk/wind-energy-development-guidelines-wedg-consultation-irish-department-housing-planning-community-and

The following statement is of note in relation to the above submission:

"*a number of acousticians working in the field have raised serious concerns over the significant amount of technical errors, ambiguities and inconsistencies in the content of the draft WEDG and these were highlighted during the consultation process by a group of acousticians*",

Therefore, in line with best practice, the assessment presented in this EIAR is based on the current guidance outlined in the *Wind Energy Development Guidelines for Planning Authorities (*2006), and has been supplemented with guidance from ESTU-R-97 and the IOA GPG and its supplementary guidance notes.

In the event that updated Wind Energy Guidelines are published during the application process for the Proposed Development it is anticipated that any relevant changes affecting the noise will be addressed through an appropriate planning condition, or where a supplementary assessment is necessary, through provision of additional information.

11.3.2.2.6 World Health Organisation (WHO) Noise Guidelines for the European Region

The World Health Organisation (WHO) *Environmental Noise Guidelines for the European Region* (2018) provide guidance on protecting human health from exposure to environmental noise. They set health-based recommendations based on average environmental noise exposure of several sources of environmental noise, including wind turbine noise.

Recommendations are rated as either 'strong' or 'conditional'. A strong recommendation, *"can be adopted as policy in most situations"* whereas a conditional recommendation, *"requires a policy-making process with substantial debate and involvement of various stakeholders. There is less certainty of its efficacy owing to lower quality of evidence of a net benefit, opposing values and preferences of individuals and populations affected or the high resource implications of the recommendation, meaning there may be circumstances or settings in which it will not apply".*

The objective of the WHO *Environmental Noise Guidelines for the European Region* is to provide recommendations for protecting human health from exposure to environmental noise from transportation, wind farm and leisure sources of noise. The guidelines present recommendations for each noise source type in terms of L_{den} and L_{night} levels above which there is risk of adverse health risks.

In relation to wind turbine noise, the WHO Guideline Development Group (GDG) state the following:

> "*For average noise exposure, the GDG* ***conditionally*** *recommends reducing noise levels produced by wind turbines below 45 dB Lden, as wind turbine noise above this level is associated with adverse health effects.*
>
> *No recommendation is made for average night noise exposure Lnight of wind turbines. The quality of evidence of night-time exposure to wind turbine noise is too low to allow a recommendation.*
>
> *To reduce health effects, the GDG* ***conditionally*** *recommends that policymakers implement suitable measures to reduce noise exposure from wind turbines in the population exposed to levels above the guideline values for average noise exposure. No evidence is available, however, to facilitate the recommendation of one particular type of intervention over another."*

The quality of evidence used for the WHO research is stated as being 'Low', the recommendations are therefore conditional.

There is potential increased uncertainty due to the parameter used by the WHO for assessment of exposure (i.e. L_{den}), which it is acknowledged may be a poor characterisation of wind turbine noise and may limit the ability to observe associations between wind turbine noise and health outcomes, as stated below.

> "*Even though correlations between noise indicators tend to be high (especially between LAeq-like indicators) and conversions between indicators do not normally influence the correlations between the noise indicator and a particular health effect, important assumptions remain when exposure to wind turbine noise in Lden is converted from original sound pressure level values. The conversion requires, as variable, the statistical distribution of annual wind speed at a particular height, which depends on the type of wind turbine and meteorological conditions at a particular geographical location. Such input variables may not be directly applicable for use in other sites. They are sometimes used without specific validation for a particular area, however, because of practical limitations or lack of data and resources. This can lead to increased uncertainty in the assessment of the relationship between wind turbine noise exposure and health outcomes. Based on all these factors, it may be concluded that the acoustical description of wind turbine noise by means of Lden or Lnight may be a poor characterization of wind turbine noise and may limit the ability to observe associations between wind turbine noise and health outcomes…*
>
> *…Further work is required to assess fully the benefits and harms of exposure to environmental noise from wind turbines and to clarify whether the potential benefits associated with reducing exposure to environmental noise for individuals living in the vicinity of wind turbines outweigh the impact on the development of renewable energy policies in the WHO European Region."*

It is therefore considered that the conditional WHO recommended average noise exposure level (i.e. 45dB L_{den}) if applied, as target noise criteria for an existing or proposed wind turbine development in Ireland, should be done with caution. The L_{den} criteria has been adopted as part of this assessment, this is based upon the review set out above and the conclusion that the conditional WHO recommended average noise exposure level (i.e. 45dB L_{den}) may be a poor characterisation of wind turbine noise and may limit the ability to observe associations between wind turbine noise and health outcomes.

11.3.3 Special Characteristics of Turbine Noise

11.3.3.1 Infrasound/Low Frequency Noise

Low Frequency Noise is noise that is dominated by frequency components less than approximately 200Hz whereas Infrasound is typically described as sound at frequencies below 20Hz. In relation to Infrasound, the following extract from the EPA document *Guidance Note for Noise Assessment of Wind Turbine Operations at EPA Licensed Sites (NG3)* (EPA, 2011) is noted here:

> *"There is similarly no significant infrasound from wind turbines. Infrasound is high level sound at frequencies below 20 Hz. This was a prominent feature of passive yaw "downwind" turbines where the blades were positioned downwind of the tower which resulted in a characteristic "thump" as each blade passed through the wake caused by the turbine tower. With modern active yaw turbines (i.e. the blades are upwind of the tower and the turbine is turned to face into the wind by a wind direction sensor on the nacelle activating a yaw motor) this is no longer a significant feature."*

With respect to infrasonic noise levels below the hearing threshold, the World Health Organisation (WHO) document *Community Noise* (WHO, 1995) has stated that:

> *"There is no reliable evidence that infrasounds below the hearing threshold produce physiological or psychological effects."*

In 2010, the UK Health Protection Agency published a report entitled *Health Effects of Exposure to Ultrasound and Infrasound, Report of the independent Advisory Group on Non-ionising Radiation.* The exposures considered in the report related to medical applications and general environmental exposure. The report notes:

> *"Infrasound is widespread in modern society, being generated by cars, trains and aircraft, and by industrial machinery, pumps, compressors and low speed fans. Under these circumstances, infrasound is usually accompanied by the generation of audible, low frequency noise. Natural sources of infrasound include thunderstorms and fluctuations in atmospheric pressure, wind and waves, and volcanoes; running and swimming also generate changes in air pressure at infrasonic frequencies.*
>
> *For infrasound, aural pain and damage can occur at exposures above about 140 dB, the threshold depending on the frequency. The best-established responses occur following acute exposures at intensities great enough to be heard and may possibly lead to a decrease in wakefulness. The available evidence is inadequate to draw firm conclusions about potential health effects associated with exposure at the levels normally experienced in the environment, especially the effects of long-term exposures. The available data do not suggest that exposure to infrasound below the hearing threshold levels is capable of causing adverse effects."*

The UK Institute of Acoustics Bulletin in March 2009 included a statement of agreement between acoustic consultants regularly employed on behalf of wind farm developers, and conversely acoustic consultants regularly employed on behalf of community groups campaigning against wind farm developments (IAO JS2009). The intent of the article was to promote consistent assessment practices, and to assist in restricting wind farm noise disputes to legitimate matters of concern. In relation to the issue of infrasound, the article states the following:

> *"Infrasound is the term generally used to describe sound at frequencies below 20 Hz. At separation distances from wind turbines which are typical of residential locations the levels of infrasound from wind turbines are well below the human perception level. Infrasound from wind turbines is often at levels below that of the noise generated by wind around buildings and other obstacles.*

Sounds at frequencies from about 20 Hz to 200 Hz are conventionally referred to as low-frequency sounds. A report for the DTI in 2006 by Hayes McKenzie concluded that neither infrasound nor low frequency noise was a significant factor at the separation distances at which people lived. This was confirmed by a peer review by a number of consultants working in this field. We concur with this view."

The article concludes that:

"from examination of reports of the studies referred to above, and other reports widely available on internet sites, we conclude that there is no robust evidence that low frequency noise (including 'infrasound') or ground-borne vibration from wind farms, generally has adverse effects on wind farm neighbours".

A report released in January 2013 by the South Australian Environment Protection Authority namely, *Infrasound levels near windfarms and in other environments* (EPA and Resonate Acoustics, 2013)[3] found that the level of infrasound from wind turbines is insignificant and no different to any other source of noise, and that the worst contributors to household infrasound are air-conditioners, traffic and noise generated by people.

The study included several houses in rural and urban areas, both adjacent to and away from a wind farm, and measured the levels of infrasound with the wind farms operating and switched off.

There were no noticeable differences in the levels of infrasound under all these different conditions. In fact, the lowest levels of infrasound were recorded at one of the houses closest to a wind farm, whereas the highest levels were found in an urban office building.

The EPA's study concluded that the level of infrasound at houses near wind turbines was no greater than in other urban and rural environments, and stated that:

"The contribution of wind turbines to the measured infrasound levels is insignificant in comparison with the background level of infrasound in the environment."

A German report[4], titled "L*ow Frequency Noise incl. Infrasound from Wind Turbines and Other Sources*" presents the details of a measurement project which ran from 2013. The report was published by the State Office for the Environment, Measurement and Nature Conservation of the Federal State of Baden-Württemberg in 2016 and concluded the following in relation to infrasound from wind turbines:

"*The measured infrasound levels (G levels) at a distance of approx. 150 m from the turbine were between 55 and 80 dB(G) with the turbine running. With the turbine switched off, they were between 50 and 75 dB(G). At distances of 650 to 700 m, the G levels were between 55 and 75 dB(G) with the turbine switched on as well as off.*"

"*For the measurements carried out even at close range, the infrasound levels in the vicinity of wind turbines – at distances between 150 and 300 m – were well below the threshold of what humans can perceive in accordance with DIN 45680 (2013 Draft)*[5]"

"The results of this measurement project comply with the results of similar investigations on a national and international level."

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3 *EPA South Australia, 2013, Wind farms https://www.epa.sa.gov.au/files/477912_infrasound.pdf*

4 *Report available at https://www4.lubw.baden-wuerttemberg.de/servlet/is/262445/low-frequency_noise_incl_infrasound.pdf?command=downloadContent&filename=low-frequency_noise_incl_infrasound.pdf*

5 *DIN 45680:2013-09 – Draft "Measurement and Assessment of Low-frequency Noise Immissions" November 2013*

In conclusion, there is a significant body of evidence to show that the infrasound associated with wind turbines will be below perceptibility thresholds and typically in line with existing baseline levels of infrasound within the environment.

11.3.3.2 Amplitude Modulation

In the context of this assessment, amplitude modulation (AM) is defined in the IOA Noise Working Group (Wind Turbine Noise) Amplitude Modulation Working Group (AMWG) document *A Method for Rating Amplitude Modulation in Wind Turbine Noise* (IOA, 2016) as:

> "*Periodic fluctuations in the level of audible noise from a wind turbine (or wind turbines), the frequency of the fluctuations being related to the blade passing frequency (BPF) of the turbine rotor(s).*"

It is now generally accepted that there are two mechanisms which can cause amplitude modulation:

- 'Normal' AM, and;
- 'Other' AM (sometimes referred to 'Excessive' AM).

In both cases, the result is a regular fluctuation in amplitude at the Blade Passing Frequency (BPF) of the wind turbine blades (the rate at which the blades of the turbine pass a fixed point). For a three-bladed turbine rotating at 20 rpm, this equates to a modulation frequency of 1 Hz.

'Normal' AM

An observer at ground level close to a wind turbine will experience 'blade swish' because of the directional characteristics of the noise radiated from the trailing edge of the blades as it rotates towards and then away from the observer.

This effect is reduced for an observer on or close to the turbine axis, and therefore would not generally be expected to be significant at typical separation distances, at least on relatively level sites.

The RenewableUK AM project (RenewableUK, 2013) has coined the term 'normal' AM (NAM) for this inherent characteristic of wind turbine noise, which has long been recognised and was discussed in ETSU-R-97 in 1996.

'Other' AM

In some cases AM is observed at large distances from a wind turbine (or turbines). The sound is generally heard as a periodic 'thumping' or 'whoomphing' at relatively low frequencies.

On sites where it has been reported, occurrences appear to be occasional, although they can persist for several hours under some conditions, dependent on atmospheric factors, including wind speed and direction.

It was proposed in the RenewableUK 2013 study that the fundamental cause of this type of AM is transient stall conditions occurring as the blades rotate, giving rise to the periodic thumping at the blade passing frequency.

Transient stall represents a fundamentally different mechanism from blade swish and can be heard at relatively large distances, primarily downwind of the rotor blade.

The RenewableUK AM project report adopted the term 'Other AM' (OAM) for this characteristic. The terms 'enhanced' or 'excess' AM (EAM) have been used by others, although such definitions do not distinguish between the source mechanisms and presuppose a 'normal' level of AM, presumably relating back to blade swish as described in ETSU-R-97.

11.3.3.2.1 Frequency of Occurrence of AM

Research by Salford University commissioned by the Department of Environment Food and Rural Affairs (DEFRA), the Department of Business, Enterprise and Regulatory Reform (BERR) and the Department of Communities and Local Government (CLG) investigated the issue of AM associated with wind turbine noise. The results were reviewed and published in the report *Research into Aerodynamic Modulation of Wind Turbine Noise* (2007). The broad conclusions of this report were that aerodynamic modulation was only considered to be an issue at 4, and a possible issue at a further 8, of 133 sites in the UK that were operational at the time of the study and considered within the review. At the 4 sites where AM was confirmed as an issue, it was considered that conditions associated with AM might occur between about 7 and 15% of the time. It also emerged that for three out of the four sites the complaints have subsided, in one case due to the introduction of a turbine control system. The research has shown that AM is a rare and unlikely occurrence at operational wind farms.

It should be noted that AM is associated with wind turbine operation and it is not possible to predict an occurrence of AM at the planning stage. It should also be noted that it is a rare event associated with a limited number of wind farms. While it can occur, it is the exception rather than the rule.

RenewableUK Research Document states the following in relation to the matter:

Page 68 Module F	"*even on those limited sites where it has been reported, its frequency of occurrence appears to be at best infrequent and intermittent.*"
Page 6 Module F	"*It has also been the experience of the project team that, even at those wind farm sites where AM has been reported or identified to be an issue, its occurrence may be relatively infrequent. Thus, the capture of time periods when subjectively significant AM occurs may involve elapsed periods of several weeks or even months.*"
Page 61 Module F	"*There is nothing at the planning stage that can presently be used to indicate a positive likelihood of OAM occurring at any given proposed wind farm site, based either on the site's general characteristics or on the known characteristics of the wind turbines to be installed.*"

11.3.3.2.2 Assessment of AM

Research and Guidance in the area is ongoing with recent publications being issued by the Institute of Acoustics (IoA) Noise working Group (Wind Turbine Noise) Amplitude Modulation Working Group (AMWG) namely, *A Method for Rating Amplitude Modulation in Wind Turbine Noise* (August 2016) (The Reference Method). The document proposes an objective method for measuring and rating AM. The AMWG does not propose what level of AM is likely to result in adverse community response or propose any limits for AM. The purpose of the group is simply to use existing research to develop a Reference Methodology for the measurement and rating of amplitude modulation.

The definition of any limits of acceptability for AM, or consideration of how such limits might be incorporated into a wind farm planning condition, is outside the scope of the AMWG's work and is currently the subject of a separate UK Government funded study. In the absence of published guidance to date, it is considered best practice to adopt the penalty rating and assessment scheme contained in an article published in the Institute of Acoustics publication *Acoustics Bulletin* (Vol. 42 No. 2 March/April 2017) titled, *Perception and Control of Amplitude Modulation in Wind Turbines Noise*.

Where it occurs, AM is typically an intermittent occurrence, therefore assessment may involve log-term measurements. The 'Reference Method' for measuring AM outlined in the IoA AMWG document will provide a robust and reliable indicator of AM and yield important information on the frequency and duration of occurrence, which can be used to evaluate different operational conditions including mitigation.

11.3.4 Comments on Human Health Impacts

11.3.4.1 The National Health and Medical Research Council

The relevant Australian authority on health issues, the National Health and Medical Research Council (NHMRC), conducted a comprehensive independent assessment of the scientific evidence on wind farms and human health, the findings are contained in the NHMRC Information Paper: *Evidence on Wind Farms and Human Health* 2015, this report concluded:

> *"After careful consideration and deliberation, NHMRC concluded that there is no consistent evidence that wind farms cause adverse health effects in humans. This finding reflects the results and limitations of the direct evidence and also takes into account the relevant available parallel evidence on whether or not similar noise exposure from sources other than wind farms causes health effects."*

11.3.4.2 Health Canada

Health Canada, Canada's national health organisation, released preliminary results of a study into the effect of wind farms on human health in 2014[6]. The study was initiated in 2012 specifically to gather new data on wind farms and health. The study considered physical health measures that assessed stress levels using hair cortisol, blood pressure and resting heart rate, as well as measures of sleep quality. More than 4,000 hours of wind turbine noise measurements were collected and a total of 1,238 households participated.

No evidence was found to support a link between exposure to wind turbine noise and any of the self-reported illnesses. Additionally, the study's results did not support a link between wind turbine noise and stress, or sleep quality (self-reported or measured). However, an association was found between increased levels of wind turbine noise and individuals reporting of being annoyed.

11.3.4.3 New South Wales Health Department

In 2012, the New South Wales (NSW) Health Department provided written advice to the NSW Government that stated existing studies on wind farms and health issues had been examined and no known causal link could be established.

NSW Health officials stated that fears that wind turbines make people sick are 'not scientifically valid'. The officials wrote that there was no evidence for 'wind turbine syndrome', a collection of ailments including sleeplessness, headaches and high blood pressure that some people believe are caused by the noise of spinning blades.

11.3.4.4 The Australian Medical Association

The Australian Medical Association put out a position statement, *Wind Farms and Health* 2014[7]. The statement said:

> *"The available Australian and international evidence does not support the view that the infrasound or low frequency sound generated by wind farms, as they are currently regulated in Australia, causes adverse health effects on populations residing in their vicinity. The*

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[6] *Health Canada 2014, Wind Turbine Noise and Health Study: Summary of Results. Available at https://www.canada.ca/en/health-canada/services/environmental-workplace-health/noise/wind-turbine-noise/wind-turbine-noise-health-study-summary-results.html*

[7] *Australian Medical Association, 2014, Wind farms and health. Available at https://ama.com.au/position-statement/wind-farms-and-health-2014*

> *infrasound and low frequency sound generated by modern wind farms in Australia is well below the level where known health effects occur, and there is no accepted physiological mechanism where sub-audible infrasound could cause health effects."*

11.3.4.5 Journal of Occupational and Environmental Medicine

The review titled, *Wind Turbines and Health: A Critical Review of the Scientific Literature* was published in the Journal of Occupational and Environmental Medicine, 2014. An independent review of the literature was undertaken by the Department of Biological Engineering of the Massachusetts Institute of Technology (MIT). The review took into consideration health effects such as stress, annoyance and sleep disturbance, as well as other effects that have been raised in association with living close to wind turbines. The study found that:

> *"No clear or consistent association is seen between noise from wind turbines and any reported disease or other indicator of harm to human health."*

The report concluded that living near wind farms does not result in the worsening of the quality of life in that region.

11.3.4.6 Summary

The peer reviewed research outlined in the preceding sections supports that there are no negative health effects on people with long term exposure to wind turbine noise. Please refer to Chapter 5 of the EIAR for further details of potential health impacts associated with the proposed development.

11.3.5 Vibration

A recent report published in Germany by the State Office for the Environment, Measurement and Nature Conservation of the Federal State of Baden-Württemberg in 2016, "*Low Frequency Noise incl. Infrasound from Wind Turbines and Other Sources*", conducted vibration measurements study for an operational Nordex N117 – 2.4 MW wind turbine. The report concluded that, at distances of less than 300m from the turbine, vibration levels had dropped so far that they could no longer be differentiated from the background vibration levels.

Considering the distance from nearest NSLs to any of the proposed turbines is some 680m, levels of vibration will be significantly below any thresholds for perceptibility. Therefore, vibration criteria have not been specified for the operational phase of the proposed development.

11.3.6 Background Noise Assessment

A noise survey was undertaken to determine typical background noise levels at representative NSLs surrounding the development site. The background noise survey was conducted through installing unattended sound level meters at 5 no. representative locations in the surrounding area.

All measurement data collected during the background noise surveys has been carried out in accordance with the Institute of Acoustic's *Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise* (IoA GPG, 2013) and accompanying, Supplementary Guidance Note 1: Data Collection (2014) discussed in the following Section.

11.3.6.1 Choice of Measurement Locations

The noise monitoring locations were identified by preparing a preliminary cumulative turbine noise model contour at an early stage of the assessment. Any locations that fell inside the predicted 35 dB L_{A90} noise contour were considered for noise monitoring in accordance with the threshold level defined in the IOA GPG. The selection of the noise monitoring locations was informed by site visits and supplemented by reviewing aerial images of the study area and other online sources of information (e.g. Google Earth, Bing Maps, etc.).

The locations selected for the noise monitoring are outlined in the following sections. Coordinates for the noise monitoring locations are detailed in Table 11.4 and illustrated in Figure 11.2, overleaf.

Table 11.4 Measurement Location Coordinates

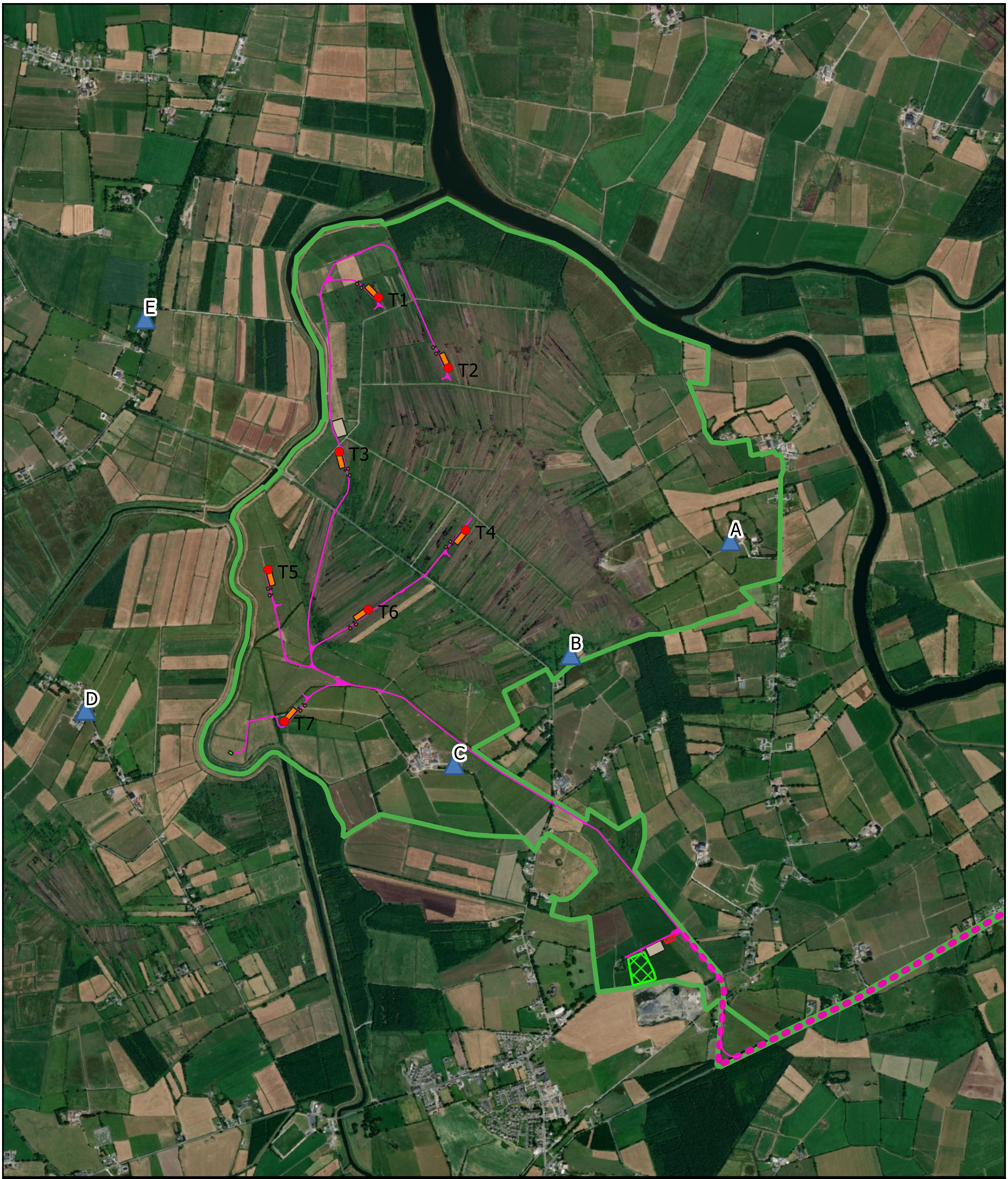
Location	ID Ref	Coordinates – Irish Grid (ITM)	
		Easting	Northing
A	H064	490,901	632,099
B	H004	490,114	631,538
C	H011	489,540	630,997
D	H023	487,727	631,265
E	H042	488,020	633,192
LiDAR Location	N/A	489,590	632,182

The noise monitoring locations were selected to obtain background noise levels representative of the noise environments at noise sensitive locations surrounding the site in line with best practice guidance contained in the IOA GPG.

The background noise environments away from any significant sources, were typically noted to comprise distant traffic movements, activity in and around the residences and wind generated noise from nearby foliage and other typical anthropogenic sources typically found in such rural settings. Additional descriptions of the noise environments from observations made on site during installation, interim visits and collection are presented below for each monitoring location where relevant.

Site visits were carried out during the morning and afternoon time; therefore, no observations were made during night-time periods. There was no perceptible source of vibration noted at any of the survey locations.

Plate 11-1to Plate 11-10 illustrate the installed noise monitoring equipment at each location. Yellow ellipses are added to the photographs to highlight the position of the noise monitoring equipment.



Map Legend

- Noise Monitoring Locations
- EIAR Study Area
- Proposed Turbine Locations
- Proposed Site Roads
- Proposed Hardstands
- Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Substation
- Proposed Met Mast
- Proposed Grid Route

Drawing Title: Noise Monitoring Locations	
Project Title: Ballynagare Wind Farm	
Drawn By: TB	Checked By: LW
Project No.: 200512	Drawing No.: Figure 11.2
Scale: 1:25000	Date: 13.10.2021

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11.3.6.1.1 Location A

The noise meter at Location A was positioned in an open field approximately 20m west of house H064. This location was judged to be representative of the cluster of nearby properties which are located on the local road to the east. Some agricultural machinery was noted at an out-building to the east of the house and assumed to operate during periods in the daytime. The monitor was located on the far side of the house within the curtilage, positioned in a location representative of the background noise levels without influence of this noise source.

Plate 11-1 Location A - Picture 1

Plate 11-2 Location A – Picture 2

11.3.6.1.2 Location B

The noise meter at Location B was positioned to the rear of house H004 on the northern side of the property. No significant noise sources were noted at this location. Dogs barking at the property was noted during the installation due to the presence of AWN personnel.

Plate 11-3 Location B – Picture 1

Plate 11-4 Location B – Picture 2

11.3.6.1.3 Location C

The noise meter at Location C was positioned in an open field approximately 20m from house H011. Noise sources included occasional vehicle movements on the adjacent access lane and distant noise from agricultural machinery.

Plate 11-5 Location C – Picture 1

Plate 11-6 Location C – Picture 2

11.3.6.1.4 Location D

Location D was positioned in the front garden of the house H023. The location was relatively quiet with local traffic noted on adjacent road. On installation, engine noise from an agricultural vehicle on the far side of the house was noted. This was audible at low level for a time at the monitoring location.

Plate 11-7 Location D – Picture 1

Plate 11-8 Location D – Picture 2

11.3.6.1.5 Location E

Location E was positioned in the front garden of house H042. The location was noted to be quiet with little distant road traffic and agricultural activity audible. Dogs barking at the house was noted on installation.

Plate 11-9 Location E – Picture 1

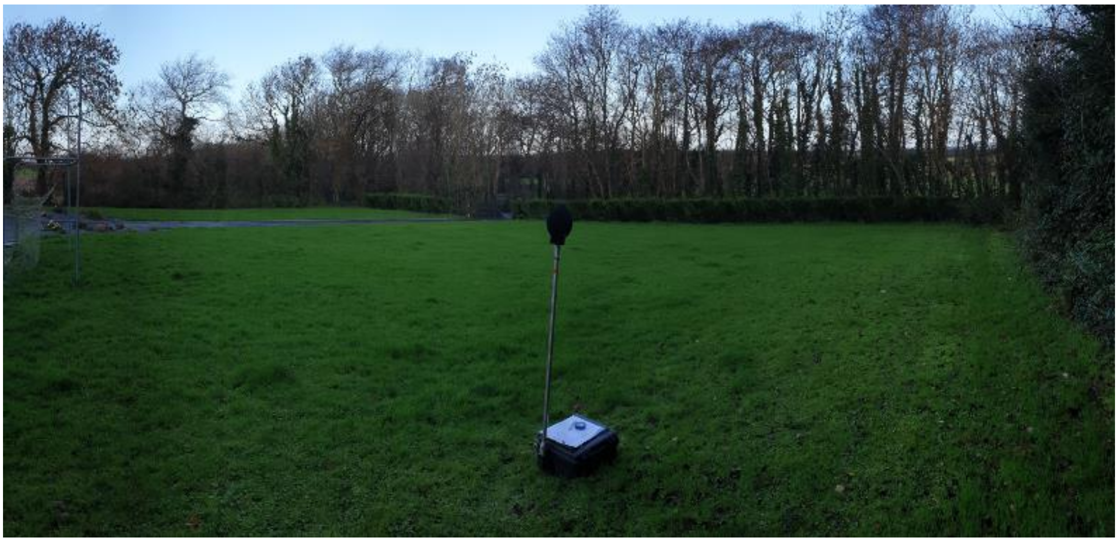


Plate 11-10 Location E – Picture 2

11.3.6.2 Measurement Periods

Noise measurements were conducted at each of the monitoring locations over the period outlined in Table 11.5.

Table 11.5 Measurement Periods

Location	Start Date	End Date
All	25 November 2020	26 January 2021

The survey was completed when an adequate number of datasets had been measured as recommended in the IOA GPG to determine a suitable representation of the typical background noise.

11.3.6.3 Personnel and Instrumentation

AWN Consulting installed and removed the noise monitors at all locations. Battery checks and meter calibrations were carried out during the survey periods. The following instrumentation was used at each location.

Table 11.6 Instrumentation Details

Location	Equipment	Serial Number	Maximum Calibration Drift Noted between Checks
A	RION – NL-52	186670	0.0 dB
B	RION – NL-52	1076328	0.1 dB
C	RION – NL-52	186671	0.0 dB
D	RION – NL-52	998409	0.0 dB
E	RION – NL-52	1076330	0.1 dB

Before and after the survey the measurement apparatus was check calibrated using a Brüel & Kjær type 4231 Sound Level Calibrator where appropriate. Instruments were calibrated on each interim visit and any drift noted. All calibration drifts were less than ±0.5 dB and within acceptable tolerances outlined in the IOA GPG. Relevant calibration certificates are presented in Appendix 11.2.

Rain fall was monitored and logged using two Texas Instruments TR-525 console data loggers that were installed at Location A for the duration of the survey. The logged rainfall data allows for the identification and removal of sample periods affected by rainfall from the data sets during analysis in line with best practice when calculating the prevailing background noise levels.

Wind data was measured by a LiDAR unit, installed on site by others, and was supplied to AWN for the data analysis.

11.3.6.4 Procedure

Measurements were conducted at five locations over the survey periods outlined in Table 11.5. Data samples for all measurements (noise, rainfall and wind) were logged continuously over 10-minute intervals for the duration of the survey.

Survey personnel noted potential primary noise sources contributing to noise build-up during the installation and removal of the sound level meters from site. Description of the observed noise environment at each of the monitoring locations is presented below. $L_{Aeq,10min}$ and $L_{A90,10min}$ parameters were measured in this instance.

11.3.6.5 Analysis of Background Noise Data

The data sets have been filtered to remove issues such as the dawn chorus and the influence of other atypical noise sources. An example of atypical sources would be short, isolated periods of raised noise levels attributable to local sources, agricultural activity, boiler flues, operation of gardening equipment etc. In addition, sample periods affected by rainfall or when rainfall resulted in prolonged periods of atypical noise levels have also been screened form the data sets. The assessment methods outlined above are in line with the guidance contained in the IoA *GPG*.

The results presented in the following sections refer to the noise data collated during 'quiet periods' of the day and night as defined in the IoA *GPG*. These periods are defined as follows:

- Daytime Amenity hours are:
  - all evenings from 18:00 to 23:00hrs;
  - Saturday afternoons from 13:00 to 18:00hrs, and;

- all day Sunday from 07:00 to 18:00hrs.
- Night-time hours are 23:00 to 07:00hrs.

The background noise levels are derived for each location with reference to the standardised 10m height wind speed relative to the assessment hub height (HH) of 95m in line with best practice, 95m being the proposed turbine hub height

11.3.6.5.1 Consideration of Wind Shear

Wind shear is defined as the increase of wind speed with height above ground. As part of a robust wind farm noise assessment due consideration should be given to the issue of wind shear. The issue of wind shear has been considered in this assessment and followed relevant guidance as outlined in the IoA GPG. It is standard procedure to reference noise data to standardised 10 metre height wind speed.

Wind speed measurements at 60m and 80m heights have been corrected to a height of 95m (the hub height adopted for the noise assessment) in accordance with Method B of Section 2.6 of the IOA GPG. The calculated hub height wind speeds were then corrected to standardised 10 metre height wind speed.

The IoA GPG presents the following equations in relation to the derivation of a standardised wind speed at 10m above ground level:

Shear Exponent Profile: $U = U_{ref} \times [(H \div H_{ref})]^{m}$

Where:

U	Calculated wind speed
U_{ref}	Measured HH wind speed.
H	Height at which the wind speed will be calculated.
H_{ref}	Height at which the wind speed was measured.
m	shear exponent = $\log(U/U_{ref})/\log(H/H_{ref})$

The Calculated hub height wind speeds have been standardised to 10 m height using the following equation:

Roughness Length Shear Profile: $U_1 = U_2 \times [(\ln(H_1 \div z))/ (\ln(H_2 \div z))]$

Where:

H_1	The height of the wind speed to be calculated (10m)
H_2	The height of the measured or calculated HH wind speed.
U_1	The wind speed to be calculated.
U_2	The measured or calculated HH wind speed.
z	The roughness length.

Note: A roughness length of 0.05m is used to standardise hub height wind speeds to 10m height in the IEC 61400-11:2003 standard, regardless of what the actual roughness length seen on a site may have been. This 'normalisation' procedure was adopted for comparability between test results for different turbines.

Any reference to wind speed in this chapter should be understood to be the standardised 10m height wind speed reference unless otherwise stated.

11.3.7 Turbine Noise Calculations

A series of computer-based prediction models have been prepared to quantify the noise level associated with the operation of the proposed development. The noise calculations also consider the potential for cumulative impacts associated with the proposed Ballyhorgan Wind Farm located to the south east of the subject development. This section discusses the methodology for the noise modelling process.

11.3.7.1 Noise Modelling Software

Proprietary noise calculation software was used for the purposes of this impact assessment. The selected software, DGMR iNoise Enterprise, calculates noise levels in accordance with ISO 9613: *Acoustics – Attenuation of sound outdoors, Part 2: General method of calculation*, (ISO, 1996).

iNoise is a proprietary noise calculation package for computing noise levels and propagation of noise sources. *iNoise* calculates noise levels in different ways depending on the selected prediction standard. In general, however, the resultant noise level is calculated considering a range of factors affecting the propagation of sound, including:

- the magnitude of the noise source in terms of A weighted sound power levels (L_{WA});
- the distance between the source and receiver;
- the presence of obstacles such as screens or barriers in the propagation path;
- the presence of reflecting surfaces;
- the hardness of the ground between the source and receiver;
- Attenuation due to atmospheric absorption; and
- Meteorological effects such as wind gradient, temperature gradient and humidity (these have significant impact at distances greater than approximately 400m).

11.3.7.2 Input Data and Assumptions

The calculation settings, input data and any assumptions made in the assessment are described in the following sections. Additional information relating to the noise model inputs and calculation settings is provided in Appendix 11.3.

11.3.7.2.1 *Turbine Details*

Table 11.7 details the co-ordinates of the 7 no. proposed turbines that are being considered in this assessment.

Table 11.7 Proposed Ballynagare Wind Turbine Co-ordinates

Turbine Ref.	Coordinates – Irish Grid (ITM)	
	Easting	Northing
T01	489,117	633,297
T02	489,513	632,947
T03	488,980	632,538
T04	489,598	632,148
T05	488,626	631,954
T06	489,119	631,758
T07	488,706	631,208

For the purposes of this assessment, the turbine type assumed for the development site is the Vestas V150 6MW turbine. The turbine is a pitch regulated upwind turbine with a three-blade rotor and is representative of the type of turbine that would be installed or available on the market.

Calculations have been performed for a turbine hub height of 95m for the proposed development.

While the noise profiles of the Vestas V150-6.0MW[8] wind turbine with serrated trailing edge (STE) blades has been used for the purposes of this assessment, the actual turbine to be installed on the site will be the subject of a competitive tender process and could include turbines not amongst the turbine models currently available. Any references to the Vestas V150-6.0MW turbines in this assessment must be considered in the context of the above and should not be construed as meaning it is the only make or model of wind turbine that could be used for the proposed development.

If alternative turbine technologies are considered for the Proposed Development-an updated noise assessment will be prepared to confirm that the noise emissions will comply with the noise criteria as per best practice guidance outlined in Section 11.4.2 and/or the relevant operational criteria associated with the grant of planning. If necessary, suitable curtailment strategies will be designed and implemented for alternative technologies to ensure compliance with the relevant noise criteria, should detailed assessment conclude that this is necessary.

The sound power levels (L_{WA}) supplied for the turbine under consideration, namely the Vestas V150 6MW turbine and used for the noise modelling, are set out in Table 11.8 below.

For the purposes of all predictions presented in this report to account for various uncertainties in the measurement of turbine source levels, a +2 dB uncertainty factor has been added to the turbine noise emission values in line with guidance for wind turbine noise assessment contained in the IOA GPG unless otherwise stated below.

[8] *Vestas Wind Systems A/S Document Ref – DMS no.: 0095-3747_01 dated 2020-11-03. Third octave noise emission – EnVentus V150-6.0MW. Values for the Power Optimized (PO6000) 6.0MW turbine with Serrated Trailing Edge (STE) blades have been used in this assessment for standard operation mode. The full manufacturer's data is not presented in this chapter for commercial reasons and associated non-disclosure agreements with the manufacturer.*

Table 11.8 L_{wa} Spectra Used for Prediction Model – Ballynagare Turbine Noise Emissions for Hub Height at 95m.

Wind Speed (m/s)	Octave Bank Centre Frequency (Hz)								dB L_{WA}
	63	125	250	500	1000	2000	4000	8000	
3	73.6	81.3	86.1	87.9	86.7	82.5	75.3	65.1	92.7
4	76.6	84.5	89.3	91.2	90.0	85.9	78.7	68.5	96.0
5	80.9	88.7	93.5	95.4	94.3	90.1	83.0	72.8	100.2
6	84.2	92.1	97.0	98.9	97.8	93.7	86.6	76.4	103.7
7	85.1	93.1	98.0	100.0	98.9	94.8	87.7	77.5	104.8
8	85.5	93.3	98.2	100.1	99.0	94.8	87.7	77.6	104.9
≥9	86.3	93.7	98.2	100.0	98.9	94.8	88.0	78.2	104.9

In line with best practice a nearby proposed wind energy development, the Ballyhorgan Wind Farm, has been considered in the noise assessment to determine if any potential cumulative noise impacts may be associated with the concurrent operation of the Ballynagare and Ballyhorgan wind farms.

Table 11.9 details the noise emission values used for noise modelling of the proposed Ballyhorgan turbines[9]. As set out in the EIAR for the Ballyhorgan development the proposed turbine models at this site are Vestas V136 4.2/4.0MW at a hub height of 88.5m.

Table 11.9 L_{wa} Spectra Used for Prediction Model - Ballyhorgan Turbine Noise Emissions for Hub Height at 88.5m.

Wind Speed (m/s)	Octave Bank Centre Frequency (Hz)								dB LWA
	63	125	250	500	1000	2000	4000	8000	
4	71.7	79.6	84.5	86.4	85.3	81.1	74.0	63.8	91.2
5	74.6	82.6	87.4	89.3	88.1	83.9	76.7	66.4	94.1
6	79.3	87.2	92.1	93.9	92.7	88.5	81.3	71.0	98.7
7	83.8	91.5	96.2	98.0	96.9	92.8	85.9	75.8	102.9
≥8	84.9	92.5	97.2	99.0	97.9	93.8	86.9	76.9	103.9

An uncertainty factor of +2.0 dB has been included for the Vestas V136 turbines in the calculations in line with the manufacturer's data.

As outlined, appropriate guidance is couched in terms of a L_{A90} criterion. The provided turbine noise is referenced in terms of the L_{Aeq} parameter. Best practice guidance contained within the IoA GPG states that *"L_{A90} levels should be determined from calculated L_{Aeq} levels by subtraction of 2 dB"*. Therefore, in accordance with best practice guidance, a 2 dB reduction has been applied to the predicted results in this assessment.

[9] *Noise emission values as presented in Ballyhorgan Environmental Impact Assessment Report (EIAR).*

Best practice specifies that a penalty should be added to the predicted noise levels, where any tonal component is present. The level of this penalty is described and is related to the level by which any tonal components exceed audibility. For this assessment, on review of the noise emission data, a tonal penalty has not been included within the predicted noise levels. A warranty will be provided by the manufacturers of the selected turbine to ensure that the noise output will not require a tonal noise correction under best practice guidance.

Appendix 11.3 presents additional details in relation to the turbine noise model inputs and the turbine location coordinates for other turbines.

11.3.7.3 Assessment of Turbine Noise Levels

The predicted cumulative turbine noise level from the proposed development and proposed Ballyhorgan wind farm development will be compared against the derived turbine noise limits for the assessment and any exceedances of the limits will be identified and where necessary, appropriate mitigation measures will be outlined. Considering the distance between the Proposed Development and the Ballyhorgan wind farm the cumulative contributions between both these sites is not considered to be significant. Further discussion is presented in Section 11.5.9.2.

11.3.8 Assessment of Construction Impacts

The potential impacts of the construction phase noise and vibration in addition to the potential impacts from additional vehicular activity on public roads will be assessed in accordance with best practice guidance as outlined in Section 11.3.2.1.

11.4 Receiving Environment

This stage of the assessment was to determine typical background noise levels in the vicinity of the noise sensitive locations (NSLs) in proximity to the proposed development. The methodology for the assessment is outlined in 11.3.6 and the results of the assessment are outlined in the following sections.

A variety of wind speed and weather conditions were encountered over the survey period outlined in Section 11.3.6.2. Figure 11:3 illustrates the distributions of wind speed and wind direction standardised to 10 metre height over the baseline noise survey period detailed in Table 11.5.

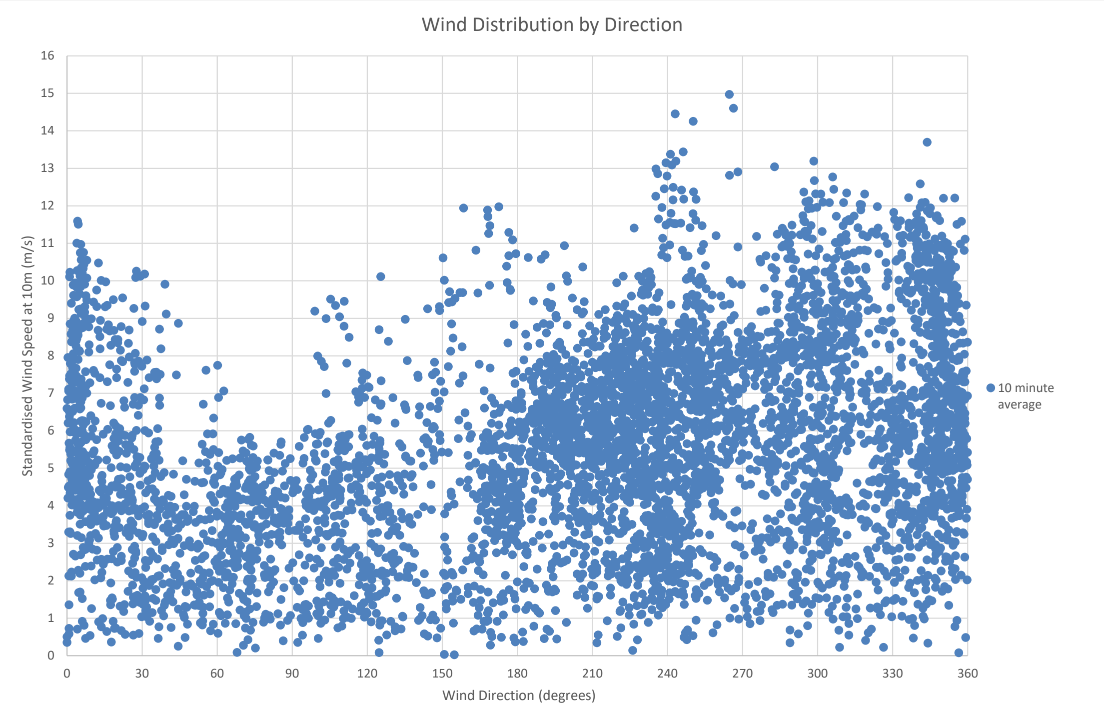


Figure 11:3 Distributions of Wind Speeds and Directions Over the Survey Period

11.4.1 Background Noise Levels

The following sections present an overview and results of the noise monitoring data obtained from the background noise survey in accordance with the methodology set out in Section 11.3.6 and 11.3.6.5. For each location two graphs are presented. One shows the screened noise datasets used to derive the daytime background noise levels and the other shows the night-time datasets.

11.4.1.1 Location A

11.4.1.1.1 Daytime Quiet Periods

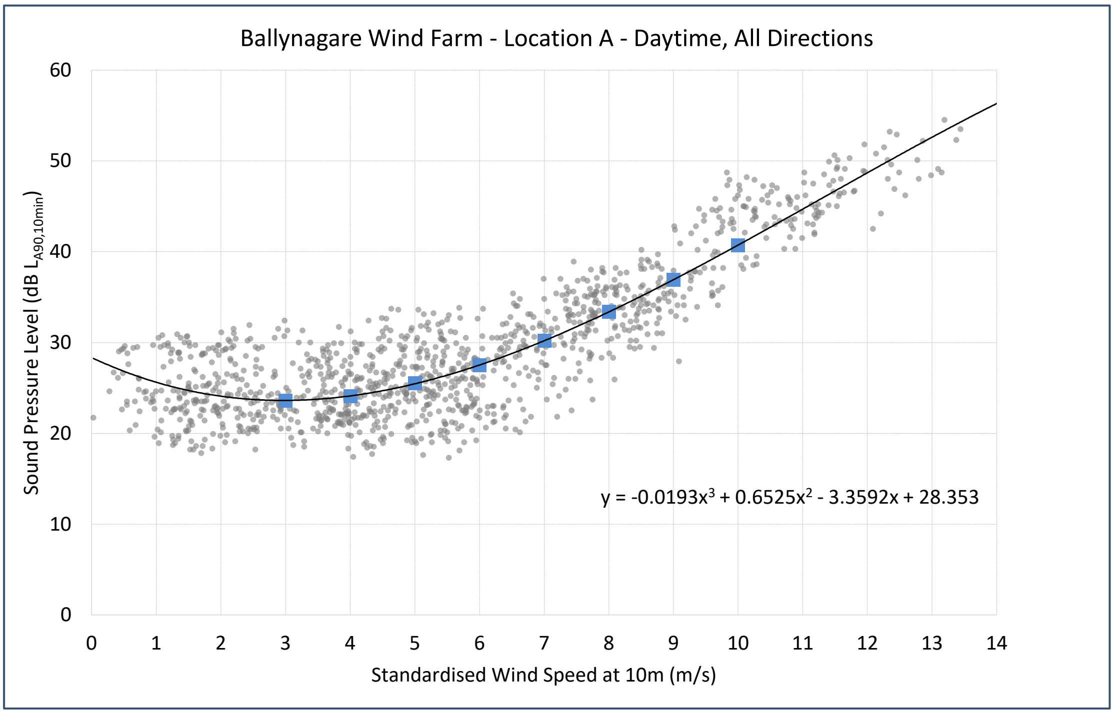


Figure 11:4 Location A - Background Noise Levels dB $L_{A90,\ 10\ min}$– Daytime

11.4.1.1.2 Night-time Quiet Periods

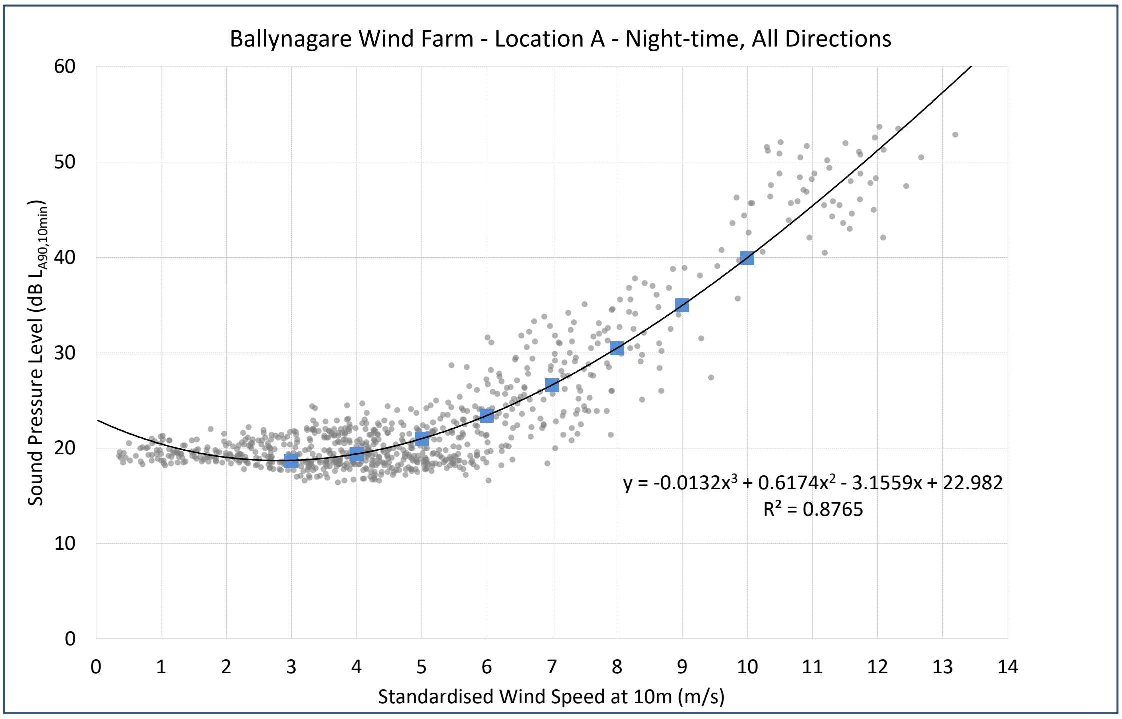


Figure 11:5 Location A - Background Noise Levels dB $L_{A90,\ 10\ min}$–Night -time

11.4.1.2 Location B

11.4.1.2.1 Daytime Quiet Periods

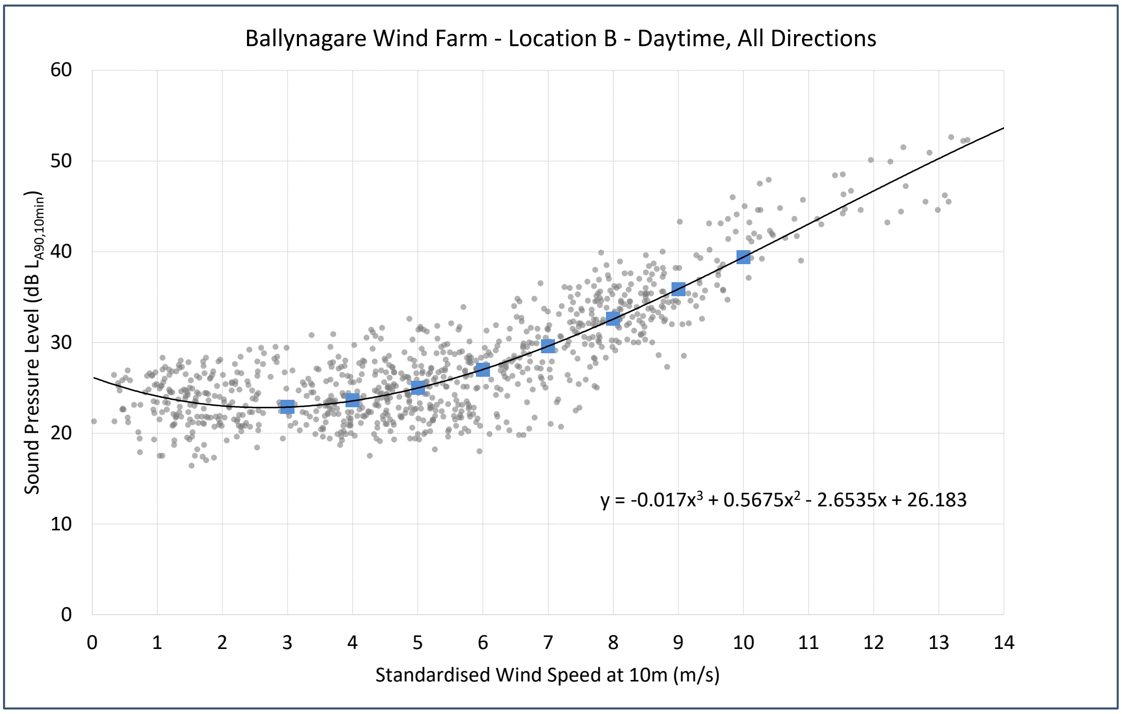


Figure 11:6 Location B - Background Noise Levels dB $L_{A90,\ 10\ min}$–Daytime

11.4.1.2.2 Night-time Quiet Periods

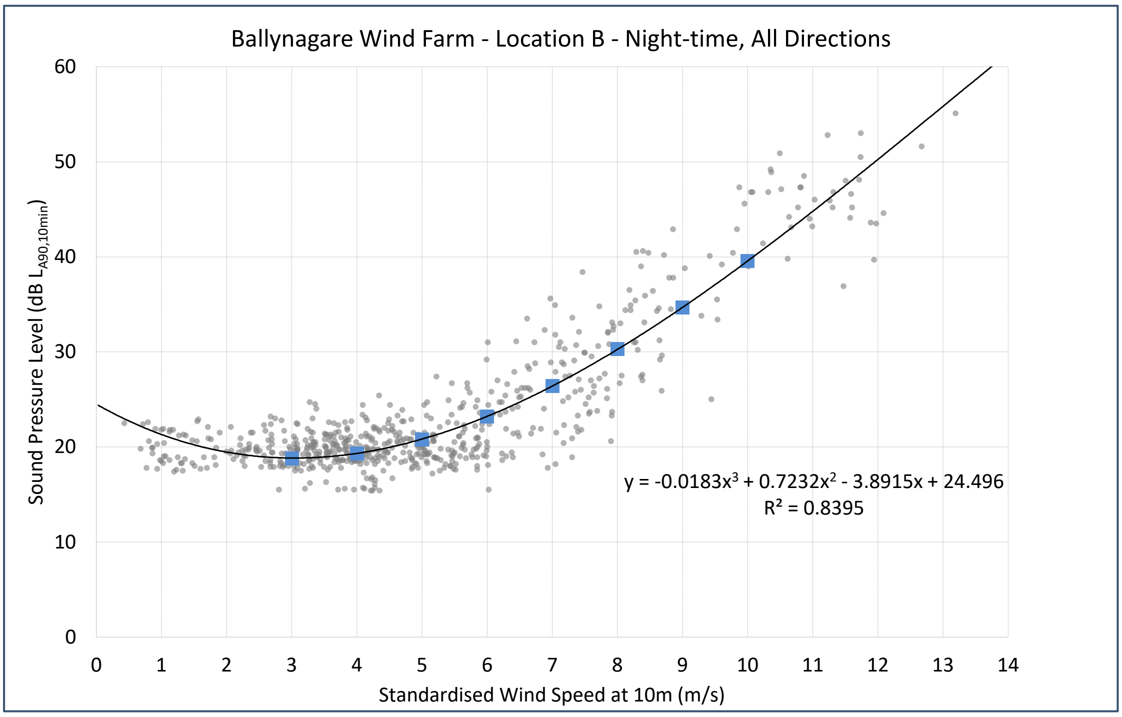


Figure 11:7 Location B - Background Noise Levels dB $L_{A90,\ 10\ min}$–Night -time

11.4.1.3 Location C

11.4.1.3.1 Daytime Quiet Periods

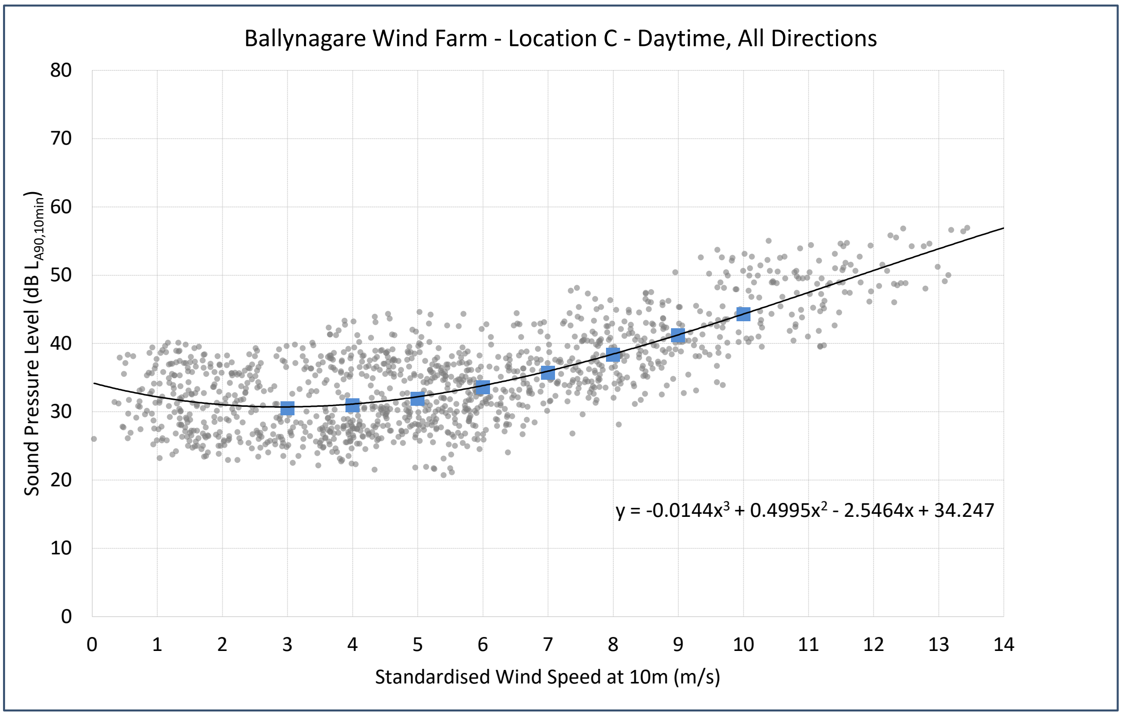


Figure 11:8 Location C - Background Noise Levels dB $L_{A90,\ 10\ min}$–Daytime

11.4.1.3.2 Night-time Quiet Periods

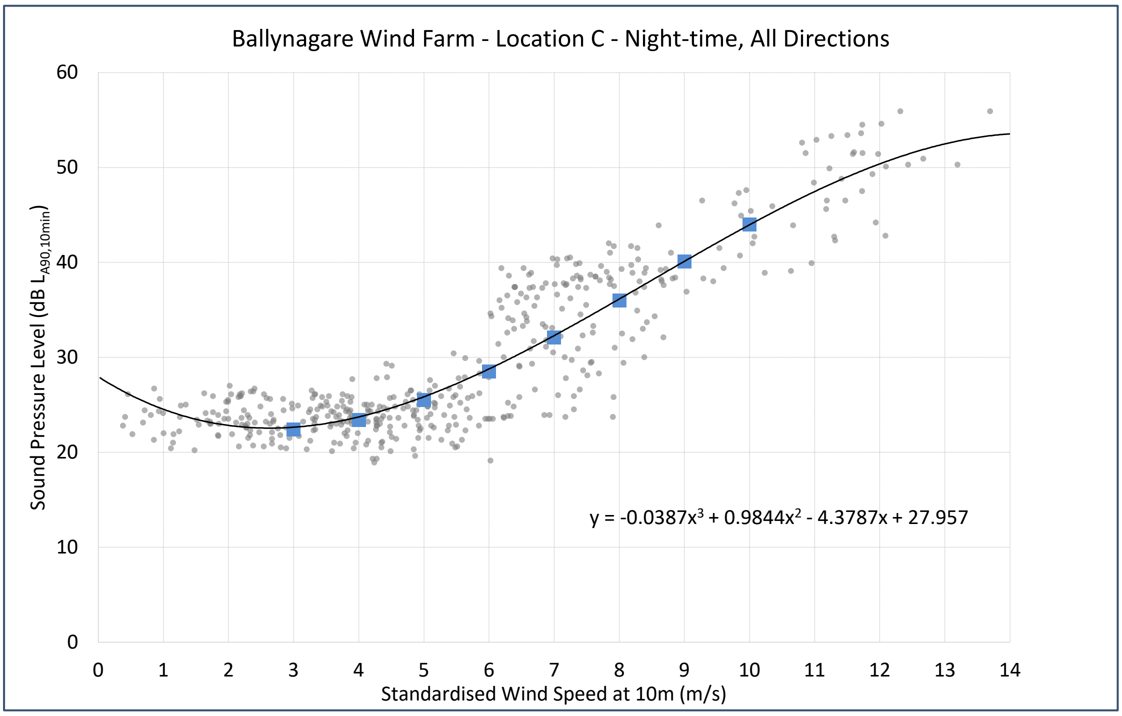


Figure 11:9 Location C - Background Noise Levels dB $L_{A90,\ 10\ min}$– Night -time

11.4.1.4 Location D

11.4.1.4.1 Daytime Quiet Periods

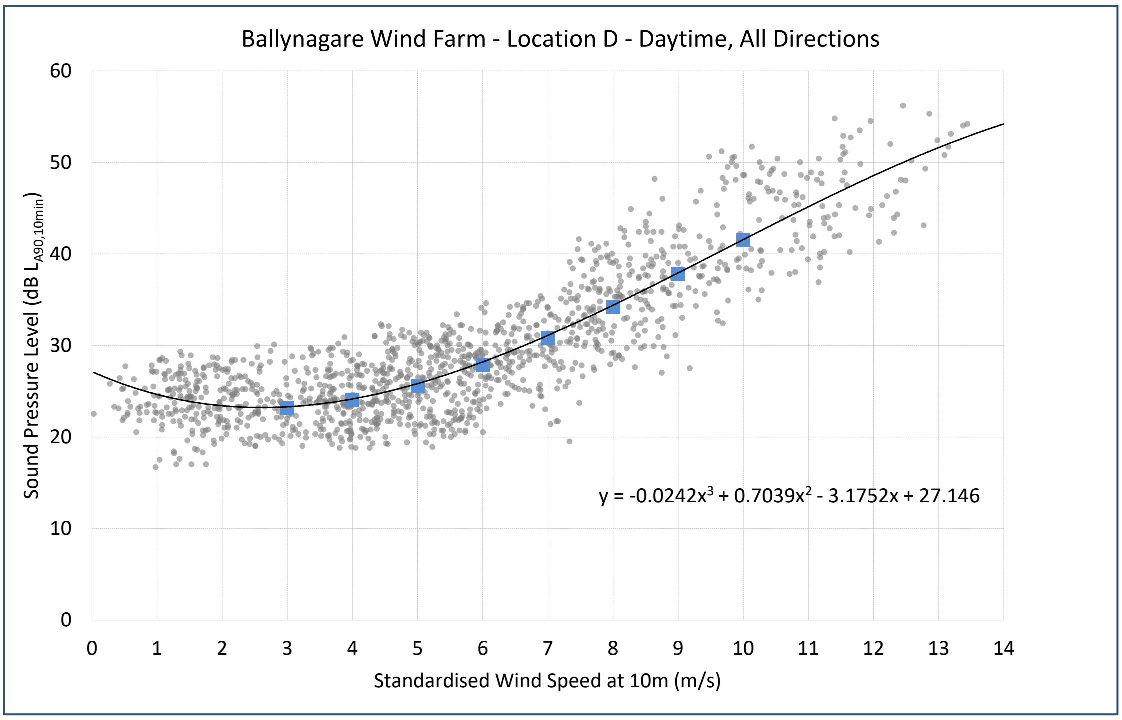


Figure 11:10 Location D - Background Noise Levels dB $L_{A90,\ 10\ min}$– Daytime

11.4.1.4.2 Night-time Quiet Periods

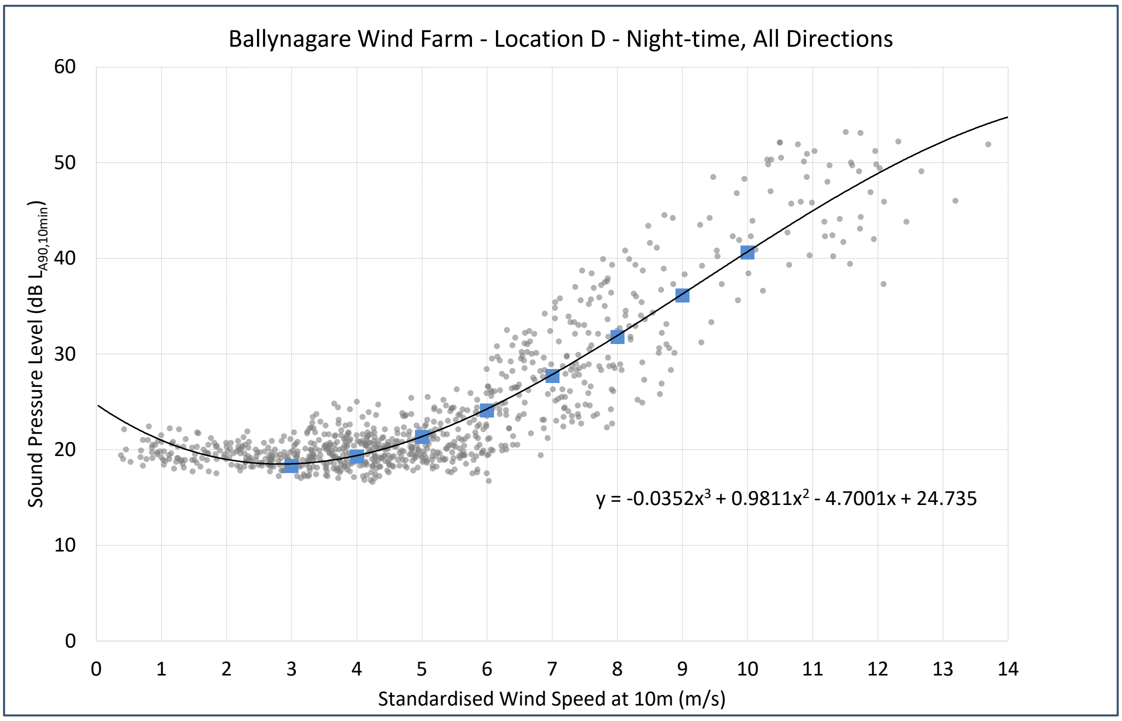


Figure 11:11 Location D - Background Noise Levels dB $L_{A90,\ 10\ min}$– Night -time

11.4.1.5 Location E

11.4.1.5.1 Daytime Quiet Periods

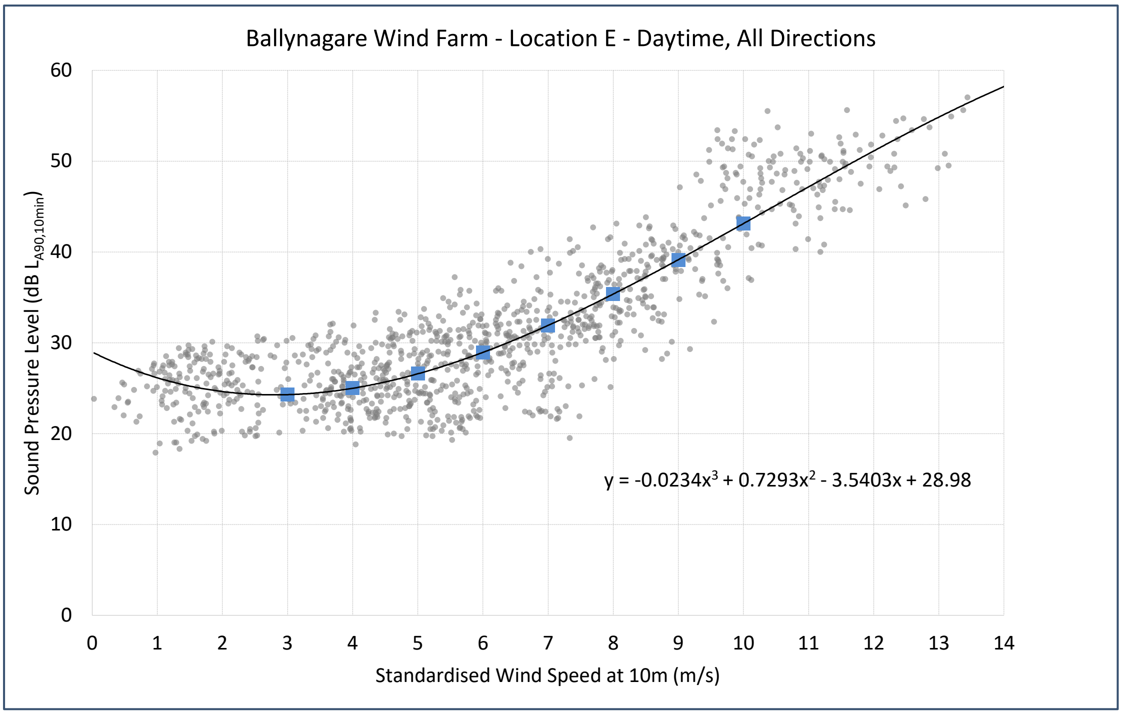


Figure 11:12 Location E - Background Noise Levels dB $L_{A90,\ 10\ min}$– Daytime

11.4.1.5.2 Night-time Quiet Periods

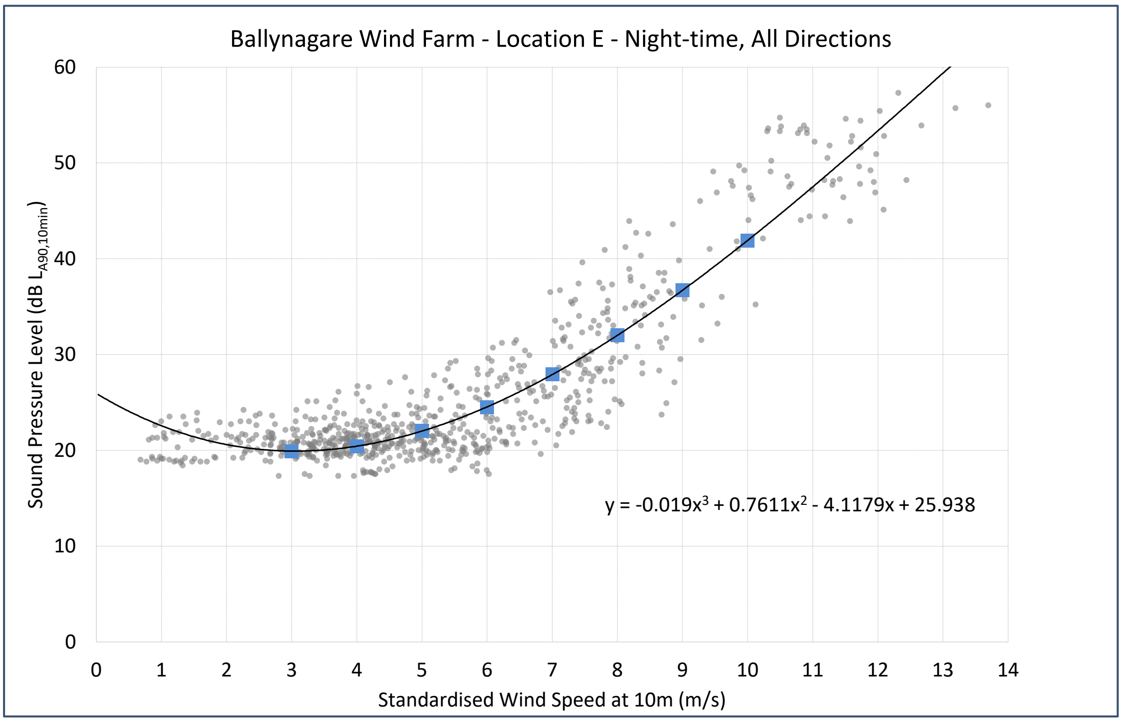


Figure 11:13 Location E - Background Noise Levels dB $L_{A90,\ 10\ min}$– Night -time

11.4.1.6 Summary of Background Noise Levels

Table 11.10Table 11.10 presents the various derived $L_{A90,10min}$ noise levels for each of the monitoring locations for daytime quiet periods and night-time periods, relating to an assessment hub height of 95m. These levels have been derived using regression analysis carried out on the data sets in line with guidance contained the IoA GPG and the *Supplementary Guidance Note (SGN) No. 2 Data Processing & Derivation of ETSU-R-97 Background Curves.*

Table 11.10 Derived Background Noise Levels

Location	Period	Derived $L_{A90, 10\ min}$ Levels (dB) at various Standardised 10m Height Wind Speed (m/s)							
		3	4	5	6	7	8	9	10
A	Day	23.6	24.1	25.5	27.5	30.2	33.4	36.9	40.7
	Night	18.7	19.4	21.0	23.4	26.6	30.5	35.0	40.0
B	Day	22.9	23.6	25.0	27.0	29.6	32.6	35.9	39.4
	Night	18.8	19.3	20.8	23.2	26.4	30.3	34.7	39.6
C	Day	30.5	30.9	31.9	33.6	35.7	38.3	41.2	44.3
	Night	22.4	23.4	25.5	28.5	32.1	36.0	40.1	44.0
D	Day	23.2	24.0	25.6	27.9	30.8	34.2	37.8	41.5
	Night	18.3	19.3	21.3	24.1	27.7	31.8	36.1	40.6
E	Day	24.3	25.0	26.6	28.9	31.9	35.4	39.1	43.1
	Night	19.9	20.4	22.0	24.5	27.9	32.0	36.7	41.9
Envelope	Day	22.9	23.6	25	27	29.6	32.6	35.9	39.4
	Night	18.3	19.3	20.8	23.2	26.4	30.3	34.7	39.6

A worst-case envelope based on the lowest average background noise levels for both day and night-time is presented in Table 11.10.

11.4.2 Wind Turbine Noise Criteria

In accordance with the noise criteria set out in the Wind Energy Development Guidelines outlined in section 11.3.2.2.2, a lower daytime fixed limit of 40 dB $L_{A90,10min}$ has been adopted for low noise environments where the background noise is less than 30 dB(A). The criterion adopted is robust and is an acceptable noise limit in areas of low background noise, this follows a review of the prevailing background noise levels and is deemed appropriate in respect of the following:

- The EPA document *'Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)'* (EPA, 2016) proposes a daytime noise criterion of 45 dB(A) in 'areas of low background noise'. The proposed lower threshold here is 5 dB more stringent than this level.
- A threshold of 40 dB is commonly adopted in planning conditions for similar developments that have been granted planning permission by An Bord Pleanála (ABP) and local planning authorities.

- The 2006 *Wind Energy Development Guidelines* states that "*An appropriate balance must be achieved between power generation and noise impact.*" Adopting a lower fixed limit is likely to have a significant impact on the potential energy yield of the proposed development.

Following comparison of the previously presented guidance the proposed operational limits in $L_{A90,10min}$ for the proposed development are:

- 40 dB $L_{A90,10min}$ for quiet daytime environments of less than 30 dB $L_{A90,10min}$;
- 45 dB $L_{A90,10min}$ for daytime environments greater than or equal to 30 dB $L_{A90,10min}$ or a maximum increase of 5 dB above background noise (whichever is higher), and;
- 43 dB $L_{A90,10min}$ or a maximum increase of 5 dB above background noise (whichever is higher) for night time periods.

With respect to the methodology in relevant guidance documents outlined in Section 0 the noise criteria curves in Table 11.11 have been derived for the NSLs surrounding the proposed development. These limit values are determined through applying the criteria to the derived background noise levels in Table 11.10.

Table 11.11 Noise Criteria Curves

Location	Period	Derived $L_{A90,\ 10\ min}$ Levels (dB) at various Standaridsed10m Height Wind Speed (m/s)							
		3	4	5	6	7	8	9	10
A	Day	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.7
	Night	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.0
B	Day	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0
	Night	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6
C	Day	45.0	45.0	45.0	45.0	45.0	45.0	46.2	49.3
	Night	43.0	43.0	43.0	43.0	43.0	43.0	45.1	49.0
D	Day	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.5
	Night	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.6
E	Day	40.0	40.0	40.0	40.0	45.0	45.0	45.0	48.1
	Night	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.9
Envelope	Day	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0
	Night	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6

11.4.2.1 Assigning Turbine Noise Limits

It is proposed to adopt this envelope to derive turbine noise thresholds for locations where representative background noise levels have not been undertaken. For other NSLs, where background noise measurements have been conducted in the vicinity and are judged to be typical/indicative of the background noise levels of the area at the measurement location, the background noise levels can be used for deriving turbine noise thresholds at other locations.

Table 11.12 confirms where representative background noise levels have been assigned to each of the relevant NSLs for the purpose of setting noise limits for the assessment of turbine noise. These levels have been assigned based on professional judgement in line with best practice guidance of representative background noise levels measured as part of the survey.

Table 11.12 Assignment of Representative Background Noise Levels

Representative Background Noise Levels	Noise Sensitive Location (NSL)
A	H064, H077 H078, H081, H083, H085, H091, H093 – H095, H097, H099 and H128.
B	H004, H006, H008 and H012
C	H001 – H003 and H011
D	H005, H007, H009, H010, H014 – H023, H026, H030, H032, H037, H039, H041, H043, H047 and H053.
E	H024, H025, H027 – H029, H033 – H036, H038, H040, H042, H044 – H046, H049, H051, H054, H058, H063, H066, H108, H114, H119, H123, H125 and H133.
Envelope	All other locations

11.5 Likely Significant Effects and Associated Mitigation Measures

11.5.1 Do-Nothing Scenario

If development were not to proceed then the existing noise environment will remain largely unchanged. In areas where traffic noise is a significant source in the environment, increases in traffic volumes on the local road network would be expected to result in slight increases in overall ambient and background noise in the area over time.

11.5.2 Construction Phase Potential Impacts

A variety of items of plant will be in use for the purposes of site preparation, construction of turbines, roads, substation and other site works. There will be vehicular movements to and from the site that will make use of existing roads. Due to the nature of these activities, there is potential for generation of significant levels of noise. These are discussed in the following Sections.

Due to the nature of the construction activities it is difficult to calculate the actual magnitude of noise emissions to the local environment. However, it is possible to predict typical noise levels at the nearest sensitive receptor using guidance set out in *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise.*

The predicted noise levels referred to in this section are indicative only and are intended to demonstrate that the contractor can comply with current best practice guidance. It should also be noted that the predicted "worst case" levels are expected to occur for only short periods of time at a very limited number of properties. Construction noise levels will be lower than these levels for most of the time at most properties in the vicinity of the proposed development.

There are several stages and elements associated with the construction phase of the proposed development which will include the following:

- Turbines and hardstands;
- Substation and grid connection;
- Borrow pits;
- Site access road; and
- Internal roads.

Detailed information is included in Chapter 4: Description of the Proposed Development.

In general, the distances between the construction activities associated with the proposed development and the nearest NSLs are such that there will be no significant noise and vibration impacts at NSLs. The only exception to this is where grid connection cabling works occur along public roads. The following sections present an assessment of the main stages of the construction phase that have the potential for associated noise and vibration impacts.

11.5.2.1 Turbines, Hardstands, Substation, Grid Connection, and Internal Roads

11.5.2.1.1 *Noise*

Several indicative sources that would be expected on a site of this nature have been identified and predictions of the potential noise emissions calculated at the nearest NSLs. The assessment is considered worst-case, construction noise levels will be lower at properties located further from the works.

Construction noise levels at various set-back distances from areas of construction works have been calculated to assess the impact at NSLs situated at greater distances from the works.

Table 11.13 outlines the noise levels associated with the typical construction noise sources assessed in this instance along with typical sound pressure levels and spectra from BS 5228 – 1: 2009. Calculations have assumed an on-time of 66% for each item of plant i.e. 8-hours over a 12-hour assessment period.

Table 11.13 Typical Construction Noise Emission Levels for Turbine Construction

Item (BS 5228 Ref.)	Activity/ Notes	Plant Noise Level at 10m Distance (dB $L_{Aeq,T}$) [10]	Predicted Noise Level at 600m (dB $L_{Aeq,T}$)	Predicted Noise Level at 700m (dB $L_{Aeq,T}$)	Predicted Noise Level at 800m (dB $L_{Aeq,T}$)
HGV Movement (C.2.30)	Removing soil and transporting fill and other materials.	79	34	32	31
Excavator mounted rock breaker (C.1.9)	Rock breaking	90	45	43	42
Tracked Excavator (C.4.64)	Removing soil and rubble in preparation for foundation.	77	32	30	29
Piling Operations (C.12.14)	Standard pile driving.	88	43	41	40
General Construction (Various)	All general activities plus deliveries of materials and plant.	84	36	34	33
Dewatering Pumps (D.7.70)	If required.	80	35	33	32
JCB (D.8.13)	For services, drainage, and landscaping.	82	37	35	34
Crane (C.4.38)	Erecting Turbines.	78	33	31	30
Vibrating Rollers (D.8.29)	Road surfacing.	77	32	30	29
Total Construction Noise (cumulative for all activities)			**49**	**47**	**45**

Turbine and Hardstands

At the nearest NSL, H001 (677m from T7), the predicted noise levels from turbine construction activities are in the range of 30 to 43 dB $L_{Aeq,T}$ with a total worst-case construction level of the order of 47 dB $L_{Aeq,T}$. The predicted noise levels at all NSLs are below the criteria outlined in Section 11.3.2.1 (Category A - 65 dB $L_{Aeq,T}$ during daytime periods).

There is no item of plant that would be expected to give rise to noise levels that would be considered out of the ordinary or in exceedance of the levels outlined in Section 11.3.2.1 and this assessment took into account all items of plant operating simultaneously.

[10] *All plant noise levels are derived from BS 5228: Part 1*

It is concluded that there will be no likely significant effects as a result of noise impacts associated with the construction of the turbine and hardstands and therefore no specific mitigation measures will be required.

Substation

The nearest NSL to the substation site is at approximately 333m (H050). Based on the same construction activities as outlined in Table 11.13 it is predicted that the likely worst-case potential noise level due to construction activities associated with the substation will be in the order of 52 dB $L_{Aeq,T}$ at the nearest NSL which is well below the significance threshold of 65 dB $L_{Aeq,T.}$ outlined in Section 11.4.1.

It is concluded that there will be no likely significant effects as a result of noise impacts associated with the construction of the Substation and therefore no specific mitigation measures will be required.

Grid Connection Works

The proposed grid connection cable route will commence from the proposed Ballynagare substation and connect to the existing 110kV Clahane switching station. The route will follow the proposed site roads to the proposed site entrance and turn south along a local road to the R557. The grid route travels east along the R557 for 2.7km where it heads south east along the tertiary road for 1.5km. It then travels south for 2km crossing under the Tralee-Tarbert 1 110kV and Tralee-Tarbert 2 110kV lines. It then turns west along the L1027 road for 0.35km where it then continues south for 1.1km. It then joins the L6074 road for 0.4km to Banemore Cross where it joins the N69. It then travels 0.45km south west along the N69 to the entrance of the existing Clahane 110kV substation which is approx. 550m from the N69 road. All works and construction machinery will operate within the curtilage of the public road. The total length of the proposed underground grid connection route is approximately 13.8 kilometres. The proposed grid connection cable will pass through 10 townlands.

The associated construction works will occur for short durations at varying distances from Noise Sensitive Locations (NSLs), at various locations along the route. *Table 11.14* presents outline noise calculations, considering the typical anticipated methods of construction, at varying distances from the construction works. The calculations assume that plant items are operating for 66% of the time and that there is no acoustic screening (i.e. barriers) in place between the site works and the NSL.

Table 11.14 Indicative noise calculations for construction – Grid Connection Route

Plant Item (BS 5228 Ref.)	Calculated Construction Noise Level dB $L_{Aeq,T}$ at distance from works (m)			
	25m	50m	100m	150m
Tracked Excavator (C.2.7)	52	44	37	32
Compressor (C.5.5)	47	40	32	28
Dump Truck (C.2.32)	60	53	45	41
Wheeled Loader (C.28)	62	55	47	43
HGV (C.6.19)	62	55	47	43
Combined L_{Aeq} from all works	**65**	**59**	**51**	**47**

Calculations indicate that the impact noise criteria may be exceeded in the unlikely event where the majority construction activity occurs within approximately 20m of an NSL. It is envisioned that works will be at the closest position to the nearest NSLs for no more than 2 to 3 days before moving on and therefore the impact will not be significant.

Where works are ongoing at 25m from the nearest NSL the predicted noise levels are within the construction noise criteria. Therefore, there will be no likely significant effect.

Internal Roads

It is proposed to construct new and upgrade existing internal roads to access the proposed turbines and associated infrastructure as part of the proposed development. Review of the internal road layout has identified that the nearest NSL is H011 which is located some 74m from the proposed road at the nearest point. All other locations are at greater distances with the majority at significantly greater distances. The full description of the proposed internal roads is outlined in Chapter 4 of the EIAR.

Table 11.15 outlines the typical construction noise levels associated with the proposed works for this element of the construction. Calculations have assumed an on-time of 66% for each item of plant.

Table 11.15 Typical Construction Noise Emission Levels for Roads

Item (BS 5228 Ref.)	Plant Noise Level at 10m Distance (dB $L_{Aeq,T}$) [11]	Highest Predicted Noise Level at Stated Distance from Edge of Works (dB $L_{Aeq,T}$)
		74m
Dump Truck (C.2.30)	79	53
Excavator with Rock Breaker (C9.12)	85	57
Vibrating Rollers (D.8.29)	77	51
Total Construction Noise (cumulative for all activities)		60

At the nearest noise sensitive location, the predicted noise levels from construction activities associated with internal roads are of the order of 60 dB $L_{Aeq,T}$, which is below the significance threshold of 65 dB $L_{Aeq,1hr.}$ outlined in Table 11.1. The calculated noise levels presented are considered to present a worst-case scenario as they are assessed at the closest point along all roads and assume all activities occurring simultaneously.

It is concluded that there will be no likely significant effects as a result of noise impacts associated with the construction of internal roads and therefore no specific mitigation measures will be required.

11.5.2.1.2 Vibration

Due to the distance of the proposed works from sensitive locations significant vibration effects are not expected.

It is concluded that there will be no likely significant effects as a result of vibration impacts associated with the construction phase of the proposed development and therefore no specific mitigation measures will be required.

[11] *All plant noise levels are derived from BS 5228: Part 1*

11.5.2.1.3 *Description of Effects*

With respect to the EPA criteria for description of effects, the potential worst-case associated effects at the nearest noise sensitive locations associated with the construction of Turbines, Hardstands, Substation, Grid Connection, and Internal Roads of the proposed development are described below.

Quality	*Significance*	*Duration*
Negative	Slight	Short-term

It is not expected that there will be any likely significant effects as a result of cumulative impacts at NSLs should the various elements of the construction phase be undertaken simultaneously.

11.5.2.2 Construction Traffic

This section has been prepared in order to review potential noise impacts associated with construction traffic on the local road network. The information presented in Chapter 14 (Section 14.1 Traffic and Transport) has been used to inform the assessment here.

The following situations are commented upon here:

- Stage 1a – Site Preparation – Concrete Pouring
- Stage 1b – Site Preparation and Ground Works
- Stage 2a – Extended Artic Deliveries (large turbine components)
- Stage 2b – Other Deliveries (small turbine components)

Changes in the traffic noise levels associated with the additional traffic for each of the construction stages listed above have been calculated for several routes. Table 11.16 presents a summary of the data used for the calculations in this assessment. The figures in Table 11.16 have been derived from the traffic data in Chapter 14 with corrections applied for the passenger car unit (PCU) factors.

Table 11.16 Construction Traffic Data for Assessment

Route	Stage	Traffic Units	%HGV
N69 south of Mountcoal	Existing	7,605	6.6
	1a	7,885	9.1
	1b	7,685	6.7
	2a	7,651	6.6
	2b	7,651	6.6
N69 north of Mountcoal	Existing	7,297	6.9
	1a	7,577	9.5
	1b	7,377	7.0
	2a	7,343	6.9

Route	Stage	Traffic Units	%HGV
	2b	7,344	6.9
L-6055 west of Mountcoal	Existing	505	5.9
	1a	785	31.2
	1b	585	7.6
	2a	551	6.5
	2b	551	6.6
R557	Existing	2,982	9.8
	1a	3,262	15.5
	1b	3,062	10.0
	2a	3,028	9.8
	2b	3,028	9.9
Local Road	Existing	589	7.6
	1a	869	29.9
	1b	668	8.9
	2a	635	8.0
	2b	635	8.0

Based on the traffic data presented in Table 11.16 the changes in noise level relative to the expected traffic noise from the existing scenario (2020) have been calculated and are outlined in Table 11.17.

Table 11.17 Calculated Changes in Traffic Noise Levels

Stage	Route	Change in Traffic Noise Level dB(A)	Estimated Number of Days
1a – Site Preparation – Concrete Pouring	N69 south of Mountcoal	+0.8	7
	N69 north of Mountcoal	+0.8	7
	L-6055 west of Mountcoal	+6.4	7
	R557	+1.5	7
	Local road	+5.4	7
1b – Site Preparation and Ground Works	N69 south of Mountcoal	+0.1	248
	N69 north of Mountcoal	+0.1	248
	L-6055 west of Mountcoal	+1.4	248
	R557	+0.2	248
	Local road	+1.0	248
2a – Extended Artic Deliveries (large turbine components)	N69 south of Mountcoal	0.0	21
	N69 north of Mountcoal	0.0	21
	L-6055 west of Mountcoal	+0.6	21
	R557	+0.1	21
	Local road	+0.5	21
2b – Other Deliveries (small turbine components)	N69 south of Mountcoal	0.0	7
	N69 north of Mountcoal	0.0	7
	L-6055 west of Mountcoal	+0.7	7
	R557	+0.1	7
	Local road	+0.5	7

With the exception of Stage 1a, the predicted increases in traffic noise levels during each of the construction stages of the proposed development are less than 2 dB along all routes. With reference to the criteria set out in Section 11.3.2.1.2 the potential impacts are minor and are worst case, therefore no additional mitigation measures are proposed.

Predicted increases in noise level associated with traffic during Stage 1a are categorised as moderate to major as per the DMRB. The predicted overall noise levels associated with Stage 1a traffic on the L-6055 west of Mountcoal and the Local Road accessing the development site are 52 dB $L_{Aeq,12hr}$ and 54 dB $L_{Aeq,12hr}$ which is below the construction noise criteria of 65 dB $L_{Aeq,T}$. Further, the estimated duration of Stage 1a is 7 no. days.

It is concluded that there will be no likely significant effects as a result of noise impacts associated with the additional traffic generated during the construction phase of the proposed development and therefore no specific mitigation measures will be required.

11.5.2.2.1 *Description of Effects*

With respect to the EPA criteria for description of effects, the potential worst-case effects at the nearest noise sensitive associated with the additional traffic generated during the construction phase of the proposed development are described below.

Quality	*Significance*	*Duration*
Negative	Slight	Temporary to short-term

11.5.2.3 Borrow Pit

To inform this aspect of the proposal a comparative noise assessment has been prepared and is outlined in the following paragraphs. Two situations have been considered as follows:

- Scenario A Blasting operation
- Scenario B Rock breaking operation

In terms of these activities please note the following:

- A mobile crusher will operate on site for both options.
- In Scenario B two rock breakers will be in use on site during daytime periods.
- For the purposes of this assessment it is assumed the plant is working in the vicinity of the potential borrow pits location indicated in Table 11.18.
- Table 11.19 outlines the assumed noise levels for the plant items as extracted from BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise.
- If the blasting option is undertaken it is estimated that some 8 to 12 blasts will be required over a 6 to 8-week period. It is expected that no more than 1 blast would occur in a single working day.

Table 11.18 Proposed Borrow Pit Location

Co-ordinates	
Easting	Northing
490,466	629,999

Table 11.19 Plant Noise Emission Levels

Item	BS 5228 Ref:	dB L_w Levels per Octave Band (Hz)								dB(A)
		63	125	250	500	1k	2k	4k	8k	
Crusher	Table C1.14	121	114	107	109	103	99	94	87	110

Item	BS 5228 Ref:	dB L_w Levels per Octave Band (Hz)								dB(A)
		63	125	250	500	1k	2k	4k	8k	
Rock breaker	Table C9.11	119	117	113	117	115	115	112	108	121

A construction noise model has been prepared to consider the expected noise emissions from the proposed construction works for the two scenarios outlined above. A percentage on-time of 66% has been assumed for the noise calculations. The predicted levels at the 10 no. closest NSLs are presented in Table 11.20.

Table 11.20 Prediction Noise Levels from Borrow Pit Activity at Nearest NSLs

Borrow Pit			
Loc.	Predicted Construction Noise Level $L_{Aeq,1hr}$		Diff. dB(A)
	Scenario		
	A	B	
H523	45	56	-11
H526	45	56	-11
H169	45	56	-11
H531	45	56	-11
H255	45	55	-10
H533	44	55	-11
H315	44	55	-11
H525	44	54	-10
H286	44	54	-10
H511	44	54	-10

Review of the results contained in Table 11.20 confirms the following:

- Predicted construction noise levels for both Scenario A and B at the borrow pit are well within the relevant construction noise criteria (65 dB $L_{Aeq,T}$). It is assumed that construction works at the borrow pit will only occur during daytime periods only (07:00 to 19:00hrs).
- The blasting proposal results in lower levels of construction noise as the rock breaking plant is not required to operate to the same extent in this scenario. Predicted noise levels are lower at all assessed locations for Scenario A. Predicted levels of 10 to 11 dB(A) lower at the various locations assessed.
- It is accepted that the individual blast events will be audible at certain locations. Blast events will be designed and controlled such that the best practice limits values outlined in the mitigation section of this chapter are not exceeded.

It is concluded that there will be no likely significant effects as a result of noise impacts associated with the borrow pit construction.

11.5.2.3.1 *Description of Effects*

With respect to the EPA criteria for description of effects, the potential worst-case effects at the nearest noise sensitive associated with the Borrow Pits during the construction phase of the proposed development are described below.

Quality	*Significance*	*Duration*
Negative	Not significant	Temporary

11.5.3 Operational Phase Potential Impacts

11.5.3.1 Turbine Noise Assessment

The predicted noise levels for the proposed development have been calculated for all noise sensitive locations identified within the study area. Separately, the potential for cumulative turbine noise impacts has been assessed and the outcome discussed in Section 11.5.9.2.

A worst-case cumulative omni-directional assessment of the Proposed Development has been completed assuming all noise locations are downwind of all turbines at the same time (an impossible scenario) and noise predictions have been made using the ISO 9613-2 standard and relating to worst-case conditions favorable to noise propagation (typically downwind propagation from source to receiver and/or downward refraction under temperature inversions).

The results of the noise modelling have been compared against the turbine noise limits that have been assigned to each of the NSLs in accordance with the criteria set out in Section 0 and the background noise levels at NSLs discussed in Section 11.4.2. The result of this exercise for all NSLs are presented in Appendix 11.4.

At all NSLs, the worst-case omni-directional turbine noise levels are below the criterion curves.

A noise contour for the omni-directional rated power wind speed (i.e. highest noise emission) for the proposed development in isolation is presented in Appendix 11.5.

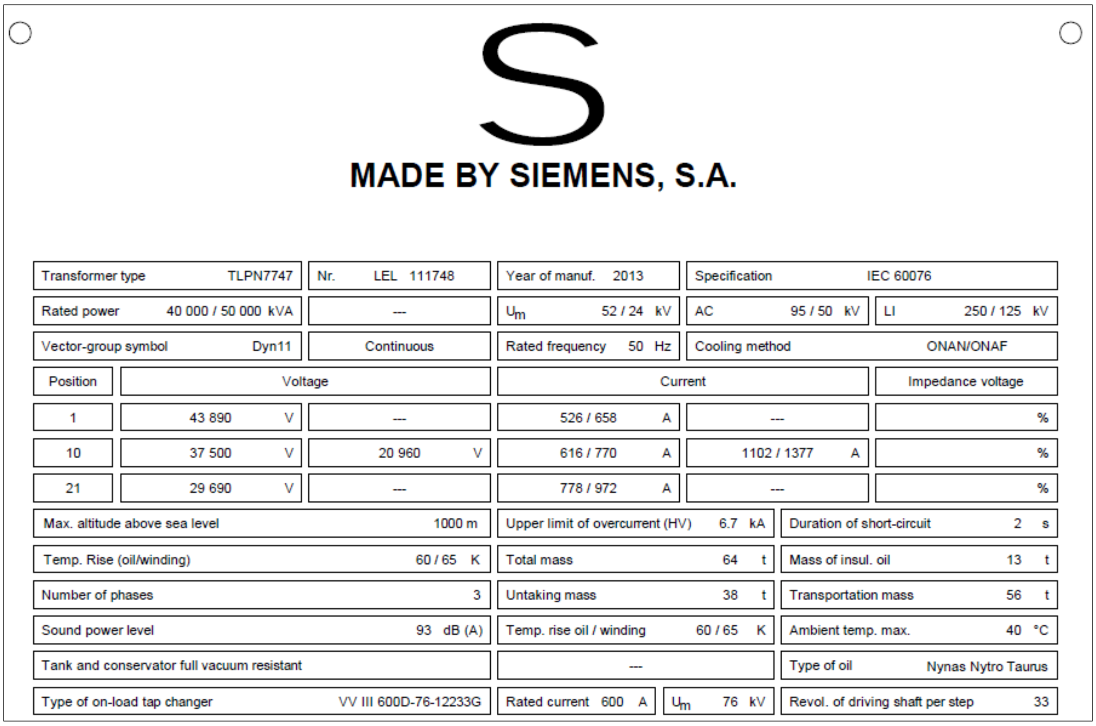
11.5.3.2 Internal Roads

Considering that there is no substantial traffic volumes expected on internal roads, there are no noise and vibration impacts anticipated from internal roads during the operational phase.

11.5.3.3 Substation

As previously stated, the proposed substation location is shown in the site layout drawings in Appendix 4.1 of this EIAR. The substation will be operational 24/7 and the noise impact at the nearest NSL has been assessed to identify the potential greatest impact associated with the operation of the Substation.

The noise emission level associated with a typical substation that would support a development of this nature is the order of 93 dB(A) L_w as shown in Figure 11.14.


S
MADE BY SIEMENS, S.A.

Transformer type TLPN7747		Nr. LEL 111748	Year of manuf. 2013	Specification IEC 60076	
Rated power 40 000 / 50 000 kVA		---	U_m 52 / 24 kV	AC 95 / 50 kV	LI 250 / 125 kV
Vector-group symbol Dyn11		Continuous	Rated frequency 50 Hz	Cooling method ONAN/ONAF	
Position	Voltage		Current		Impedance voltage
1	43 890 V	---	526 / 658 A	---	%
10	37 500 V	20 960 V	616 / 770 A	1102 / 1377 A	%
21	29 690 V	---	778 / 972 A	---	%
Max. altitude above sea level 1000 m			Upper limit of overcurrent (HV) 6.7 kA	Duration of short-circuit 2 s	
Temp. Rise (oil/winding) 60 / 65 K			Total mass 64 t	Mass of insul. oil 13 t	
Number of phases 3			Untaking mass 38 t	Transportation mass 56 t	
Sound power level 93 dB (A)			Temp. rise oil / winding 60 / 65 K	Ambient temp. max. 40 °C	
Tank and conservator full vacuum resistant			---	Type of oil Nynas Nytro Taurus	
Type of on-load tap changer VV III 600D-76-12233G			Rated current 600 A	U_m 76 kV	Revol. of driving shaft per step 33

Figure 11:14 Statement of Lw for Typical Substation Used for Assessment

Noise prediction calculations for the operation of the substation have been undertaken in accordance with *ISO 9613: Acoustics – Attenuation of sound outdoors, Part 2: General method of calculation* (1996), the results at the nearest noise sensitive location are presented in Table 11.21.

Table 11.21 Prediction Noise Levels from Operation of Substation at Nearest NSLs

Location	Height (m)	Predicted Substation Noise Level, $L_{Aeq,T}$ dB
H497	4	26
H502	4	26
H509	4	25
H511	4	25
H409	4	25
H490	4	25
H517	4	25
H525	4	24
H513	4	24
H526	4	24

The worst-case predicted level is 26 dB(A). This level is determined to be not significant in the context of the prevailing noise environment. Noise emissions from the substation once operational should contain no audible tones at nearby NSLs. Therefore, there will be no likely significant effect from the substation during the operational phase.

11.5.3.3.1 *Description of Effects*

With respect to the EPA criteria for description of effects, the potential worst-case effects at the nearest noise sensitive location associated with the operation of the Substation are described below.

Quality	*Significance*	*Duration*
Negative	Imperceptible to not significant	Long-term

11.5.4 Decommissioning Phase Potential Impacts

In relation to the decommissioning phase, similar overall noise levels as those calculated for the construction phase would be expected, as similar tools and equipment will be used.
The noise and vibration impacts associated with any decommissioning of the site are considered to be comparable to those outlined in relation to the construction of the Project (as per Section 11.5.2). There is no item of plant that would be expected to give rise to noise levels that would be considered out of the ordinary or in exceedance of the levels outlined in Section 11.4.1.

11.5.4.1 Description of Effects

With respect to the EPA criteria for description of effects, the anticipated associated effects at the nearest noise sensitive locations associated with the decommissioning phase are described below.

Quality	*Significance*	*Duration*
Negative	Slight	Short-term

It is not expected that there will be any likely significant effects at NSLs should the various elements of the decommissioning phase be undertaken simultaneously.

11.5.5 Construction Phase Mitigation

The assessment of potential impacts has demonstrated that the proposed development is predicted to comply with the identified criteria for the construction phase. However, to minimise potential noise and vibration impacts, a schedule of mitigation measures has been developed and is set out in the following sections.

Regarding construction activities, BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise* and BS 5228-2:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Vibration* have been taken into account.

11.5.5.1 Construction Phase Mitigation Measures – Noise

While it was concluded in Section 11.5.2 that there will be no likely significant effects as a result of noise impacts associated with the construction of the proposed development and that no specific mitigation measures were required, the following best practice mitigation measures from BS5528-1 standard will be implemented for the duration of the construction phase:

- limiting the hours during which site activities likely to create high levels of noise or vibration are permitted;
- establishing channels of communication between the contractor/developer, Local Authority and residents;
- appointing a site representative responsible for matters relating to noise and vibration;
- monitoring typical levels of noise and vibration during critical periods and at sensitive locations;
- keeping site access roads even to mitigate the potential for vibration from lorries.

Furthermore, a variety of practicable noise control measures will be employed. These include:

- selection of plant with low inherent potential for generation of noise and/ or vibration;
- placing of noisy / vibratory plant as far away from sensitive properties as permitted by site constraints, and;
- regular maintenance and servicing of plant items.

The contract documents will clearly specify that the Contractor undertaking the construction of the works will be obliged to take specific noise abatement measures and comply with the recommendations of British Standard BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise.* The following list of measures will be implemented on site, to ensure compliance with the relevant construction noise criteria:

- No plant used on site will be permitted to cause an on-going public nuisance due to noise.
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on-site operations.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract.
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers.
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.
- Any plant, such as generators or pumps, which is required to operate outside of general construction hours will be surrounded by an acoustic enclosure or portable screen.
- During the course of the construction programme, supervision of the works will include ensuring compliance with the limits detailed in Section 11.3.2 using methods outlined in British Standard BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise*.
- The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 7:00hrs and 19:00hrs Monday to Saturday. However, to ensure that optimal use is made of good weather periods or at critical periods within the programme (i.e. concrete pours, rotor/tower deliveries) it will be necessary on occasion to work outside of these hours.

11.5.5.2 Construction Phase Mitigation Measures – Vibration

While it was concluded in Section 11.5.2.1.2 that there will be no likely significant effects as a result of vibration impacts associated with the construction of the proposed development and that no specific mitigation measures were required, it is recommended that vibration from construction activities will be limited to the values set out in Section 11.3.2.1.

It should be noted that these limits are not absolute but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage these limits may need to be reduced by up to 50%.

11.5.6 Operational Phase Mitigation Measures

An assessment of the operational noise levels has been undertaken in accordance with best practice guidelines and procedures as outlined in Section 0 of this Chapter.

The findings of the assessment confirmed that the predicted operational noise levels from the internal site roads, and substation will be within the relevant best practice noise criteria. Therefore, no mitigation measures are required for these elements.

Mitigation measures for the management of turbine related noise are outlined in the following section.

11.5.6.1 Turbine Noise

An assessment of the operation noise levels has been undertaken in accordance with best practice guidelines and procedures. The assessment has identified no potential exceedances of the derived noise criteria, and therefore mitigation is not required.

If alternative turbine technologies are considered for the Proposed Development an updated noise assessment will be prepared to confirm that the noise emissions will comply with the noise criteria as per best practice guidance outlined in Section 11.4.2 and/or the relevant operational criteria associated with the grant of planning. If necessary, suitable curtailment strategies will be designed and implemented for alternative technologies to ensure compliance with the relevant noise criteria curves, should detailed assessment conclude that this is necessary.

Based on review of relevant guidance and best practice it is considered that the following are appropriate noise criteria in relation to the operation of the wind turbines in relation to the proposed development:

- 40 dB $L_{A90,10min}$ for quiet daytime environments of less than 30 dB $L_{A90,10min}$;
- 45 dB $L_{A90,10min}$ for daytime environments greater than or equal to 30 dB $L_{A90,10min}$ or a maximum increase of 5 dB above background noise (whichever is higher), and;
- 43 dB $L_{A90,10min}$ or a maximum increase of 5 dB above background noise (whichever is higher) for night time periods.

11.5.6.2 Low Frequency Noise

In the unlikely event that an issue with low frequency noise is associated with the proposed development, it is recommended that an appropriate detailed investigation be undertaken. Due consideration should be given to guidance on conducting such an investigation which is outlined in Appendix VI of the EPA document entitled *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities* (NG4) (EPA, 2016). This guidance is based on the threshold values outlined in the Salford University document entitled *Procedure for the assessment of low frequency noise complaints*, Revision 1, December 2011.

11.5.6.3 Amplitude Modulation

In the unlikely event that a complaint is received which indicates potential amplitude modulation (AM) associated with turbine operation, the operator shall employ an independent acoustic consultant to assess the level of AM in accordance with the methods outlined in the Institute of Acoustics (IoA) Noise working Group (Wind Turbine Noise) Amplitude Modulation Working Group (AMWG) namely, Institute of Acoustics IOA Noise Working Group (Wind Turbine Noise) Amplitude Modulation

Working Group Final Report: *A Method for Rating Amplitude Modulation in Wind Turbine Noise* (9 August 2016) or subsequent revisions.

The measurement method outlined in the IoA AMWG document, known as the 'Reference Method', will provide a robust and reliable indicator of AM and yield important information on the frequency and duration of occurrence, which can be used to evaluate different operational conditions including mitigation.

It should be noted that amplitude modulation cannot be predicted but will be investigated in the unlikely event that it is identified during the operational phase of the proposed development.

11.5.6.4 Monitoring

Commissioning noise surveys will be undertaken to ensure compliance with any noise conditions applied to the development. In the unlikely instance that an exceedance of these noise criteria is identified, the assessment guidance outlined in the IoA GPG and *Supplementary Guidance Note 5: Post Completion Measurements* (July 2014) should be followed and relevant corrective actions will be taken. For example, implementation of noise operational modes resulting in curtailment of turbine operation can be implemented for specific turbines in specific wind conditions to ensure predicted noise levels are within the relevant noise criterion curves/planning conditions. Such curtailment can be applied using the wind farm SCADA system without undue effect on the wind turbine.

It is recommended that the noise monitoring detailed in Section 11.3.6 be repeated, post-commissioning of the turbines, with consideration of the guidance outlined in the IoA GPG and Supplementary Guidance Note 5.

11.5.7 Decommissioning Phase Mitigation Measures

The mitigation measures that will be considered in relation to any decommissioning of the site are the same as those proposed for the construction phase of the development, i.e. as per Section 11.5.2.

11.5.8 Description of Residual Effects

11.5.8.1 Construction and Decommissioning Phase

During the construction and decommissioning phase of the project there will be some effect on nearby noise sensitive properties due to noise emissions from site traffic and other construction activities. However, given the distances between the main construction works and nearby noise sensitive properties and the fact that the construction phase of the development is temporary in nature, it is expected that the various noise sources will not be excessively intrusive. Furthermore, the application of binding noise limits and hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration effects are kept to a minimum. It is reiterated here that the assessment has concluded that the expected noise and vibration phase levels will be well within the criteria outlined in Section 11.3.2.1 and therefore there are no likely significant effects associated with the construction and decommissioning phases.

With respect to the EPA's criteria for description of effects, in terms of these construction activities, the potential worst-case associated residual effects at the nearest noise sensitive locations associated with the various elements of the construction and decommissioning phases are described below.

11.5.8.2 General Construction – Turbines and Hardstands Substation and Grid Connection

11.5.8.2.1 *Turbines and Hardstands*

The predicted residual noise effect associated with this element of the construction phase is described follows:

Quality	*Significance*	*Duration*
Negative	Slight	Short-term

The above effects should be considered in terms that the effect is variable, and that this assessment considers the locations of the greatest potential impact.

11.5.8.2.2 *Substation*

The predicted residual noise effect associated with this element of the construction phase is described follows:

Quality	*Significance*	*Duration*
Negative	Slight	Short-term

The above effects should be considered in terms that the effect is variable, and that this assessment considers the locations of the greatest potential impact.

11.5.8.2.3 *Grid Connection*

The predicted residual noise effect associated with this element of the construction phase is described follows:

Quality	*Significance*	*Duration*
Negative	Slight to moderate	Short-term

The above effects should be considered in terms that the effect is variable, and that this assessment considers the locations of the greatest potential impact.

11.5.8.3 Internal Roads Construction

The predicted residual noise and vibration effect associated with the proposed internal road construction operations at NSLs is summarised as follows:

Quality	*Significance*	*Duration*
Negative	Moderate	Short-term

The above effects should be considered in terms that the effect is variable, and that this assessment considers one location with the greatest potential impact.

11.5.8.4 Borrow Pits

The predicted residual noise and vibration effect associated with the Borrow Pit construction at NSL's is summarised as follows:

Quality	*Significance*	*Duration*
Negative	Not significant	Temporary

The above effects should be considered in terms that the effect is variable, and that this assessment considers one location with the greatest potential impact.

11.5.8.5 Construction Traffic

The potential worse case residual effect associated with construction traffic with respect to the EPA criteria is described as follows:

Quality	*Significance*	*Duration*
Negative	Slight	Temporary to short-term

The above effects should be considered in terms that the effect is variable, and that this assessment considers the route and stage with the greatest potential impact.

11.5.8.6 Operational Phase

11.5.8.6.1 *Wind Turbine Noise*

The assessment has demonstrated that the turbine noise emissions from the Ballynagare Wind Farm are predicted to be within the best practice noise criteria curves recommended in Irish guidance '*Wind Energy Development Guidelines for Planning Authorities'* published by the Department of the Environment, Heritage and Local Government in 2006. Therefore, it is not considered that a likely significant effect is associated with the development.

While environmental noise levels at low wind speeds will increase due to the proposed development and specifically the operation of the turbines, the predicted levels will remain low, albeit new sources of noise will be introduced into the soundscape.

The predicted residual operational turbine noise effects are summarised as follows at the closest noise sensitive locations to the site:

Quality	*Significance*	*Duration*
Negative	Moderate	Long-tern

The above effect should be considered in terms that the effect is variable, and that this assessment considers periods of the greatest potential effect.

For most of the NSLs assessed the effect of the operational turbines can be described as follows:

Quality	*Significance*	*Duration*

Negative	Slight	Long-tern

11.5.8.6.2 *Substation Noise*

The associated residual effect from the operation of the substation is summarised as follows:

Quality	*Significance*	*Duration*
Negative	Imperceptible to not significant	Long-term

11.5.8.7 Vibration

There are no expected sources of vibration associated with the operational phase of the proposed development. In relation to of vibration the associated residual effect is summarised as follows:

Quality	*Significance*	*Duration*
Neutral	Imperceptible	Long Term

11.5.9 Cumulative Effects

11.5.9.1 Construction Phase

It is not expected there will be any other construction activities that would give rise to significant cumulative impacts during the construction phase. The predicted noise emissions for most elements of the construction works are not of enough magnitude to cause an increase in the cumulative construction noise emissions exceeding the threshold for significant impacts at any NSL.

The predicted noise levels from the construction activity would need to be in excess of 55 dB L_{Aeq} for the potential for a cumulative noise increase that would result in any exceedance of the noise threshold. The only element of the construction phase where there may be potential for cumulative construction noise impacts are grid connection works occurring in proximity to an NSL. In such instance, the contractor will adopt appropriate mitigation measures to minimise any impacts in line with best practice as discussed in Section 11.5.5. It is expected that with appropriate mitigation measures in place cumulative impacts during the construction phase will not be significant.

11.5.9.2 Operational Phase

A review of existing, proposed and permitted wind turbine developments in the wider study has been undertaken in accordance with the guidance contained in the IOA GPG. The operational noise impact assessment has considered the potential cumulative impacts of the Proposed Development in combination with the proposed Ballyhorgan Wind Farm in accordance with best practice guidance discussed in Section 11.3. The assessment has demonstrated that the turbine noise emissions from the Proposed Development in combination with the proposed Ballyhorgan development in the vicinity, will be within the noise criteria outlined in Section 11.3.2. Therefore, potential cumulative noise impacts have been accounted for in the assessment.

12. ARCHAEOLOGY AND CULTURAL HERITAGE

12.1 Introduction

This archaeological, architectural, and cultural heritage chapter was prepared by Tobar Archaeological Services. It presents the results of an archaeological, architectural and cultural heritage impact assessment for a proposed wind farm at Ballynagare, Co. Kerry. The development area predominantly comprises a previously worked raised peat bog and adjacent agricultural farmland.

The purpose of this chapter is to assess the potential direct and indirect effects of the proposed development on the surrounding archaeological, architectural and cultural heritage landscape. The assessment is based on both a desktop review of the available cultural heritage and archaeological data and a comprehensive programme of field walking of the study area. The report amalgamates desk-based research and the results of field walking to identify areas of archaeological/architectural/ cultural significance or potential, likely to be impacted either directly or indirectly by the proposed development. An assessment of potential effects, including cumulative effects, is presented, and a number of mitigation measures are recommended where appropriate. The visual effect of the proposed development on any newly discovered monuments/sites of significance as well as known recorded monuments is also assessed.

12.1.1 Proposed Development

The proposed wind farm development comprises 7 no. turbines and associated hardstands, site access tracks, upgrades to existing roads, 1 no. met mast, 1 no. on-site electrical substation, 1 no. borrow pit, 2 no. temporary construction compounds, 2 no. peat repositories, underground cable works, grid connection cable, and all associated drainage infrastructure. All elements of the proposed development are assessed in this chapter. A full description of the proposed development is provided in Chapter 4 of this EIAR.

12.1.2 Statement of Authority

This chapter of the EIAR has been prepared by Miriam Carroll and Annette Quinn of Tobar Archaeological Services. Miriam and Annette both graduated from University College Cork in 1998 with a Masters degree in Methods and Techniques in Irish Archaeology. Both are licensed by the Department of Housing, Local Government and Heritage to carry out excavations and are members of the Institute of Archaeologists of Ireland. Annette Quinn and Miriam Carroll have been working in the field of archaeology since 1994 and have undertaken numerous projects for both the private and public sectors including excavations, site assessments (EIAR) and surveys. Miriam Carroll and Annette Quinn are directors of Tobar Archaeological Services which has been in operation for 17 years.

12.1.3 Legislation and Guidelines

The chapter has been prepared in compliance with all relevant EIA legislation and guidance (see Chapter 1: Introduction for relevant guidance and legislation).

12.1.3.1 Current Legislation

Archaeological monuments are safeguarded through national and international policy, which is designed to secure the protection of the cultural heritage resource. This is undertaken in accordance with the provisions of the European Convention on the Protection of the Archaeological Heritage (Valletta Convention). This was ratified by Ireland in 1997.

Both the National Monuments Acts 1930 to 2014 and relevant provisions of the Cultural Institutions Act 1997, as amended, are the primary means of ensuring protection of archaeological monuments, the latter of which includes all man-made structures of whatever form or date. There are a number of provisions under the National Monuments Acts which ensure protection of the archaeological resource. These include the Register of Historic Monuments (1997 Act) which means that any interference to a monument is illegal under that Act. All registered monuments are included on the Record of Monuments and Places (RMP).

The Record of Monuments and Places (RMP) was established under Section 12 (1) of the National Monuments (Amendment) Act 1994 and consists of a list of known archaeological monuments and accompanying maps. The Record of Monuments and Places affords some protection to the monuments entered therein. Section 12 (3) of the 1994 Amendment Act states that any person proposing to carry out work at or in relation to a recorded monument must give notice in writing to the Minister (Environment, Heritage and Local Government) and shall not commence the work for a period of two months after having given the notice. All proposed works, therefore, within or around any archaeological monument are subject to statutory protection and legislation (National Monuments Acts 1930-2014).

The term 'national monument' as defined in Section 2 of the National Monuments Act 1930 means a monument *'the preservation of which is a matter of national importance by reason of the historical, architectural, traditional, artistic or archaeological interest attaching thereto…'*. National monuments in State care include those which are in the ownership or guardianship of the Minister for Arts, Heritage and the Gaeltacht. Section 5 of the National Monuments Act (1930) allows owners of other national monuments to appoint the Minister for the Arts, Heritage and the Gaeltacht or the relevant local authority as guardian of such monuments, subject to their consent. This means in effect that while the property of such a monument remains vested in the owner, its maintenance and upkeep are the responsibility of the State. Some monuments are also protected by Preservation Orders and are also regarded as National Monuments. National Monuments also includes (but not so as to limit, extend or otherwise influence the construction of the foregoing general definition) every monument in Saorstát Éireann to which the Ancient Monuments Protection Act, 1882, applied immediately before the passing of this Act, and the said expression shall be construed as including, in addition to the monument itself, the site of the monument and the means of access thereto and also such portion of land adjoining such site as may be required to fence, cover in, or otherwise preserve from injury the monument or to preserve the amenities thereof.

Under the Heritage Act (1995) architectural heritage is defined to include *'all structures, buildings, traditional and designed, and groups of buildings including street-scapes and urban vistas, which are of historical, archaeological, artistic, engineering, scientific, social or technical interest, together with their setting, attendant grounds, fixtures, fittings and contents…'*. A heritage building is also defined to include *'any building, or part thereof, which is of significance because of its intrinsic architectural or artistic quality or its setting or because of its association with the commercial, cultural, economic, industrial, military, political, social or religious history of the place where it is situated or of the country or generally'*.

12.1.3.1.1 Granada Convention

The Council of Europe, in Article 2 of the 1985 Convention for the Protection of the Architectural Heritage of Europe (Granada Convention), states that *'for the purpose of precise identification of the monuments, groups of structures and sites to be protected, each member State will undertake to maintain inventories of that architectural heritage'*. The Granada Convention emphasises the importance of inventories in underpinning conservation policies.

The National Inventory of Architectural Heritage was established in 1990 to fulfill Ireland's obligations under the Granada Convention, through the establishment and maintenance of a central record, documenting and evaluating the architectural heritage of Ireland. Article 1 of the Granada Convention establishes the parameters of this work by defining 'architectural heritage' under three broad categories of Monument, Groups of Buildings, and Sites:

- Monument: all buildings and structures of conspicuous historical, archaeological, artistic, scientific, social or technical interest, including their fixtures and fittings;
- Group of buildings: homogeneous groups of urban or rural buildings conspicuous for their historical, archaeological, artistic, scientific, social or technical interest, which are sufficiently coherent to form topographically definable units;
- Sites: the combined works of man and nature, being areas which are partially built upon and sufficiently distinctive and homogenous to be topographically definable, and are of conspicuous historical, archaeological, artistic, scientific, social or technical interest.

The Council of Europe's definition of architectural heritage allows for the inclusion of structures, groups of structures and sites which are considered to be of significance in their own right, or which are of significance in their local context and environment. The National Inventory of Architectural Heritage believes it is important to consider the architectural heritage as encompassing a wide variety of structures and sites as diverse as post boxes, grand country houses, mill complexes and vernacular farmhouses.

12.1.3.2 Kerry County Development Plan 2015-2021

The Kerry County Development Plan 2015-21 outlines a number of objectives relating to archaeology and built heritage as follows.

12.1.3.2.1 *Archaeological Heritage including Archaeological Landscapes*

It is an objective of the Council to :-

H-25 Protect and preserve the underwater archaeological heritage of the County. In assessing proposals for development, the Council will take account of the rivers, lakes, intertidal and sub-tidal environments.

H-26 Secure the preservation of all sites, features and objects of archaeological interest within the County. In securing such preservation the Council will have regard to the advice and recommendations of the National Monuments Service, Department of Arts Heritage & the Gaeltacht, the National Museum of Ireland and the County Archaeologist.

H-27 Ensure that proposed development (due to location, size or nature) which may have implications for the archaeological heritage of the County are subject to an Archaeological Assessment which may lead to further subsequent archaeological mitigation – buffer zones/exclusion zones, monitoring, pre-development archaeological testing, archaeological excavation and/or refusal of planning. This includes areas close to archaeological monuments, extensive in area (half hectare or more) or length (1km or more) and development that requires an Environmental Impact Statement.

H-28 Ensure the protection and preservation of archaeological monuments and features, as yet not listed in the Record of Monuments & Places (RMP), Sites & Monuments Record (SMR) and as yet unrecorded, through ongoing review of the archaeological potential of the Plan area. In securing such protection the Council will have regard to the advice and recommendations of The National Monuments Service, Department of Arts, Heritage & the Gaeltacht and the County Archaeologist.

H-29 Ensure that development (including forestry, renewable energy developments and extractive industries) within the vicinity of a recorded monument, zone of archaeological potential or archaeological landscape does not detract from the setting of the feature and is sited and designed appropriately and sympathetically with the character of the monument/feature/landscape and its setting.

H-30 Ensure the active protection of the 18 identified, significant archaeological landscapes outlined in Volume 2 with particular emphasis on the landscape settings, views of and from the landscapes and monument/feature intervisibility within these landscapes.

H-31 Protect archaeological/historical graveyards within the County and to encourage and promote their maintenance in accordance with legislation, conservation principles and best practice.

H-32 Protect and preserve the industrial archaeological heritage of the County as reflected in such sites as mills, lighthouses, harbours, Valentia cable station etc. Proposals for refurbishment works or redevelopment of these sites should be subject to a full architectural and archaeological assessment.

H-33 Promote public awareness and facilitate appropriate advisory guidance in relation to the protection of the archaeological heritage of the County.

12.1.3.2.2 Architectural Heritage

H-34 Protect the architectural heritage and promote conservation-led regeneration and re-use of buildings, where appropriate.

H-35 Promote and improve the understanding of the architectural heritage of Co. Kerry.

H-36 Facilitate and exercise appropriate advisory guidance in relation to maintenance and development of the architectural heritage.

H-37 Encourage the retention of original building fabric such as cut stone, thatch, timber sash windows, timber doors, lime mortar, natural slate, render and joinery detailing.

H-38 Ensure that any development, modification, alteration, or extension affecting a protected structure and/or its setting:-

- Is appropriate in terms of the proposed materials, scale, density and layout,
- Addresses the issue of reversibility,
- Respects the original design plan and form,
- Demonstrates an understanding of the historical importance of the building and its setting and does not detract from the special character / interest of the protected structure,
- Deal sensitively with historically important features and fittings,
- Takes account of any protected species that may utilise the structure and accordingly mitigate any impacts on the species.

H-39 Ensure that the special interest of protected structure is not gradually eroded by minor alterations.

H-40 Ensure that measures to upgrade the energy efficiency of protected structures and historic buildings do not damage the historic fabric.

H-41 Encourage owners or prospective owners of protected structures to seek Section 57 Declarations in order to provide certainty about the type of works that may be undertaken without planning permission.

H-42 Promote the positive enhancement of existing ACAs and review the possibility of designating additional ACAs as is deemed appropriate. ACA designation helps to protect existing street layouts, historic building lines and traditional plot widths.

H-43 Ensure that any new development or alteration to a building within or adjoining an Architectural Conservation Area positively enhances the character of the area and is appropriate in terms of the proposed materials, scale, density and layout, proportions, plot ratio and building lines.

H-44 Ensure a balanced approach to maintenance and development of the architectural heritage, having regard to both the qualities of the given architectural context and the modern requirements to safety, comfort and usage, thus facilitating continuity of use of the architectural heritage in a sustainable manner.

H-45 Encourage the protection, appreciation, retention and appropriate renovation of vernacular buildings throughout the County.

H-46 Facilitate the compilation of a comprehensive survey over the term of the plan of vernacular architecture in the south and west of the County to ensure that these buildings are identified and adequately protected in the record of protected structures.

H-47 Review the Record of Protected Structures including taking into consideration ministerial recommendations arising from the National Inventory of Architectural Heritage and add structures of special interest as appropriate, including industrial, maritime or vernacular heritage.

H-48 Implement statutory protection against unauthorized works, demolition, deterioration, dereliction or any alteration which would affect the character or special interest of a protected structure.

H-49 Support the designation of Listowel as a Historic Town.

The Kerry County Development Plan 2015-2021 also includes the Record of Protected Structures (RPS) for the county.

12.1.3.3 Statutory Consultations

The Development Applications Unit provided a response, to a scoping consultation by MKO, on Archaeology (Ref G Pre00255/2020). The observations were as follows:

'***Archaeology***

All proposed development and strategies should be in compliance with the National Monuments Acts 1930 to 2004 and with the national policy on protection of archaeological heritage – 'Framework and Principles for the Protection of the Archaeological Heritage' published in 1999.

General Guidance:

1. All areas of archaeological heritage should be addressed, including;

a) Immovable cultural heritage e.g. monuments and ancient field boundaries.

b) Underwater cultural heritage.

c) Movable cultural heritage e.g. loose carved stones, sculptures, architectural fragments etc.

2. All impacts which may impinge on the archaeological heritage should be assessed by a suitably qualified archaeologist.

3. Where appropriate, specialists in the field of archaeological heritage should be consulted throughout the process, from design through to implementation.

4. All surveys pertaining to archaeological heritage must be of a high standard in order to allow informed decisions to be taken.

5. All impacts must be assessed, to include ground disturbance, impacts on the setting of the monuments and visual impacts. These should include direct, indirect, temporary and cumulative impacts.

6. Mitigation of impacts, identified through consultation, should be taken into account within the development at the earliest possible stages. Various approaches should be considered, such as avoidance, design modification and relocation where appropriate.

7. Where there are no archaeological monuments present but the development is large in scale, e.g., over 0.5 hectares in area and over 1 kilometre in length, it is recommended that an archaeological assessment should be undertaken, unless there are substantial grounds to show that it is not necessary. Refer to Framework and Principles for the Protection of the Archaeological Heritage 1999, in particular section 3.6.6 in regard to Environmental Impact Assessment (EIA).'

The issues raised in the consultation response were considered and are address through the assessment process as outlined in this chapter.

12.1.4 Location and Topography

The proposed development is located in North County Kerry, c. 9km west of Listowel, c. 14km north-east of Tralee and a short distance north of the village of Lixnaw. It is situated in flat, primarily bogland immediately west of the confluence of the Cashen River and the River Feale. Land use comprises a mix of previously worked bog on the fringes of which is agricultural land. It is situated in the townlands of Ballynagare, Dysert Marshes, Dysert, Curraghcroneen, and Farrandeen. The site is accessed via a local road which extends through the proposed development area and a series of existing tracks located within the bog.

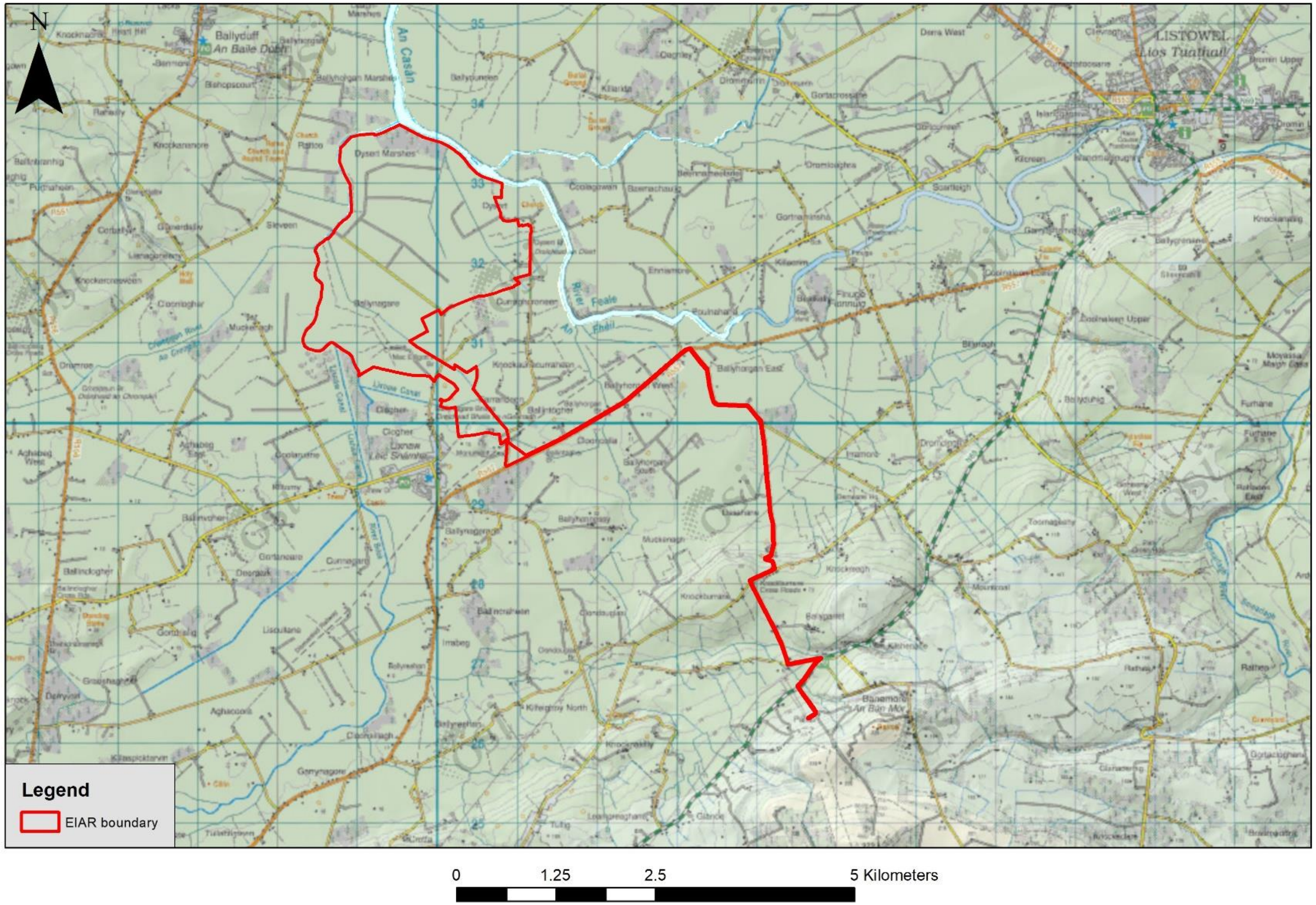


Figure 12.1: Site location map.

12.2 Assessment Methodology

The assessment of the archaeology, architecture and cultural heritage of the proposed development area included GIS mapping and desk-based research followed by field inspection. A desk-based study of the proposed development site was initially undertaken in order to assess the archaeological, architectural and cultural heritage potential of the area and to identify constraints or features of archaeological/cultural heritage significance within or near to the proposed development site.

12.2.1 Geographical Information Systems

GIS is a computer database which captures, stores, analyses, manages and presents data that is linked to location. GIS is geographic information systems which includes mapping software and its application with remote sensing, land surveying, aerial photography, mathematics, photogrammetry, geography and tools that can be implemented with GIS software. A geographic information system (GIS) was used to manage the datasets relevant to the archaeological and architectural heritage assessment and for the creation of all the maps in this section of the report. This involved the overlaying of the relevant archaeological and architectural datasets on georeferenced aerial photographs and road maps (ESRI), where available. The integration of this spatial information allows for the accurate measurement of distances of a proposed development from archaeological and cultural heritage sites and the extraction of information on 'monument types' from the datasets. Areas of archaeological or architectural sensitivity may then be highlighted in order to mitigate the potential negative effects of a development on archaeological, architectural and cultural heritage.

ArcGIS online viewshed analysis was also used to assess effects on setting of archaeological and architectural heritage monuments. The Viewshed tool uses the ESRI Elevation Analysis service to determine which areas are visible from specified observer points (the observer points being the monuments). Visibility settings are used to set the height of the observer (1.75m standard), the height, for example of the observed features (e.g. turbines), and the maximum viewing distance of the observer. This tool was utilised to ascertain the potential/theoretical visual effects on Cultural Heritage Assets. The results show the worst-case scenario since the model does not take trees or vegetation into consideration. The results are outlined in Section 12.3.1.2.

12.2.2 Desktop Assessment

The following sources were consulted as part of the desktop assessment for the proposed development:

- The Record of Monuments and Places (RMP)
- The Sites and Monuments Record (SMR)
- National Monuments in State Care County Kerry
- The Topographical Files of the National Museum of Ireland
- First edition Ordnance Survey maps (OSI)
- Second edition Ordnance Survey maps (OSI)
- Third edition Ordnance Survey Map (Record of Monuments and Places)
- Down Survey maps (www.downsurvey.tcd.ie)
- Aerial photographs (copyright of Ordnance Survey Ireland (OSI))
- Excavations Database
- National Inventory of Architectural Heritage (NIAH)
- Record of Protected Structures
- North Kerry Archaeological Survey

Each of these are discussed in the following sections.

12.2.2.1 Record of Monuments and Places, Sites and Monuments Record and National Monuments

A primary cartographic source and base-line data for the assessment was the consultation of the Sites and Monuments Record (SMR) and Record of Monuments and Places (RMP) for County Kerry. All known recorded archaeological monuments are indicated on 6-inch Ordnance Survey (OS) maps and are listed in these records. The SMR/RMP is not a complete record of all monuments as newly discovered sites may not appear in the list or accompanying maps. In conjunction with the consultation of the SMR and RMP the electronic database of recorded monuments and SMRs which may be accessed at Historic Environment Viewer (archaeology.ie).

A review of all National Monuments in State Care and those subject to Preservation Orders was undertaken as part of the assessment in order to ascertain any potential impacts on their setting as a result of the proposed development.

12.2.2.2 Cartographic Sources and Aerial Photography

The 1st (1840s) and 2nd (1900s) edition OS maps for the area were consulted, where available, as was OSI aerial photography.

12.2.2.3 Topographical Files - National Museum of Ireland

Details relating to finds of archaeological material and monuments in numerous townlands in the country are contained in the topographical files held in the National Museum of Ireland. In order to establish if any new or previously unrecorded finds had been recovered from the study area these files were consulted for every townland within and adjacent to the same. The bogs database, also held in the National Museum of Ireland was also consulted for finds or items recovered from the proposed development site.

12.2.2.4 Archaeological Inventory Series

Further information on archaeological sites may be obtained in the published County Archaeological Inventory series prepared by the Department of Housing, Local Government and Heritage. The archaeological inventories present summarised information on sites listed in the SMR/RMP and include detail such as the size and location of particular monuments as well as any associated folklore or local information pertaining to each site. The inventories, however, do not account for all sites or items of cultural heritage interest which are undiscovered at the time of their publication. Many sites have been discovered since the publication of the Inventory Series which have now been added to the Sites and Monuments Record.

12.2.2.5 Record of Protected Structures

The Record of Protected Structures for County Kerry was consulted for the schedule of buildings and items of cultural, historical or archaeological interest which may be affected by the Proposed Development. The development plan also outlines policies and objectives relating to the protection of the archaeological, historical and architectural heritage landscape of the County. The digital dataset for Protected Structures was added to the project GIS mapping (Section 12.2.1 above) used for the creation of figures in this chapter.

12.2.2.6 Excavations Database

The Excavations Database is an annual account of all excavations carried out under license. The database is available on line at www.excavations.ie and includes excavations from 1985 to 2020. This database was consulted as part of the desktop research for this assessment to establish if any archaeological excavations had been carried out within or near to the proposed development area.

12.2.2.7 National Inventory of Architectural Heritage (NIAH)

This source lists some of the architecturally significant buildings and items of cultural heritage and is compiled on a county by county basis by the Department of Housing, Local Government and Heritage. The NIAH database was consulted for all townlands within and adjacent to the study area. The NIAH survey for Kerry has been published and was downloaded on to the base mapping for the proposed development (www.buildingsofireland.ie). The National Inventory of Architectural Heritage (NIAH) is a state initiative under the administration of the Department of Housing, Local Government and Heritage and established on a statutory basis under the provisions of the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act 1999.

The purpose of the NIAH is to identify, record, and evaluate the post-1700 architectural heritage of Ireland, uniformly and consistently as an aid in the protection and conservation of the built heritage. NIAH surveys provide the basis for the recommendations of the Minister for Housing, Local Government and Heritage to the planning authorities for the inclusion of particular structures in their Record of Protected Structures (RPS). The published surveys are a source of information on the selected structures for relevant planning authorities. They are also a research and educational resource. It is hoped that the work of the NIAH will increase public awareness and appreciation of Ireland's architectural heritage.

12.2.3 Field Inspection

A programme of field inspection of the proposed development area was undertaken over two days in March 2021. The inspection was undertaken by Miriam Carroll and Annette Quinn and consisted of a walk-over examination of the proposed development site, an assessment of any recorded monuments, architectural, built or cultural heritage items within the site and the potential direct and indirect impacts on those monuments. Any newly discovered archaeological monuments, items of built heritage or cultural heritage value within the study area were also recorded during the field inspection. A full photographic record of the site was made and is attached in Appendix 12.1.

12.2.3.1 Limitations Associated with Fieldwork

Where dense vegetation was present within the bog, this limited the ability to inspect the field surface for any potential features that may exist therein. Vegetation cover also limited the visibility of recorded monument KE009-088 Road – unclassified togher which extends through the northern portion of the proposed development area.

12.2.4 Assessment of Likely Significant Effects

The likely effects on the existing archaeological, architectural and cultural heritage environment are assessed using the criteria as set out in the draft *Guidelines on the Information to be contained in Environmental Impact Assessment Reports* (EPA, 2017) and as outlined in Chapter 1. The following terminology is used when describing the likely effects of the proposed development from a Cultural Heritage perspective.

12.2.4.1 Types of Impact

- Direct impacts arise where an archaeological heritage feature or site is physically located within the footprint of the development whereby the removal of part, or all of the feature or site is thus required.

- Indirect impacts may arise as a result of subsurface works undertaken outside the footprint of the development, secondary environmental change such as a reduction in water levels and visual impacts.
- Cumulative Impacts arise when the addition of many impacts create a larger, more significant impact.
- Residual Impacts are the degree of environmental changes that will occur after the proposed mitigation measures have been implemented.

12.2.4.1.1 *Magnitude of Effects (Significance)*

- Profound: Applies where mitigation would be unlikely to remove adverse effects. Reserved for adverse, negative effects only. These effects arise where an archaeological site is completely and irreversibly destroyed.

- Very Significant: An effect which by its character, magnitude, duration or intensity significantly alters most of the sensitive aspect of the environment.

- Significant: An effect which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment. An effect like this would be where part of a site would be permanently impacted upon, leading to a loss of character, integrity and data about an archaeological site.

- Moderate: A moderate effect arises where a change to an archaeological site is proposed which, though noticeable, is not such that the integrity of the site is compromised and which is reversible. This arises where an archaeological site can be incorporated into a modern day development without damage and that all procedures used to facilitate this are reversible.

- Slight: An effect which causes changes in the character of the environment which are not high or very high and do not directly impact or affect an archaeological site.

- Not Significant: An effect which causes noticeable changes in the character of the environment but without significant consequences.

- Imperceptible: An effect on an archaeological site capable of measurement but without noticeable consequences.

12.2.5 Methodology for the assessment of impacts on visual setting (indirect effects)

A standardised approach was utilised for the assessment of impacts of visual setting (indirect effects) according to types of monuments and cultural heritage assets which may have varying degrees of sensitivity. This assessment does not include visits to each and every site as this is considered to be beyond the scope of the EIAR as they are mainly located on private lands. The assessment of impacts on visual setting was undertaken using both the Zone of Theoretical Visibility (ZTV) map in the Landscape and Visual Impact Assessment (LVIA), as presented in Chapter 13 of this EIAR, and also viewshed analysis from specific cultural heritage assets (viewshed analysis is described in Section 12.2.1 above). The viewshed analysis used in the assessment of potential impacts on the visual setting of cultural heritage assets in the wider landscape of 10km and 20km considers the effects of the proposed turbines only. Other lower visibility infrastructure such as roads, grid connection, sub-station etc. are not included in the viewshed analysis. All other infrastructure (proposed roads, grid connection, sub-station, compounds etc) are assessed without the use of viewshed analysis.

While direct physical impacts to a site or monument can easily be assessed in quantitative terms, the assessment of impacts on setting can be subjective and as such is a matter of qualitative, professional judgement and experience. The distances below used in the assessment of impacts on setting are regarded as appropriate and are based on professional judgement.

Table 12.1: Cultural Heritage Assets considered according to sensitivity

Cultural Heritage Asset	Distance Considered
UNESCO World Heritage Sites (including tentative sites)	20km
National Monuments (State Ownership and Preservation Order Sites)	10km
Recorded Monuments, RPS	5km
NIAH structures	5km
Undesignated sites, if relevant	500m from proposed development

12.3 Existing Environment – Wind Farm

12.3.1 Archaeological Heritage

Archaeological Heritage includes World Heritage Sites, National Monuments, sites which are subject to a preservation order, sites listed in the RMP/SMR and newly discovered archaeological sites. Each of these are addressed in the following sections.

12.3.1.1 UNESCO World Heritage Sites (and those on tentative List)

No world heritage sites or those on a tentative list are located within 20km of the proposed windfarm site.

12.3.1.2 National Monuments

National Monuments are those recorded monuments which are in the ownership / guardianship of the Minister for Culture, Heritage and the Gaeltacht (DCHG). They are frequently referred to as being in 'State Care'. An assessment of all National Monuments in State Care within 10km of the proposed turbines was undertaken to ascertain any potential impacts on their visual setting (See Section 12.2.5 for methodology of assessment). No National Monuments are located within the proposed development site, however, the early medieval ecclesiastical site at Rattoo is situated 1.1km from the nearest proposed turbine, T1. National Monuments and those subject to Preservation Orders located within 10km of the proposed turbines are listed in Table 12.2 and shown on Figure 12.2.

Table 12.2: National Monuments and those subject to Preservation Orders within 10km of nearest proposed turbine

NM /PON o.	ITM E	ITM N	NAME/TYPE	SMR	TOWNLAND	WTG ID	DISTANCE (M)
1/2008 TPO	482097	636096	Ringfort - rath	KE009-029—	COM DHÍNEOL THEAS	T1	7607
Mar-08	482098	636090	Souterrain	KE009-029001-	COM DHÍNEOL THEAS	T1	7604
303	484375	627077	Tonaknock (Kilahan) Cross	KE015-108002-	Tonaknock	T7	5985
260	498914	633592	Listowel Castle	KE010-059—	Listowel	T2	9423
55	488082	633678	Rattoo Early Medieval Ecclesiastical Site	KE009-056003-, KE009-056004-, KE009-056001-	Rattoo	T1	1153

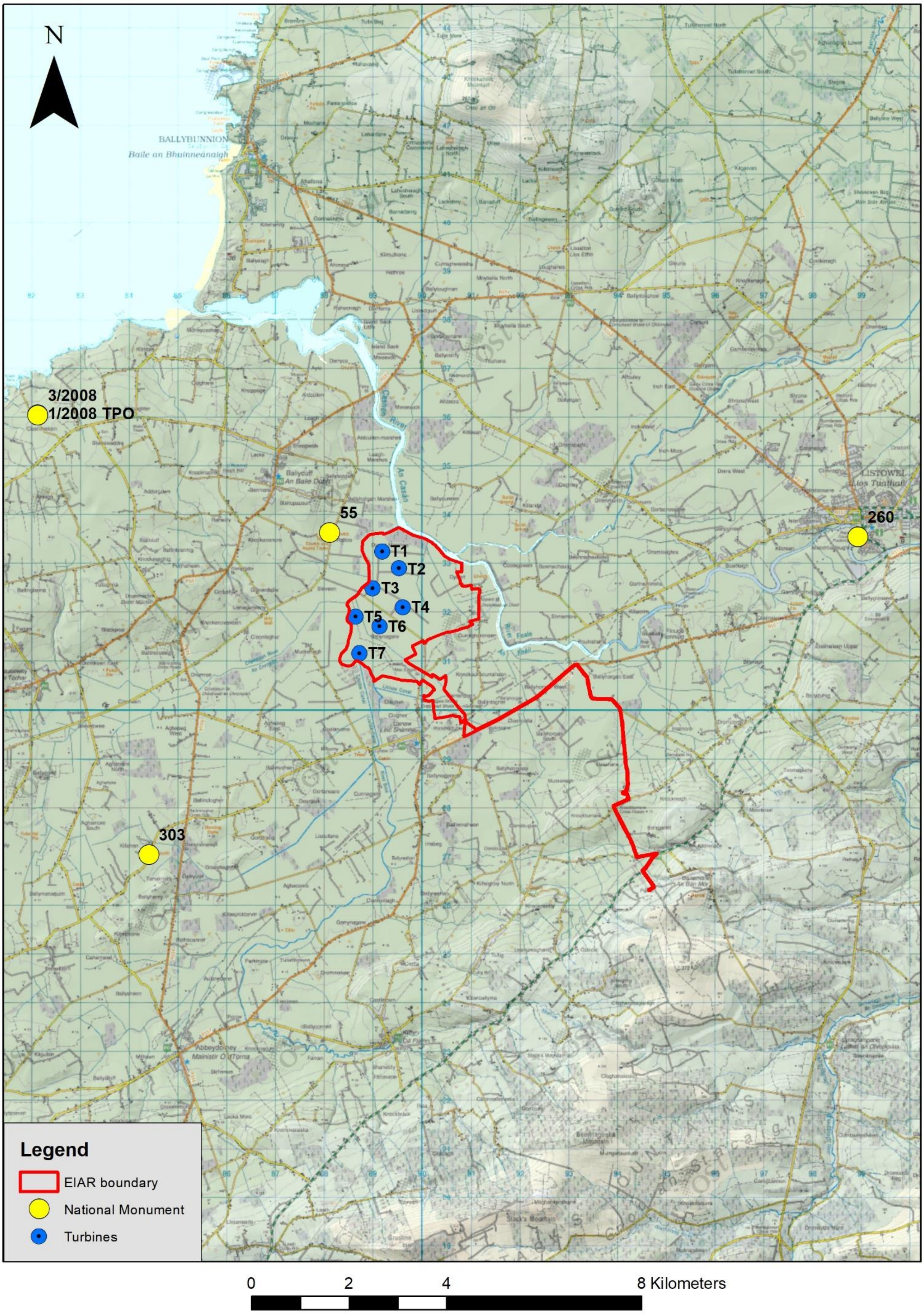


Figure 12.2: National Monuments and those subject to Preservation Orders within 10km of the nearest proposed turbine.

12.3.1.2.1 National Monument No. 55 Rattoo Early Medieval Ecclesiastical Site

Description

A number of monuments are located at the Early Medieval ecclesiastical site at Rattoo. The National Monument (No. 55) includes the round tower KE009-056001, church KE009-056003 and religious house -Augustinian canons KE009-056004.

Plate 12.1: Rattoo round tower , church and graveyard NM No. 55 looking west from local road located between the national monument and the proposed wind farm site.

KE009-056001-
Class: Round tower
Townland: RATTOO
Scheduled for inclusion in the next revision of the RMP: Yes
Description: This complete tower, which stands on a platform of masonry, rises to a maximum height of 29.56m (OPW) and is constructed of hard quartzose sandstone, which is well dressed and coursed internally and externally. The tower is 15m in circumference at the base. The internal diameter is 2.3m at the doorway, where the walls are a little over 1m thick. The external wall would appear to batter from the base to the cornice, and the external diameter at the sills of the top windows measures 3.5m (OPW). This means that over a height of 21.44m, there is a reduction in radius of 55cm, giving a batter of 1.39.

Originally there were five storeys above the basement, measuring 6.1m, 4.2m, 3.4m and 4.2m high, with the top storey 3.1m high to the cornice plus 2.8m to the internal vertex. Between the floors of each storey, rough corbel stones project. The top floor windows face a little to the right of the cardinal points and measured 1.45m to the apex, 51cm wide at the base and 43cm wide at the springing. The only other window is on the fourth floor. It measures 76cm to the apex, 43cm wide at the base and 33m wide at the springing.

The round-headed doorway is situated 2.83m above ground level and is 1.6m high. It consists of a semi-circular arch of three stones ornamented with a simple curvilinear motif in relief. The carving is about 1cm in thickness and is much weathered. The central portion above the central stone has upturned curving spirals at each end measuring 4.5cm in diameter; the central portion of the relief motif measures 20cm overall. Extending from the underneath of each spiral is a plain bead moulding which rounds the arch for 44cm and then terminates on either side in curving spirals. The two spirals on either side of the arch extend in the same direction, clockwise on the left and anti-clockwise on the right. This design appears to be unique for a round tower.

Another feature unique to this round tower is the Sheela-na-gig (KE009-056002-), which is situated on the top left- hand corner of the frame of the N window, facing in to the interior of the tower. This feature was discovered in 1880-81, when the top two-thirds of the cap were being reset. A plaster cast of the Sheela- na-gig now lies in the National Museum. It is carved in relief on two stones, the head and shoulders set on the end of the lintel stone and the rest on the jamb stone below it. It measures 30cm from head to foot and 14cm at the widest point across the knees.

The term 'Sheela-na-gig' may have derived from Síle na gCioch (Sheila of the breasts) or Síle-in-a-glob (Sheila on her hunkers). Other interpretations have suggested that it could be a male/female with a large open mouth. The name Síle/Sheela/Sheila is itself an Irish version of the Latin name 'Cecilia'. These figures occur most frequently in Ireland, where over 77 have been recorded. They also occur in Britain (35) and France (11), where they appear to be more ornate and explicit in detail. They seem to be associated with late medieval castles, tower houses and churches. It has been suggested that Sheela-na-gigs were used as fertility symbols, but when we look at other idols connected with fertility we usually see large or multiple breasts and huge bellies. There is nothing about the Sheela-na-gig which suggests life: it is more likely that they were meant to ward off evil spirits. The more crude and grotesque the figure, the more effective it would be, the belief being that evil repels evil.

In 1832, when William Morrison visited the tower, it stood on a circular earthen terrace with a causeway running below its doorway E for about 38.7m. This, however, is now only discernible from the air. The land around the tower belonged to the Gunn family who lived in Rattoo House, which is situated on the N side of the field. Around 1880, when Mr Wilson Gunn drained and planted the land, the causeway disappeared.

Plate 12.2: Rattoo round tower from within the ecclesiastical complex, looking NW.

KE009-056003-
Class: Church
Townland: RATTOO
Scheduled for inclusion in the next revision of the RMP: Yes
Description: Rattoo Church (in ruins), graveyard (KE009-056005-). This church is situated in a graveyard enclosed by a stone wall built in the last century. Immediately NW of this church lies Rattoo round tower (KE009-056001-). The church is rectangular in plan, measuring 11.5m x 6.6m externally. The walls measures .6m thick and have a noticeable batter. The doorway is situated on the W gable. On the exterior side it is formed of cut limestone in the pointed style and measures .8m wide and 1.7m high. However, on the interior side, the door is covered by a flat lintel, possibly suggesting an early date.

Built into the wall inside the doorway is a stone with an inscription on the upper part, which is turned towards the doorway. The stone measures .4m x .3m and was probably used to repair the doorway. The inscription may read as follows: 'X MARGARET O'DINIGHEN, EJUS 1666, VXOR, HIC JACET' (Lynch, JRSAI 40, 1910, 244-245). The X before the name Margaret may have been intended to connect it to another inscription, possibly her husband's, or it may have served as a mark when this stone was separated from another.

The E gable contains a window formed of cut limestone in the pointed style which was originally divided into two lights by a stone mullion which exists no longer. The window measures .6m wide x 2.2m high. The S wall contained two windows, but these have been blocked up. Though this church is generally given as 15th century (O'Donovan 1841, Harbison 1970, Barrington 1976), there are obvious earlier characteristics incorporated into the building, but because it has been so modernised it is difficult to ascertain a definite date.

Plate 12.3: View from graveyard at Rattoo ecclesiastical complex looking ESE towards the proposed wind farm site.

KE009-056004-
Class: Religious house - Augustinian canons
Townland: RATTOO
Scheduled for inclusion in the next revision of the RMP: Yes
Description: This site is situated on low-lying pastureland NE of Rattoo round tower (KE009-056001-) and church (KE009-056003-). To the E lies the River Brick, which flows into the River Cashen. This Augustinian friary consists of one house only, which is orientated in a NW-SE direction. It measures 27.7m x 6.4m internally, with walls c 1m thick.

The E window is pointed and formed of cut limestone. It is 1.5m wide on the exterior side, splaying to 2.2m internally. It is divided into three bays by stone mullions and is surmounted by six compartments of various sizes.

The S wall contains five pointed windows, all but one now disfigured. A doorway exists in the S wall at a distance of 6.5m from the W gable; it too is disfigured. A second doorway existed in the N wall at a distance of 9.7m from the W gable. This is now completely destroyed.

Rattoo was originally a preceptory of the Knights Hospitallers of St John of Jerusalem, founded by Friar William and confirmed by Meyler Fitz Meyler (son of Meyler Fitz Henry, Lord Justice in Ireland) in the reign of King John (1199-1216). The words of Meyler's charter – 'built by Friar William in my lands of Kerry' – were witnessed by David, Bishop of Iarmuan or Ardfert (Bishop of Kerry 1193-1207).

Rattoo was later converted into a monastery of the regular canons of the Aroacia and dedicated to St Peter and St Paul (Hickson, JRSAI 1883-84, Vol VI 295-305). The abbot was a Lord of Parliament. On the suppression of the monasteries, the formal grant of Rattoo was given to the Earl of Desmond, on a 20-year lease from the Crown. When he rebelled in 1583 his lands were confiscated. The abbey changed hands several times before being finally destroyed in 1600 on the advance of Sir Charles Wilmot in 1600 to Rattoo Castle (1003); the abbey was first fortified by the Irish, but then abandoned and burnt to the ground.

Plate 12.4: Religious house KE009-056004—at Rattoo taken from local road located between the national monument and the proposed wind farm site.

Viewshed Analysis Results

The viewshed results show that theoretically, turbines T1, T2, T3, T5 and T6 could be seen in full (from base to tip height) from Rattoo ecclesiastical site, with the remainder visible approximately from mid-shaft upwards. This assumes no vegetation, buildings, natural screening such as field boundaries and therefore is a worst case scenario. The Zone of Theoretical Visibility (thereafter ZTV) utilised in the LVIA shows that 6-7 turbines will be visible from this area and accords with the results of the viewshed analysis.

Potential impacts are discussed in Section 12.5.

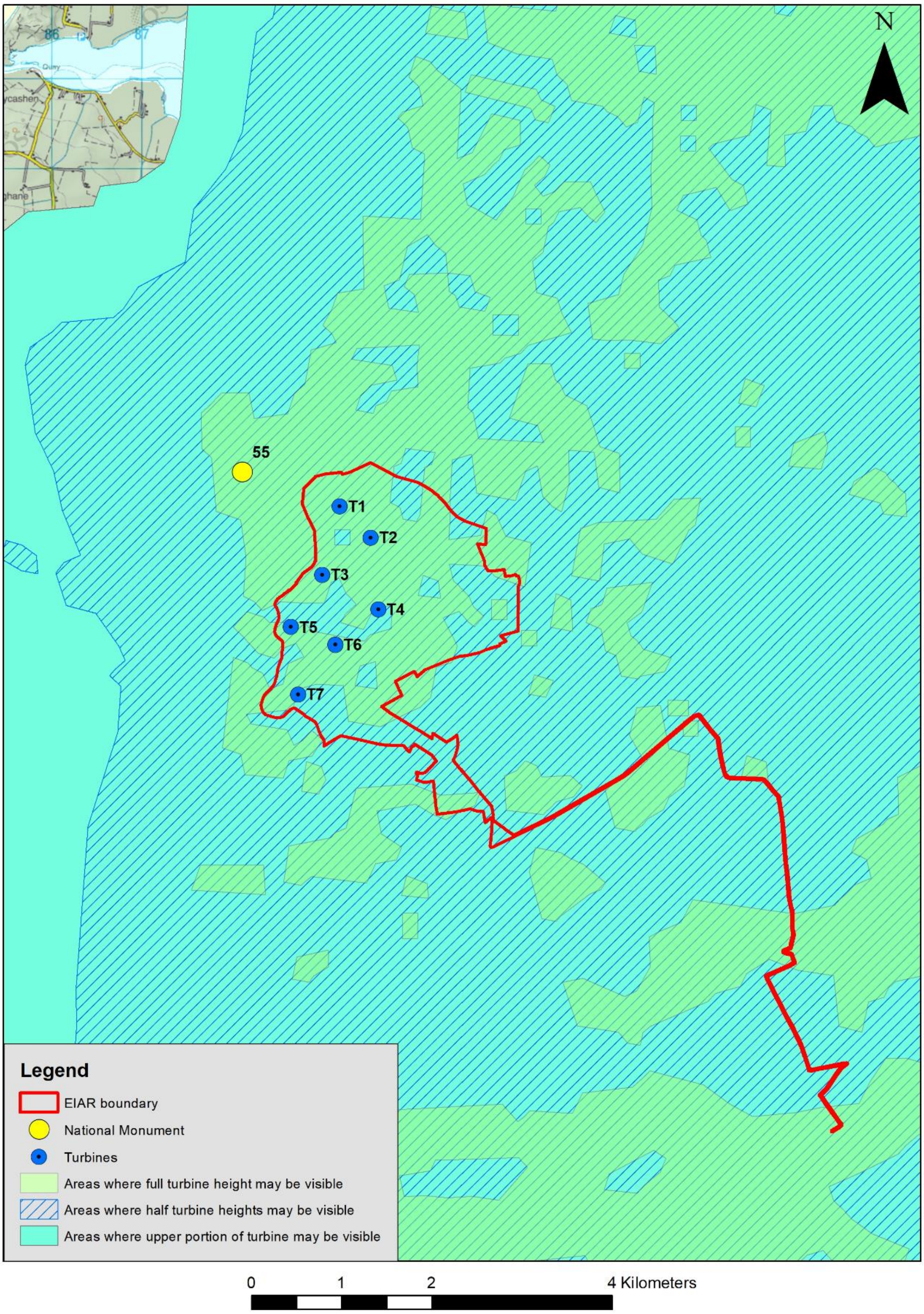


Figure 12.3: Viewshed analysis results from National Monument No. 55 Rattoo ecclesiastical site showing varying degrees of visibility depending on height of structures in the landscape (such as turbines).

12.3.1.2.2 National Monument No. 303 Tonaknock Cross

Description

KE015-108002-
Class: Cross - High cross
Townland: TONAKNOCK
Scheduled for inclusion in the next revision of the RMP: Yes
Description: Killahan Church (KE015-108001-), graveyard (KE015-108003-).
To the W of this site, across a road, lies the stone cross of Tonaknock (KE015-108002-). This is the original location of the cross, for the present location see KE015-108004.

The stone cross at Tonaknock comprises an upstanding roadside monument.

Viewshed Analysis Results

The viewshed results show that theoretically T7 may be seen from mid shaft upwards from Tonaknock Cross with the upper portion of the remaining turbines also visible. This assumes no vegetation, buildings, natural screening such as field boundaries and therefore is a worst case scenario. The Zone of Theoretical Visibility (thereafter ZTV) utilised in the LVIA shows that 6-7 turbines may theoretically be visible from this area.

Potential impacts are discussed in Section 12.5.

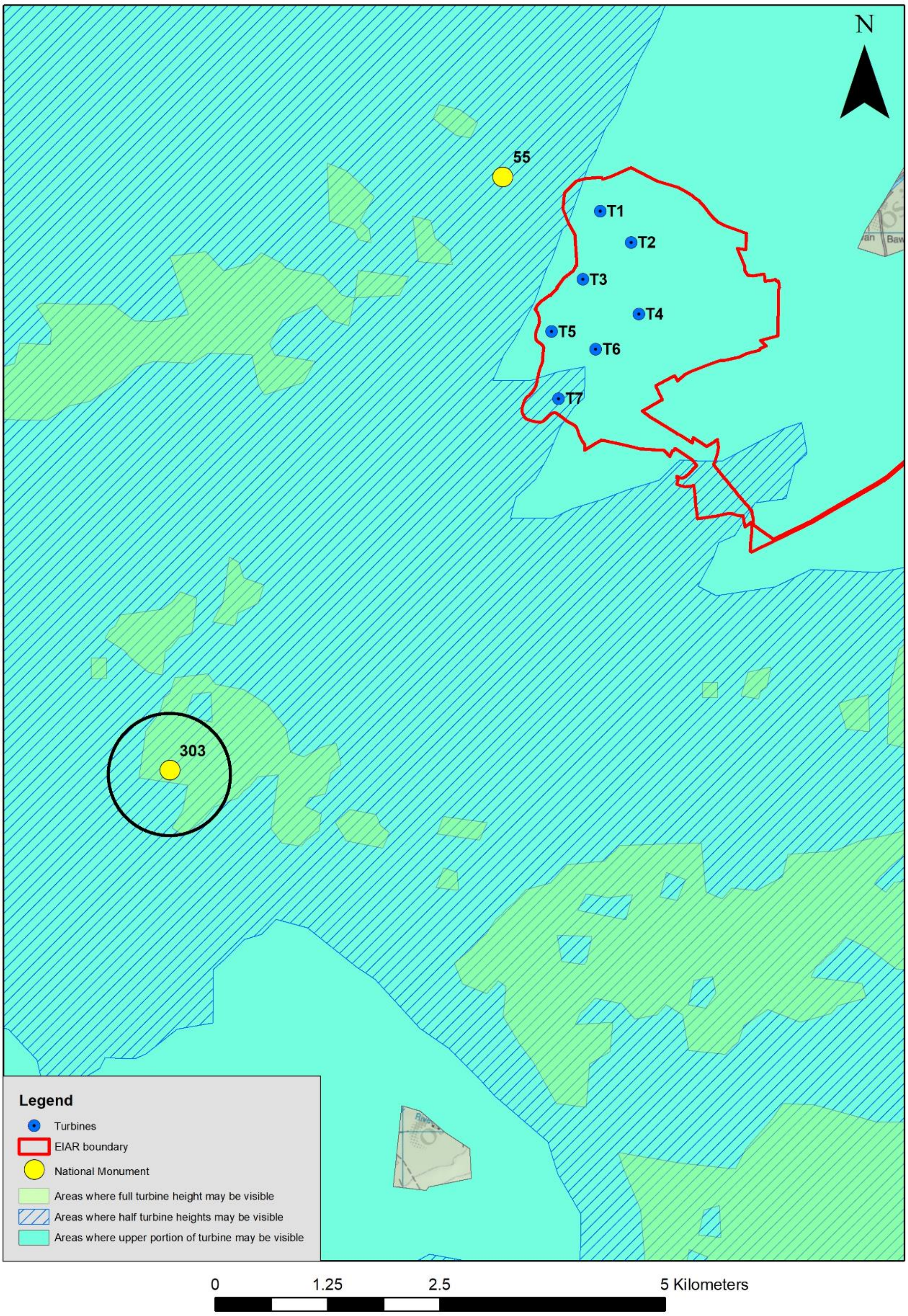


Figure 12.4: Viewshed analysis results from National Monument No. 303 Tonaknock Cross showing varying degrees of visibility depending on height of structures in the landscape (such as turbines).

12.3.1.2.3 National Monument No. 260 Listowel Castle

Description

KE010-059—
Class: Castle - Anglo-Norman masonry castle
Townland: LISTOWEL
Scheduled for inclusion in the next revision of the RMP: Yes
Description: Situated on the N bank of the River Feale, Listowel Castle originally extended from its present position to the river's edge, but this section has now disappeared. The present fabric of the castle dates probably to the 15th century. There is documentary evidence that a castle was built in Listowel soon after the Normans arrived in North Kerry, and towards the end of the 13th century, possibly around 1270, Maurice Fitzmaurice also had a castle constructed. Whether these were all built in the same location is not known.

A substantial portion of the front of the present castle remains. It consists of two towers connected by a wall and high arches and is similar in design to Bunratty Castle (Co. Clare). The material used in the construction of the castle is limestone with lime and sand mortar. The window stones and quoin stones are also limestone and the quoin stones are cut.

Front East Tower: The bottom window is splayed, a typical feature of many tower-houses. The three window loops on the E tower all have pointed arches. As with the lower windows, these loops are surrounded by cut limestone blocks. These windows could be used for defence but, as they had a very narrow field of vision, it seems their primary purpose was to provide light and air.

Front West Tower: Again the bottom window is heavily splayed. This tower also has three pointed window loops surrounded by cut limestone blocks. In addition there are two smaller square-headed windows slits. Both towers have a slight batter all around their base.

Central Wall: A large pointed arch connects both towers at the top. The arch stands out from the wall so that the space between it and the wall forms a large machicolation over the door, from which point missiles could be thrown down on an attacker. On the central wall in the angle of the wall on both sides are five square-headed slits (2 E, 3 W), through which defenders could provide covering fire for the door. The door has a pointed arch and is set in the centre of a large long rectangular recess which also includes a round-headed window loop. There are also three square-headed window slits and a pointed window loop further up the wall. The door, arch, and windows are all surrounded by cut limestone blocks.

The E tower contains an unusual carving of what appears to be a head. Tradition gives a few versions of whose head it is: that of Thomas Fitzmaurice; that of the builder of the castle; or the head of an ape. The ape was associated with the Fitzmaurices because one of their ancestors was reputedly saved by one (Gaughan, 1973).

Two long strips of rubble at the rear of the castle indicates where the walls of the centre keep once stood.

Black East Tower (Left): One enters through a square doorway which leads into a small lobby. Square niches in the wall facing this doorway lead into a small high-vaulted room. This vaulted room, square in shape, contains a large square recess and two large splayed windows. The splay in the windows is quite steep and both have two stepping stones up to the loop. The room also has an opening (forced) into the garderobe chute. Looking up the chute it is clear that it served more than one latrine for two are visible. This room and the one in the W tower opposite probably served as guardrooms.

Back West Tower (Right): The vaulted room is similar to the one in the E tower, having a large recess and steps leading to the loop. The wicker and mortar centering is also visible in the pointed vault of this room. Just to the right of the entrance is a doorway (blocked up by the OPW) to a small chamber. This room possibly contained the stairs as no stairs exist in either of the vaulted rooms. No access can be gained to the upper floors without a ladder. Some steps can be seen leading from the 3rd to the 4th floor.

The Fitzmaurices, Lords of Kerry and owners of this castle, proved disloyal to the English crown in both the Desmond and O'Neill wars. By 1600 Listowel Castle was the last stronghold remaining to them and here they were besieged by Sir Charles Wilmot's forces. Wilmot tried to blow the castle up, digging a tunnel into which he set gunpowder. His first tunnel was flooded by a gush of spring water, but a second proved more successful and reached a vault in the castle. While service sumps were being constructed close to the castle in 1986 a tunnel was unearthed which ended near the foundations beneath the chamber in the west tower. According to Michael Ward (1986) this tunnel avoids the underground water course which had caused the first one to be abandoned, and he believes it to be the second tunnel executed by Wilmot. When the garrison realised the success of the second tunnel they finally surrendered their three-week seige. The woman and children were allowed to go free and, unknown to Wilmot, Lord Kerry's five-year-old eldest son was smuggled out by his nurse. However, in return for his life and the life of the child, a priest by the name of Sir Dermot MacBridie revealed the whereabouts of the boy, who was captured and sent to England (Gaughan, 1973).

For his achievements in North Kerry, Sir Charles Wilmot was created Earl of Athlone. Pacata Hibernia (1633) gives a good account of the siege of Listowel Castle and the fate of the garrison. Wilmot immediately hanged nine of the 18 weaponed men for that was the number of men he had lost during the siege; the rest of the garrison soon met the same fate.

In 1604 Thomas Fitzmaurice, the 18th Lord of Kerry, submitted to James I for his and his father's offences against the crown, and was pardoned. He surrendered his estates and had them conferred on him by letters patent in July 1604 and confirmed on the 1st July 1612 (Bourke, 1895). From this time on the Fitzmaurices remained loyal to the crown. Richard Hare purchased the manorial rights in 1783. The castle has been the responsibility of the Office of Public Works since 1923, and is one of the national monuments listed for North Kerry.

Viewshed Analysis Results

The viewshed results show that theoretically, Turbines T1 – T7 may be seen from Listowel Castle from approximately mid-shaft upwards. This assumes no vegetation, buildings, natural screening such as field boundaries and therefore is a worst case scenario. The Zone of Theoretical Visibility (thereafter ZTV) utilised in the LVIA also shows that 6-7 turbines would theoretically be visible from this area.

Potential impacts are discussed in Section 12.5.

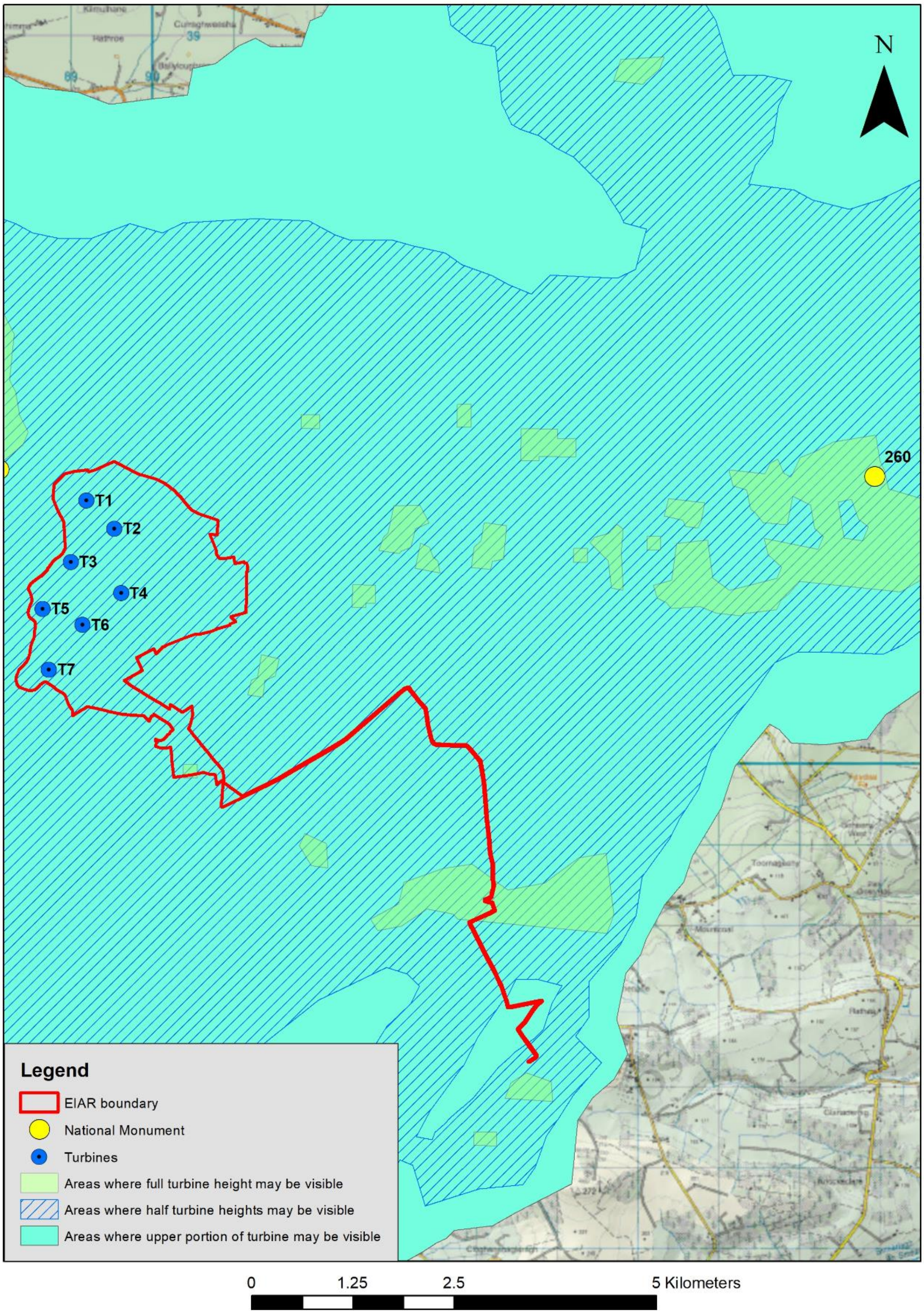


Figure 12.5: Viewshed analysis results from National Monument No. 260 Listowel Castle showing varying degrees of visibility depending on height of structures in the landscape (such as turbines).

12.3.1.2.4 Preservation Order No. 3/2008, 1/2008 Ringfort and Souterrain

Description

KE009-029—
Class: Ringfort - rath
Townland: CLASHMELCON
Scheduled for inclusion in the next revision of the RMP: Yes
Description: Internal diameter 33m N-S, 31m E-W
This bivallate rath is touched by a fieldbank to the SW and SE. Immediately NW is a small pond. This site consists of a circular area enclosed by a well-defined inner bank, fosse and outer bank. The inner bank is c 7m wide and rises to a maximum of 3.6m externally and 2.2m above the interior. The fosse and outer bank can only be distinguished NNE to E, the fosse measuring 2m in width. The outer bank is low and wide and measures 7m in width and .9m high. In the S to SW sector of the interior, there is a raised platform area .8m high. Contained within this raised area is a depression 1.4m x 4m. Since 'cave' is marked on the 1841-42 and 1915-16 OS maps, this is possibly the remains of the souterrain (KE009-029001-). Two main gaps appear in the bank, one to the W which is 2.6m wide and the other to the SE which is 2m wide, both providing access to the interior.

KE009-029001-
Class: Souterrain
Townland: CLASHMELCON
Scheduled for inclusion in the next revision of the RMP: Yes
Description: Bivallate rath KE009-029— is touched by a fieldbank to the SW and SE. Immediately NW is a small pond. This site consists of a circular area enclosed by a well-defined inner bank, fosse and outer bank.
In the S to SW sector of the interior, there is a raised platform area .8m high. Contained within this raised area is a depression 1.4m x 4m. Since 'cave' is marked on the 1841-42 and 1915-16 OS maps, this is possibly the remains of the souterrain (KE009-029001-).

Viewshed Analysis Results

The viewshed analysis from this monument shows that theoretically none of the proposed turbines will be visible from this area. This accords with the ZTV which also shows that theoretically no proposed turbines will be visible from this area.

Potential impacts are discussed in Section 12.5.

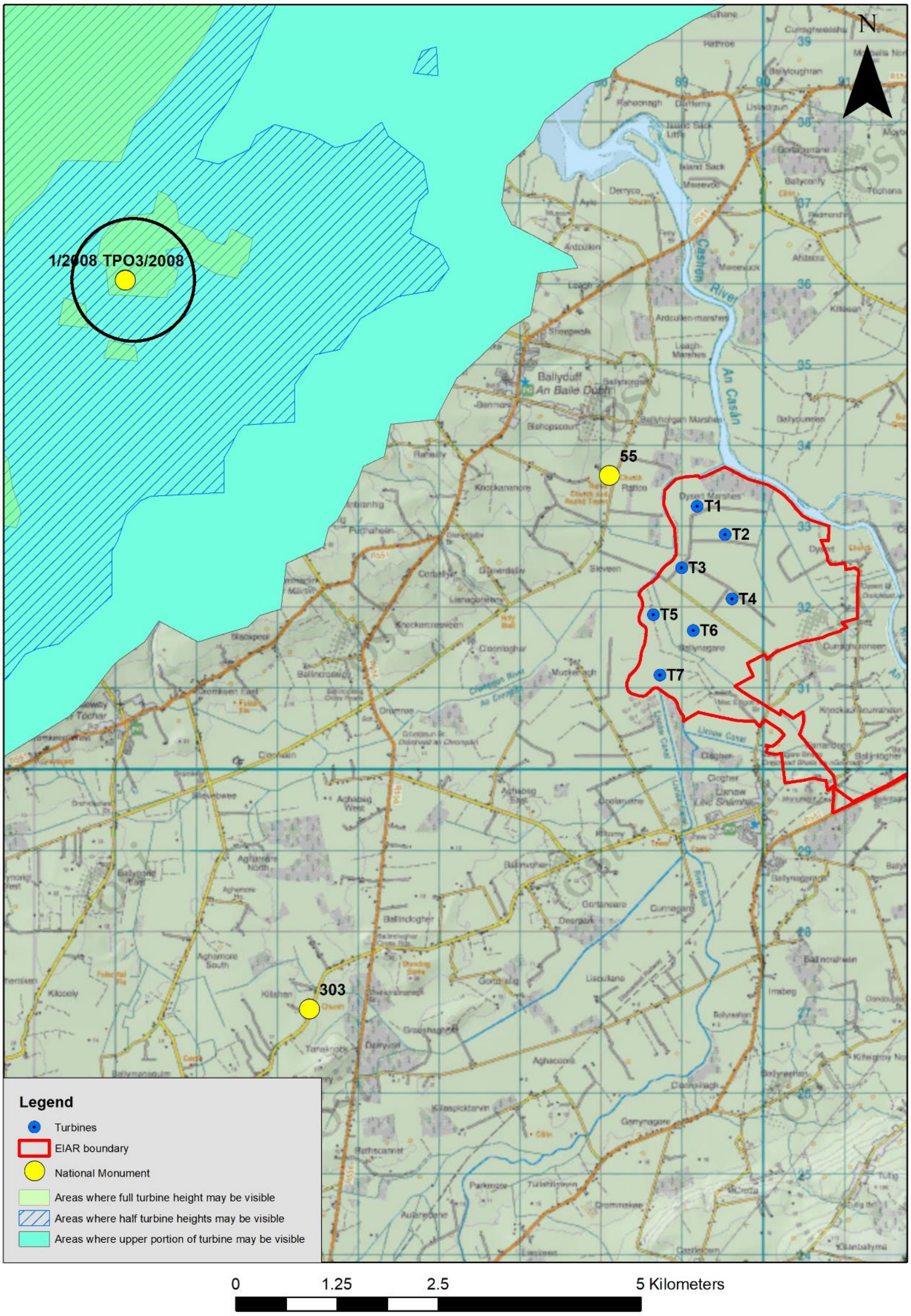


Figure 12.6: Viewshed analysis results from PO 1/2008 and 3/2008 showing varying degrees of visibility depending on height of structures in the landscape (such as turbines).

12.3.1.3 Recorded Monuments within the EIAR site boundary

Ten recorded monuments are located within the wind farm EIAR site boundary (monuments along the grid connection route are dealt with separately in Section 12.4.1). The monuments are listed in Table 12.3 and shown on Figure 12.7, Figure 12.8, Figure 12.9 and Figure 12.10.

Of these monuments, KE009-088 road – unclassified togher is located immediately adjacent to T1 and its associated hardstand (Figure 12.8 and Figure 12.10). The outer enclosing element of ecclesiastical enclosure KE016-004001- is situated c. 60m to the south-west of the proposed road which extends in a south-easterly direction to the proposed substation, compound and borrow pit area (Figure 12.9). Further to the south-east KE016-005 enclosure is located immediately adjacent to the same proposed road (Figure 12.9). Two additional monuments KE016-013— and KE016-013001 ringfort and souterrain are located c. 50m to the west of the proposed borrow pit (Figure 12.9).

Table 12.3: SMRs within the wind farm EIAR boundary.

SMR	ITM E	ITM N	TYPE	TOWNLAND
KE016-005—	490542	630282	Enclosure	FARRANDEEN
KE016-004003-	490142	630364	Ringfort - rath	BALLYNAGARE
KE016-003—	489834	630712	Mound	BALLYNAGARE
KE016-013—	490360	629957	Ringfort - rath	FARRANDEEN
KE016-013001-	490360	629957	Souterrain	FARRANDEEN
KE016-076—	490270	629970	Ringfort - rath	FARRANDEEN
KE016-076001-	490270	629970	Mound	FARRANDEEN
KE010-081—	490936	632152	Redundant record	CURRAGHCRONEEN
KE009-088—	489718	633051	Road - unclassified togher	DYSERT MARSHES
KE016-004001-	490067	630508	Ecclesiastical enclosure	BALLYNAGARE

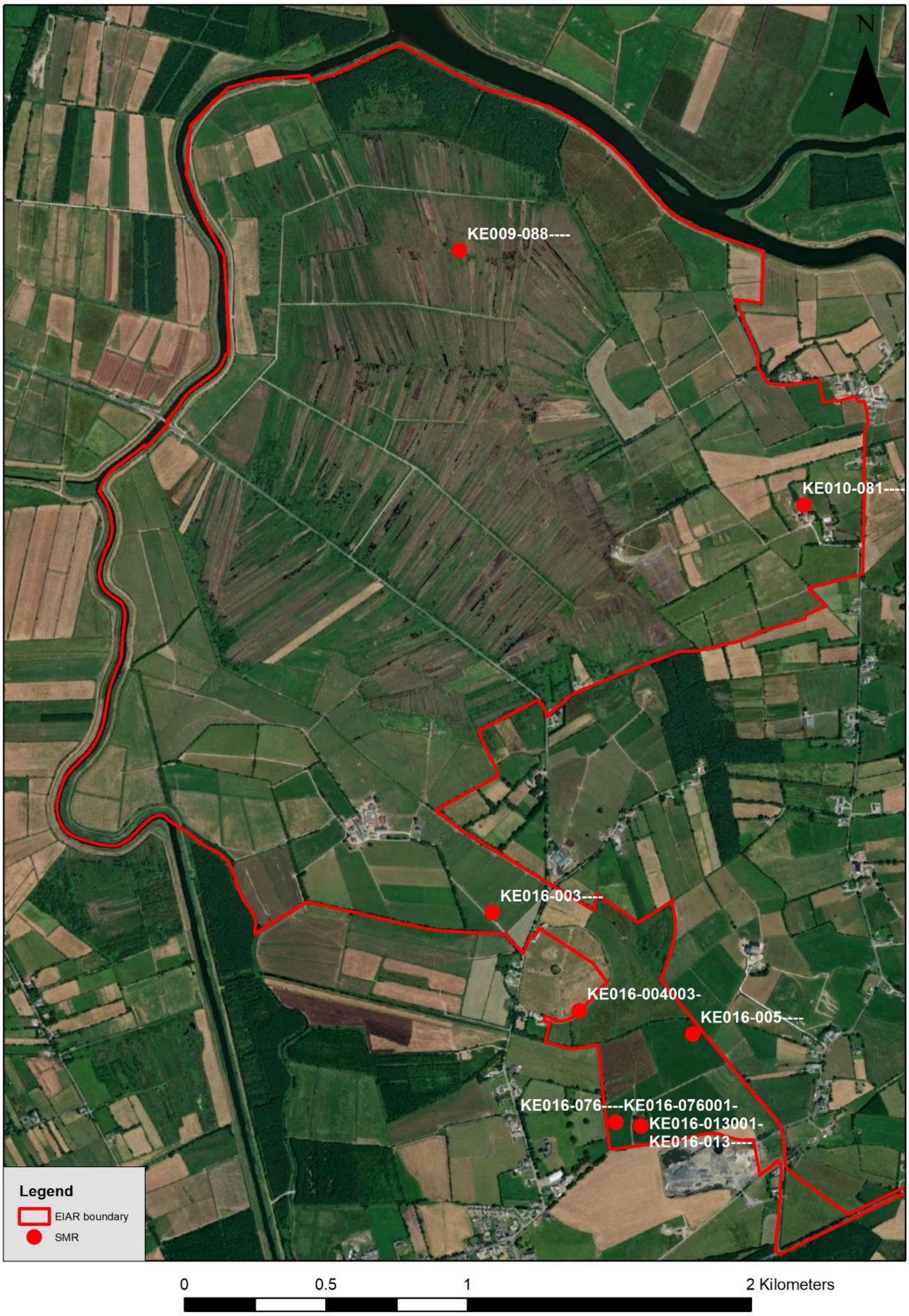


Figure 12.7: Overview map of SMRs within the wind farm EIAR boundary.

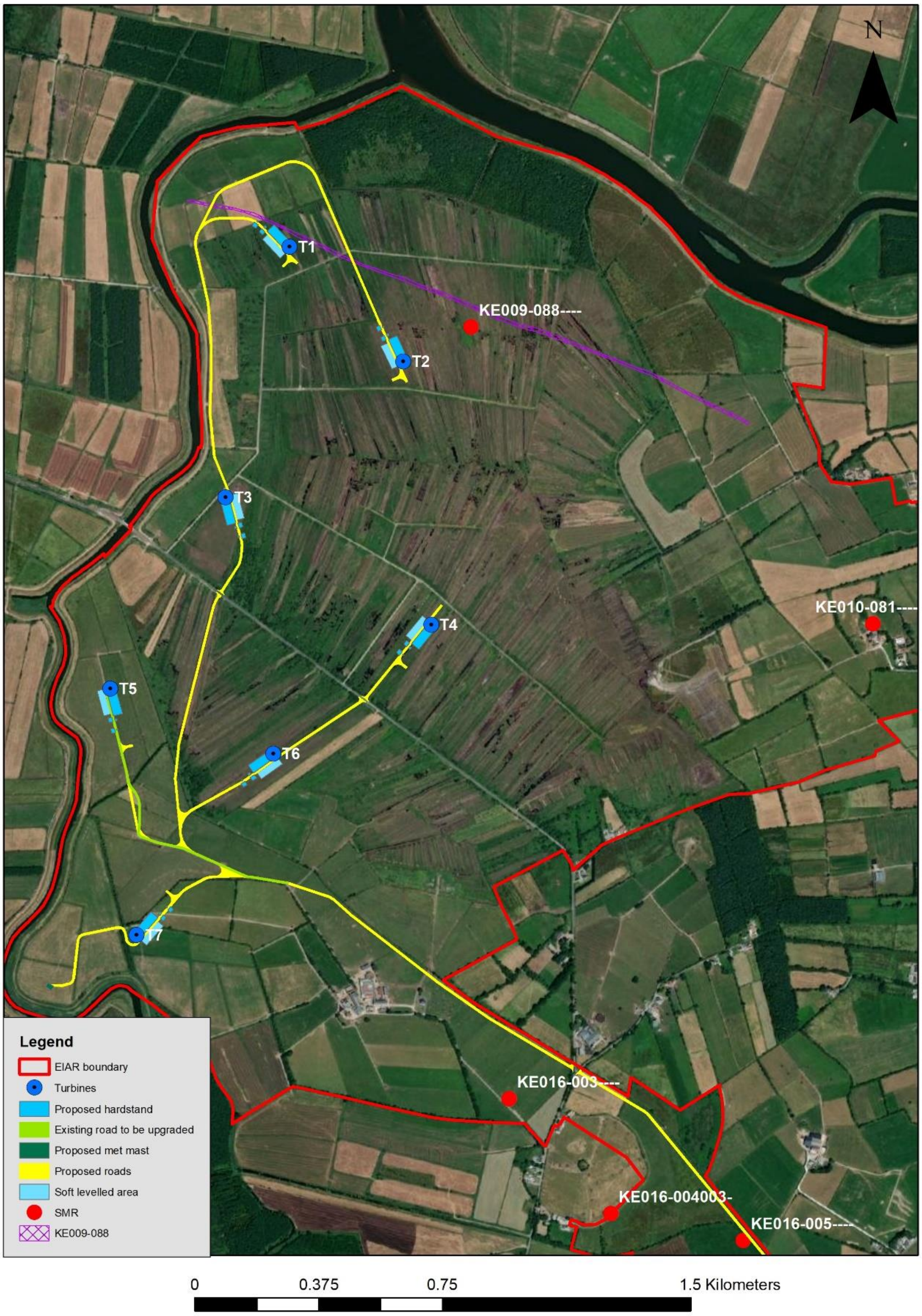


Figure 12.8: SMRs in relation to proposed infrastructure within the northern portion of the EIAR boundary.

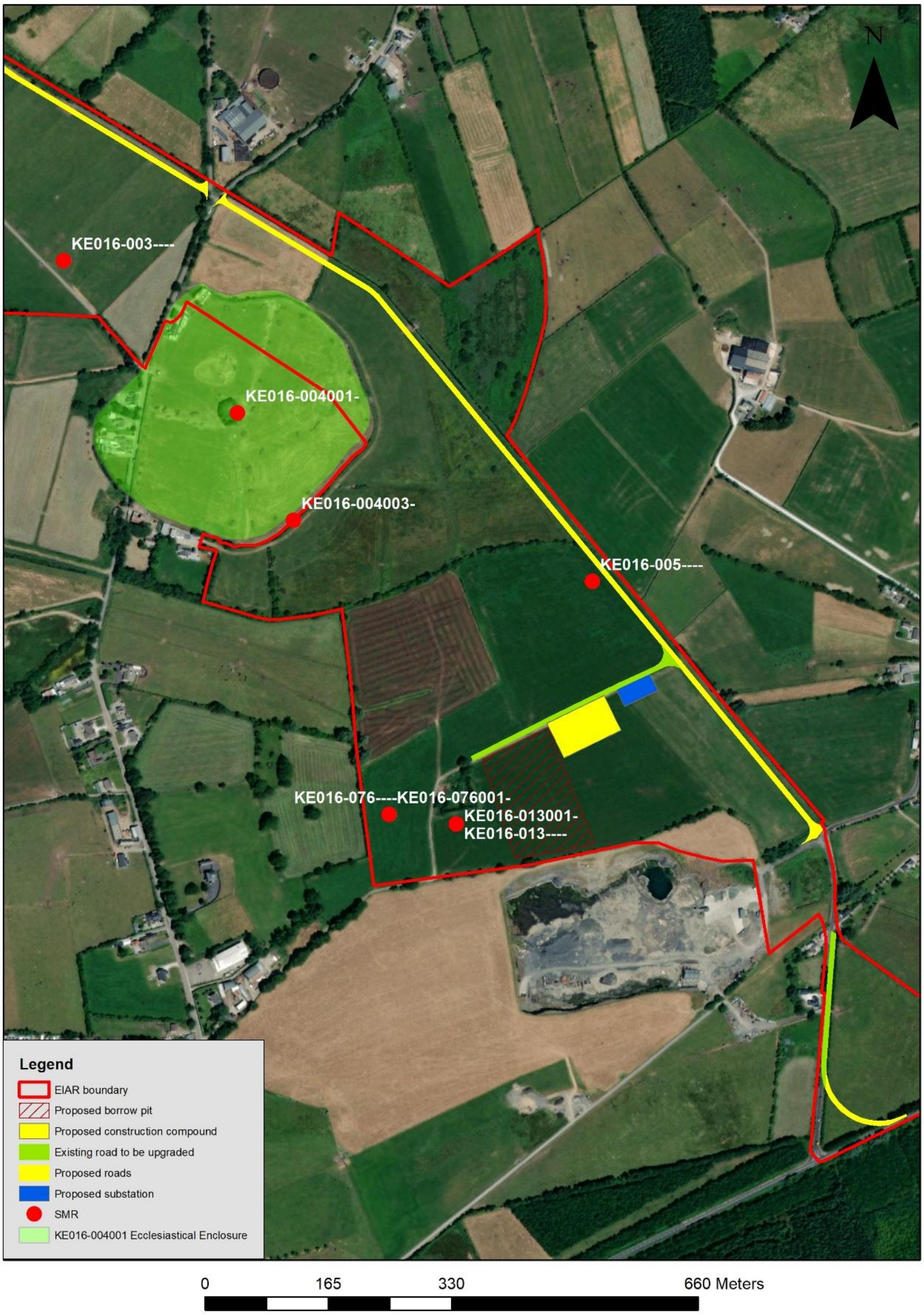


Figure 12.9: SMRs in relation to proposed infrastructure within the southern portion of the EIAR boundary. Note shaded extent of KE016-004001 ecclesiastical enclosure.

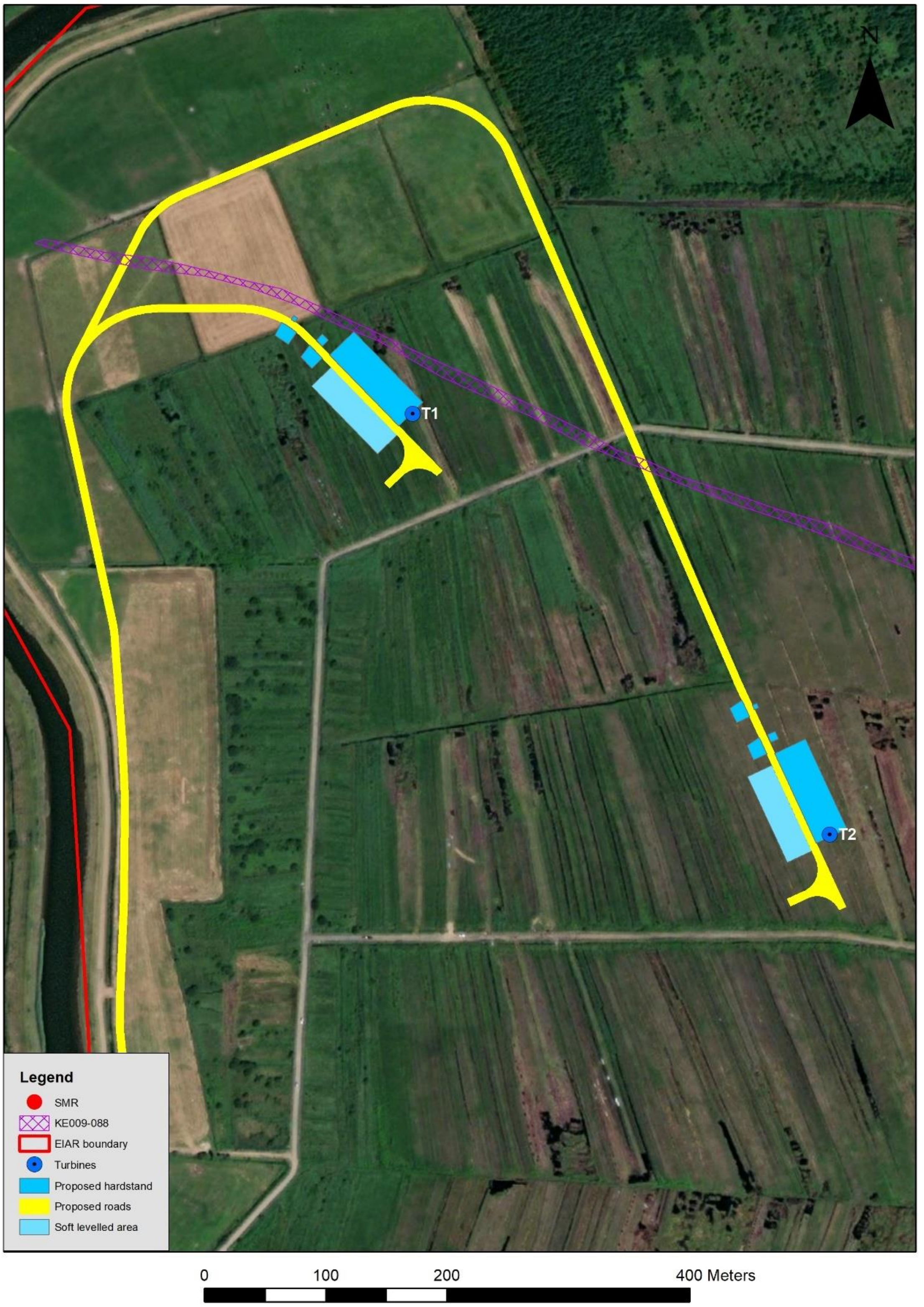


Figure 12.10: T1, T2 and associated proposed roads in relation to indicative projected line of KE009-088 togher. Route of togher is projected from visibility on aerial photographs and depiction on 1st edition OS map.

12.3.1.3.1 KE009-088 – Road – unclassified togher

This monument is located within the northern portion of the proposed wind farm site and extends in a north-west south-east direction through the bog. In places it is apparent as a low bank, particularly at the north-west where it extends out of the bog into land now used for agricultural purposes. Within the bog itself it is difficult to discern on the ground due to vegetative overgrowth. It is described on the Historic Environment Viewer (HEV) as follows:

KE009-088—
Class: Road - unclassified togher
Townland: DYSERT MARSHES
Scheduled for inclusion in the next revision of the RMP: Yes
Description: This ancient roadway is marked on the 1841-42 OS map as Bohergarránban. Though it does not appear on the later edition map, it is quite visible on the ground. It is possible that this roadway extended from the monastic settlement at Dysert (KE010-062002-) across the marshes to Rattoo, for it is recorded (Petrie, 1845) that a causeway extended from Rattoo Round Tower towards the River Brick and the 'bohergarránban' can be traced from the E side of the river across the marshes. 'An ancient road now called white horse ridge extends from the old church of Dysart, through the bog, as far as Rattoo' (O'Donovan, OSBN 1841). It would appear that this road was constructed in straight sections and had a consistent width of 2.75m throughout. It is visible for 1,830m. See also (KE010-062—).

The route of the road is visible as a crop mark on aerial photographs and is also indicated and named 'Bohergarraunbaun' on the 1st edition OS map. During field inspection undertaken as part of this assessment the remains of the road could be seen in pastureland at the north-west end of the monument (Plate 12.5 and Plate 12.6) but was not discernible as it extended into the bog due to overgrowth. Further to the south-east within the bog it is also visible as a low rise where an existing track crosses the monument (Plate 12.7). Potential impacts to this monument are discussed in Section 12.5 below.

Plate 12.5: Low rise of togher KE009-088 in pasture to NW of T1, looking SE.

Plate 12.6: KE009-088 togher visible as low rise in pasture to NW of T1, looking N.

Plate 12.7: Low rise of KE009-088 where it is traversed by an existing track within the bog, looking NE.

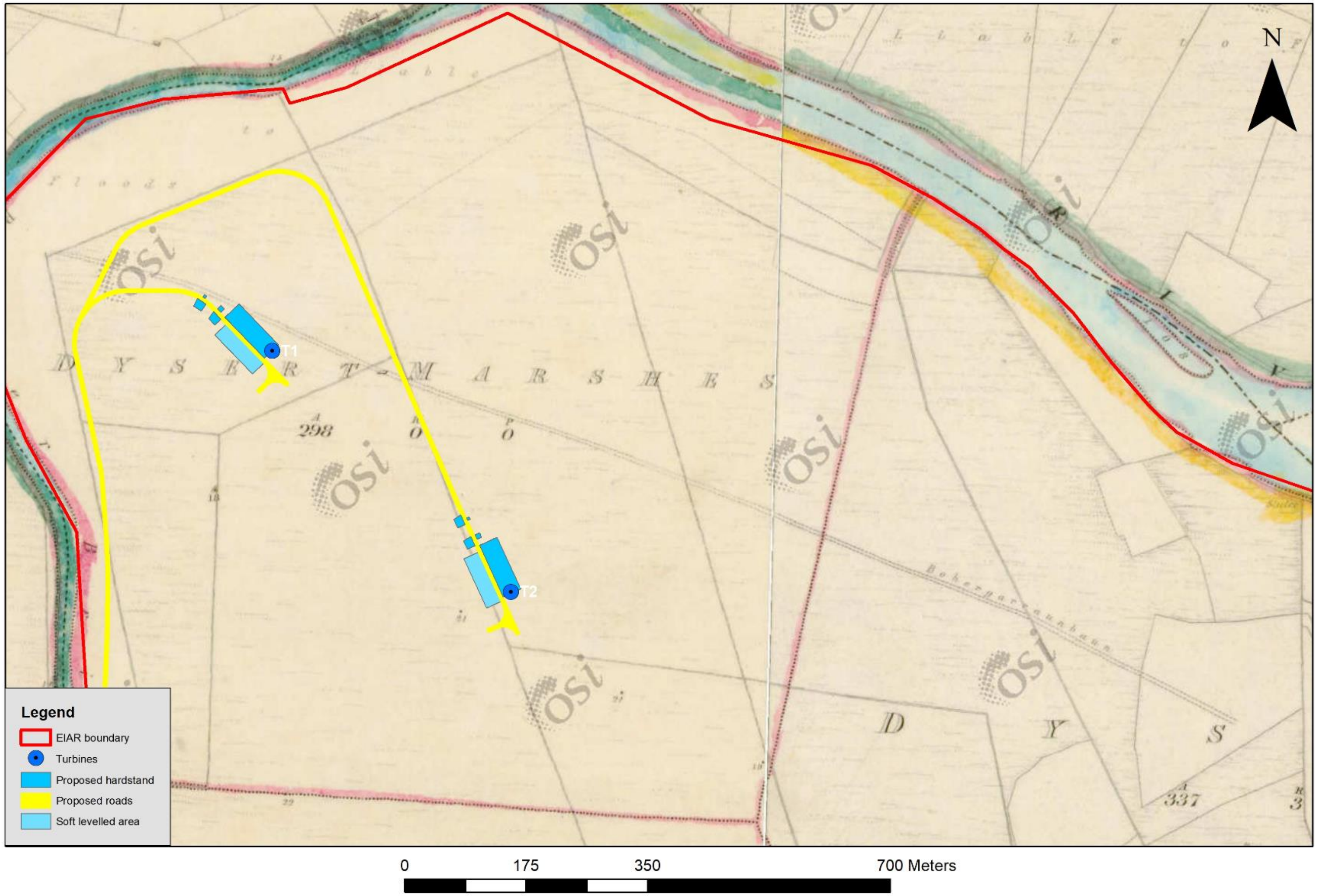


Figure 12.11: KE009-088 togher as shown on 1st edition OS map and named as 'Bohergarraunbaun' in relation to T1, T2 and associated proposed roads.

12.3.1.3.2 KE016-003---- Mound

This monument is located within the wind farm EIAR boundary c. 175m south-west of a proposed road. It is located in pasture and was apparent as a low rise with a scarped edge from the east→south→south-west (Plate 12.8). As this monument is not located within the footprint of any proposed infrastructure no direct impacts to same are anticipated (Figure 12.9). It is described on the HEV as follows:

KE016-003—
Class: Mound
Townland: BALLYNAGARE
Scheduled for inclusion in the next revision of the RMP: Yes
Description: Situated on low-lying land, this site is a sub-circular mound, c 33m NE-SW, rising to .8m in height. In the interior is a slight depression, 1.7m x 4.8m x .1m deep.

Plate 12.8: KE016-003 mound, looking N.

12.3.1.3.3 KE016-004001- Ecclesiastical enclosure

A portion of this monument is located within the EIAR boundary. It comprises a large sub-circular enclosure defined around much of its perimeter by a field boundary. It is transected at the west by the public road. The eastern upstanding outer enclosing element of this monument is located c. 60m to the south-west of the proposed road which extends in a south-easterly direction to the proposed substation and borrow pit (Figure 12.12). As this monument is not located within the footprint of any proposed infrastructure and the outer enclosing element of same is situated c. 60m south-west of the proposed road no direct impacts to this monument are anticipated. The enclosure is described on the HEV as follows:

KE016-004001-
Scope note
Class: Ecclesiastical enclosure
Townland: BALLYNAGARE
Scheduled for inclusion in the next revision of the RMP: Yes
Description: This sub-circular enclosure, dotted in on the 1841-42 OS map, is also delimited on the later 1914-15 map. 'Clooncraff Fort' (KE016-0040012-) lies in the centre of the enclosure, and another rath (KE016-004003-) is situated on its SE perimeter, cut slightly by the enclosing bank. This possible ecclesiastical enclosure is c 264m N-S and 330m E-W. The enclosure is situated c 530m NW of Kilbinane Church (site of) (KE016-014001-).

12.3.1.3.4 *KE016-005--- Enclosure*

The site of this enclosure is located immediately west of the proposed road which extends in a south-easterly direction to the proposed substation and borrow pit. It no longer has any above-ground trace and the field inspection undertaken as part of this assessment did not detect any visible remains of the monument. It is indicated on the 1st edition OS map as a circular area, the outer extent of which is c. 12m south-west of the aforementioned proposed road (Figure 12.12). Potential impacts to this monument are discussed in Section 12.5. It is described on the HEV as follows:

KE016-005—
Class: Enclosure
Townland: FARRANDEEN
Scheduled for inclusion in the next revision of the RMP: Yes
Description: Marked on the 1841-42 OS map as a circular enclosure, this site does not appear on the 1914-15 map. No surface trace survives.

Plate 12.9: Site of enclosure KE016-005–, looking east.

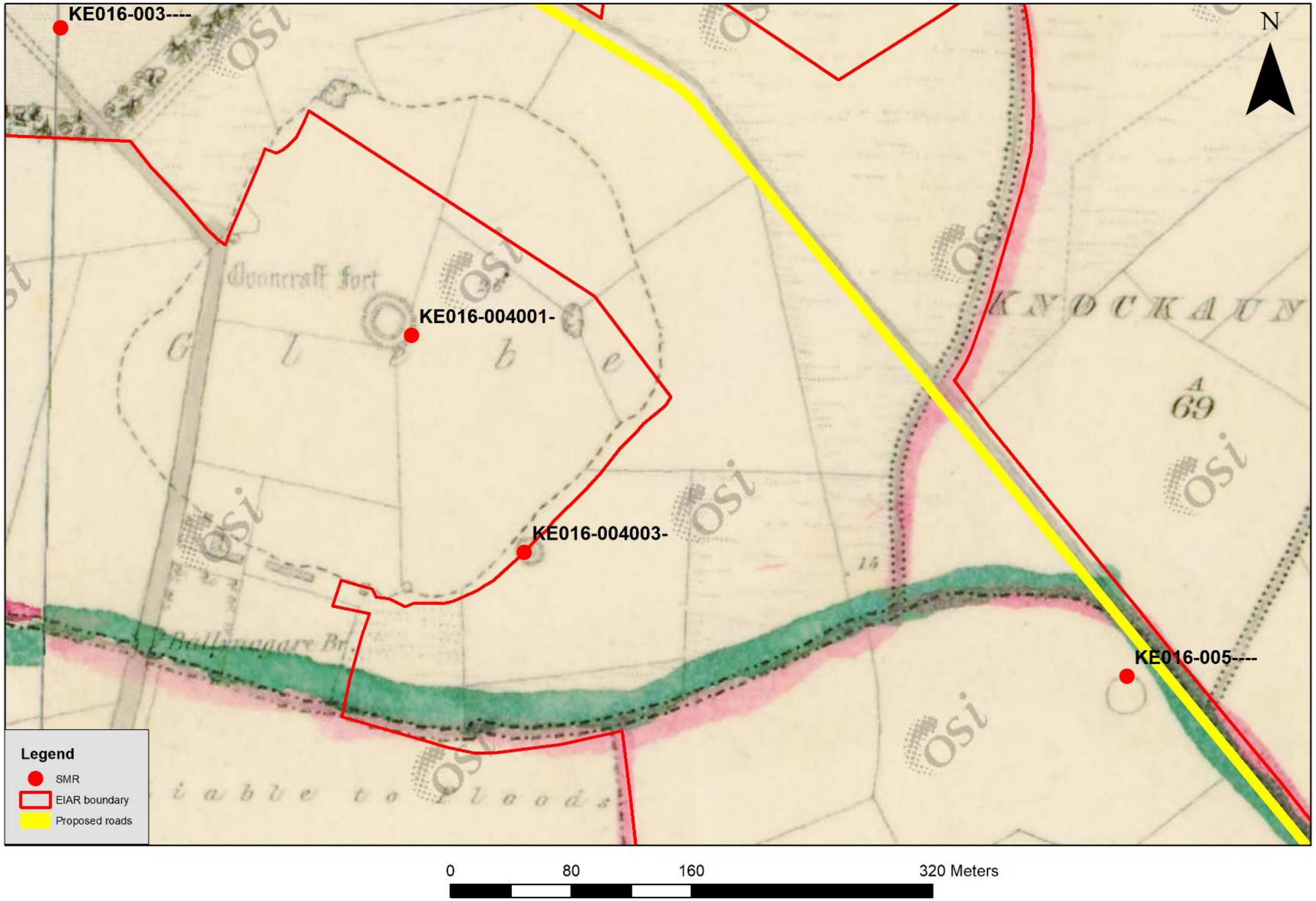


Figure 12.12: KE016-004001- ecclesiastical enclosure and KE016-005 enclosure as depicted on 1st edition OS map, in relation to proposed road.

12.3.1.3.5 KE016-013--- and KE016-013001- Ringfort and souterrain

The site of this ringfort and souterrain is located a short distance west of the proposed borrow pit. The monuments lo longer have any above-ground trace but are indicated on the 1st edition OS map (Figure 12.13). As depicted on the latter the outer extent of the ringfort is situated c. 48m to the west of the proposed borrow pit. The monuments are described on the HEV as follows:

KE016-013— and KE016-013001-
Class: Ringfort – rath and souterrain
Townland: FARRANDEEN
Scheduled for inclusion in the next revision of the RMP: Yes
Description: This circular enclosure is situated SE of KE016-076— in the same field. It is marked on the 1841-42 and 1914-15 OS maps, and on the earlier edition 'cave' (KE016-013001-) is marked in the interior. No surface trace survives today.

Plate 12.10: Site of KE016-013- and KE016-013001- ringfort and souterrain, looking WNE.

12.3.1.3.6 KE016-076- and KE016-076001- Ringfort and mound

These monuments are situated c. 50m north-west of KE016-013—and also no longer have any above-ground remains. The ringfort is depicted on the 1st edition OS map as a hachured circular enclosure c. 122m west of the proposed borrow pit (Figure 12.13). The monuments are described on the HEV as follows:

KE016-076—
Class: Ringfort - rath
Townland: FARRANDEEN
Scheduled for inclusion in the next revision of the RMP: Yes
Description: This circular enclosure is marked on the 1841-42 and 1914-15 OS maps. It has since been almost completely levelled and all that remains is an oval shaped mound, 7.8m x 3m internally and .6m high.

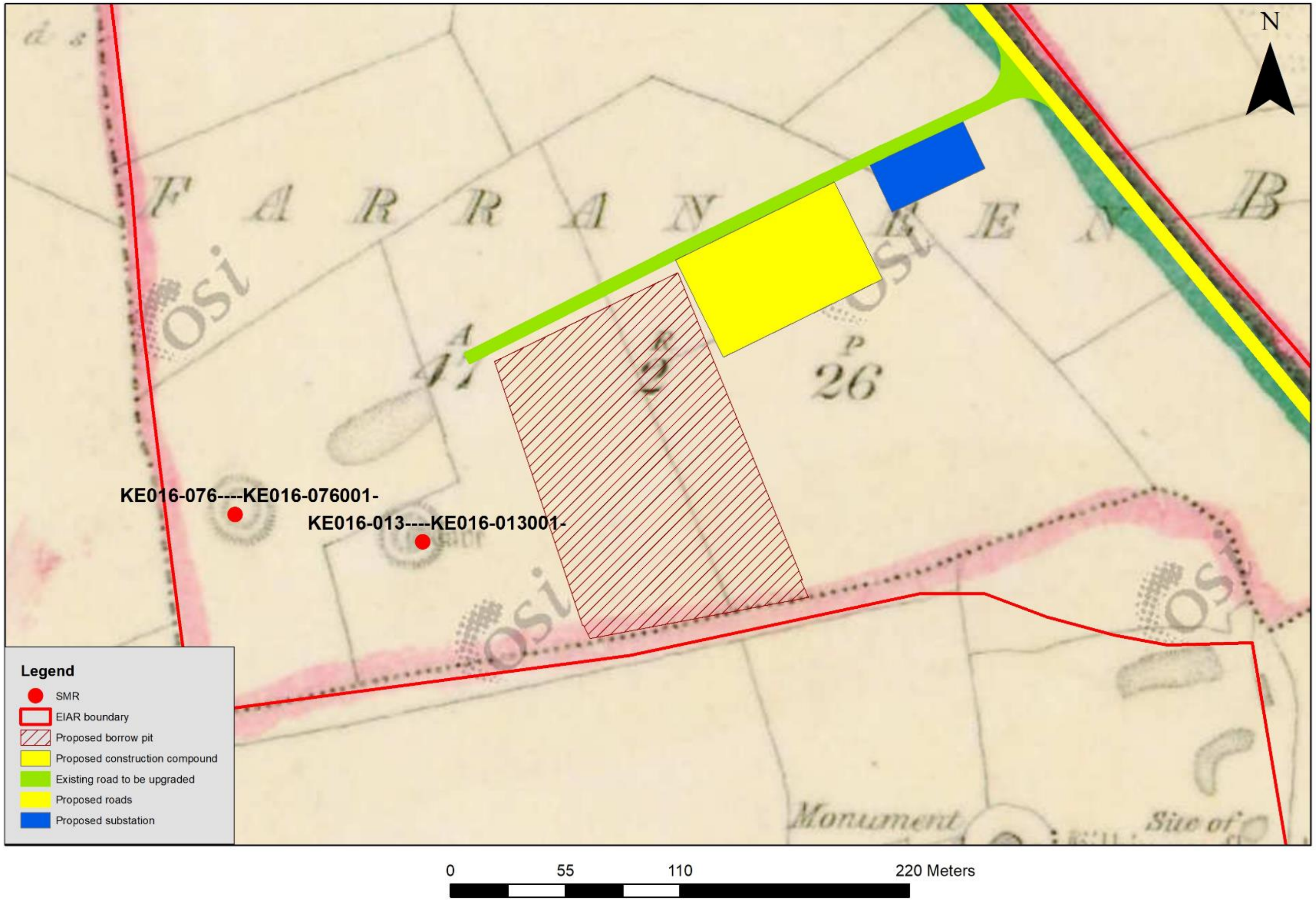


Figure 12.13: KE016-013– and KE016-076– in relation to proposed borrow pit and substation on 1st edition OS background.

12.3.1.4 Recorded Monuments within 5km of the proposed Turbines

One hundred and ninety-nine (199) monuments are located within 5km of the nearest proposed turbine and are listed below in Table 12.4. The distance (5km) criteria methodology is described in Section 12.2.5. The monuments are labelled from 1-199 (Map ID) for ease of reference on Figure 12.14. Monuments within 5 kilometres of the proposed turbines are included here for the purpose of assessing potential visual impacts in the wider landscape setting only. The table also includes the monuments within the wind farm EIAR boundary as discussed above in section 12.3.1.3.

Only two of the 199 monuments are located within 1km of the nearest proposed turbine. Thirty-six monuments are located between 1 and 2km from the nearest proposed turbine. Forty-six are located between 2 and 3km of the nearest proposed turbine with 53 monuments located between 3 and 4km from the nearest proposed turbine. The remaining sixty-two monuments are located between 4 and 5km from the nearest proposed turbine. The classification of monuments by type is depicted in Figure 12.15. Direct and Indirect effects are addressed below in Section 12.5 below.

The majority of monument types within 5km of the nearest proposed turbine are ringforts (96), enclosures (21) and souterrains (13), all of which date to the early medieval period. Monuments with religious associations including churches, graveyards, burial grounds (including children's burial grounds), graveyards, ecclesiastical enclosures, holy wells and round towers are also well represented, accounting for thirty-two of the total. The remainder of monuments occur in lower numbers (1-3).

Table 12.4: RMPs within 5km of the nearest proposed turbine

Map ID	RMP NO.	ITM E	ITM N	DESCRIPTION	TOWNLAND	WTG ID	DISTANCE (M)
1	KE009-088—	489718	633051	Road - unclassified togher	DYSERT MARSHES	T2	230
2	KE015-039—	487947	630745	Ringfort - rath	MUCKENAGH (Clanmaurice By., Kiltomy ED)	T7	889
3	KE015-038—	487656	631335	Ringfort - rath	MUCKENAGH (Clanmaurice By., Kiltomy ED)	T7	1057
4	KE016-002—	489879	630957	Redundant record	BALLYNAGA RE	T6	1104
5	KE016-001—	490174	631192	Ringfort - rath	BALLYNAGA RE	T4	1117
6	KE009-056004-	488082	633678	Religious house - Augustinian canons	RATTOO	T1	1153
7	KE015-045—	487490	631090	Ringfort - rath	MUCKENAGH (Clanmaurice	T7	1221

Map ID	RMP NO.	ITM E	ITM N	DESCRIPTION	TOWNLAND	WTG ID	DISTANCE (M)
					By., Kiltomy ED)		
8	KE016-003—	489834	630712	Mound	BALLYNAGARE	T7	1232
9	KE009-056—	487888	633641	Settlement deserted - medieval	RATTOO	T1	1327
10	KE010-081—	490936	632152	Redundant record	CURRAGHCRONEEN	T4	1338
11	KE009-073—	487507	632696	Ringfort - rath	SLEVEEN	T5	1342
12	KE009-089—	487848	633611	Ecclesiastical enclosure	RATTOO	T1	1358
13	KE009-056003-	487835	633610	Church	RATTOO	T1	1371
14	KE009-056005-	487827	633614	Graveyard	RATTOO	T1	1379
15	KE009-056006-	487823	633615	Memorial stone	RATTOO	T1	1384
16	KE009-056001-	487814	633632	Round tower	RATTOO	T1	1396
17	KE009-056002-	487815	633636	Sheela-na-gig	RATTOO	T1	1396
18	KE009-072—	487235	632479	Ringfort - rath	GLANERDALL IV	T5	1486
19	KE009-072001-	487225	632479	Souterrain	GLANERDALL IV	T5	1496
20	KE016-004002-	490053	630512	Ringfort - rath	BALLYNAGARE	T7	1516
21	KE016-004001-	490067	630508	Ecclesiastical enclosure	BALLYNAGARE	T7	1531
22	KE009-091—	488392	634702	Enclosure	BALLYHORGAN	T1	1608
23	KE009-071—	487073	632483	Ringfort - rath	GLANERDALL IV	T5	1640
24	KE009-071001-	487073	632483	Souterrain	GLANERDALL IV	T5	1640
25	KE016-004003-	490142	630364	Ringfort - rath	BALLYNAGARE	T7	1666

Map ID	RMP NO.	ITM E	ITM N	DESCRIPTION	TOWNLAND	WTG ID	DISTANCE (M)
26	KE016-010—	489824	629945	Ringfort - rath	CLOGHER (Clanmaurice By., Lixnaw ED)	T7	1687
27	KE010-045—	490466	634451	Enclosure	BALLYOUNEE N	T1	1738
28	KE009-070—	486935	632400	Ringfort - rath	GLANERDALL IV	T5	1748
29	KE016-011—	490074	630115	Enclosure	CLOGHER (Clanmaurice By., Lixnaw ED)	T7	1751
30	KE010-062002-	491288	632765	Ecclesiastical enclosure	DYSERT	T2	1785
31	KE010-062—	491292	632762	Church	DYSERT	T2	1789
32	KE010-062001-	491293	632760	Graveyard	DYSERT	T2	1790
33	KE009-055—	487801	634524	Ringfort - rath	BISHOPSCOU RT NORTH	T1	1839
34	KE015-058—	488389	629360	Ringfort - rath	COOLARUAN E,KILTOMY	T7	1875
35	KE009-068—	486715	632004	Ritual site - holy well	LISNAGONEE NY	T5	1911
36	KE016-076—	490270	629970	Ringfort - rath	FARRANDEEN	T7	1995
37	KE016-076001-	490270	629970	Mound	FARRANDEEN	T7	1995
38	KE015-059—	488848	629214	Hermitage	LIXNAW	T7	1999
39	KE009-069—	486709	632605	Ringfort - rath	GLANERDALL IV	T5	2024
40	KE009-054—	487836	634823	Ringfort - rath	BISHOPSCOU RT NORTH	T1	2028
41	KE016-005—	490542	630282	Enclosure	FARRANDEEN	T6	2050
42	KE015-060001-	489158	629199	House - indeterminate date	LIXNAW	T7	2059
43	KE016-013—	490360	629957	Ringfort - rath	FARRANDEEN	T7	2074
44	KE016-013001-	490360	629957	Souterrain	FARRANDEEN	T7	2074

Map ID	RMP NO.	ITM E	ITM N	DESCRIPTION	TOWNLAND	WTG ID	DISTANCE (M)
45	KE015-055—	487781	629287	Redundant record	KILTOMY	T7	2132
46	KE015-051—	487014	629833	Ringfort - rath	AGHABEG EAST	T7	2180
47	KE015-060—	489215	629088	Castle - Anglo-Norman masonry castle	LIXNAW	T7	2180
48	KE016-012—	490109	629505	Ringfort - rath	MONUMENT	T7	2207
49	KE009-053—	487225	634408	Enclosure	BISHOPSCOU RT SOUTH	T1	2240
50	KE015-056001-	487803	629157	Church	KILTOMY	T7	2241
51	KE015-056002-	487801	629157	Inscribed stone	KILTOMY	T7	2242
52	KE015-056003-	487814	629151	Graveyard	KILTOMY	T7	2242
53	KE009-066—	486402	632240	Ringfort - rath	LISNAGONEE NY	T5	2242
54	KE015-054—	487534	629229	Redundant record	KILTOMY	T7	2300
55	KE015-052—	487129	629524	Ringfort - rath	AGHABEG EAST	T7	2307
56	KE009-039—	488418	635518	Ringfort - rath	LEAGH	T1	2347
57	KE015-137—	489398	628965	Redundant record	LIXNAW	T7	2347
58	KE009-067—	486283	632123	Ringfort - rath	LISNAGONEE NY	T5	2349
59	KE016-014001-	490597	629799	Church	MONUMENT	T7	2358
60	KE015-050—	486672	629959	Ringfort - rath	AGHABEG EAST	T7	2387
61	KE009-065—	486251	632197	Ringfort - rath	LISNAGONEE NY	T5	2387
62	KE009-038—	487927	635341	Ringfort - rath	SHEEPWALK	T1	2394
63	KE016-014002-	490648	629802	Monumental structure	MONUMENT	T7	2398
64	KE009-064—	486231	632290	Ringfort - rath	LISNAGONEE NY	T5	2418

Map ID	RMP NO.	ITM E	ITM N	DESCRIPTION	TOWNLAND	WTG ID	DISTANCE (M)
65	KE009-064001-	486231	632290	Souterrain	LISNAGONEE NY	T5	2418
66	KE015-057—	487874	628893	Ringfort - rath	GORTANEAR E (Clanmaurice By., Kilcaragh Par.)	T7	2460
67	KE009-037—	487912	635520	Enclosure	SHEEPWALK	T1	2556
68	KE010-047002-	491870	633942	Burial ground	KILLARIDA	T2	2559
69	KE016-015—	491131	630095	Ringfort - rath	BALLINTOGH ER	T4	2563
70	KE010-047001-	491888	633945	Ecclesiastical enclosure	KILLARIDA	T2	2576
71	KE010-047003-	491900	633962	Church	KILLARIDA	T2	2594
72	KE010-046001-	491794	634251	Burial ground	KILLARIDA	T2	2628
73	KE015-037—	485926	631639	Ringfort - rath	KNOCKERCR EEVEEN	T5	2718
74	KE010-048—	492019	634000	Children's burial ground	KILLARIDA	T2	2719
75	KE010-048001-	492019	634000	Enclosure	KILLARIDA	T2	2719
76	KE016-016—	491423	630091	Ringfort - rath	BALLINTOGH ER	T4	2750
77	KE015-082—	487990	628531	Church	GORTANEAR E (Clanmaurice By., Kiltomy Par.)	T7	2771
78	KE009-036—	488093	635876	Ringfort - rath	LEAGH	T1	2797
79	KE009-052—	486482	634280	Ringfort - rath	BENMORE	T1	2862
80	KE009-035—	487460	635613	Redundant record	LEAGH	T1	2880
81	KE015-084—	489772	628449	Ritual site - holy well	BALLYNAGER AGH	T7	2958
82	KE009-063—	485716	632501	Enclosure	CORBALLY (Clanmaurice By.)	T5	2961

Map ID	RMP NO.	ITM E	ITM N	DESCRIPTION	TOWNLAND	WTG ID	DISTANCE (M)
83	KE016-034—	490112	628580	Enclosure	BALLYNAGER AGH	T7	2980
84	KE015-036—	485666	631593	Children's burial ground	DROMMARTI N	T5	2982
85	KE010-031—	490007	636189	Ringfort - rath	MWEEVUCK	T1	3014
86	KE010-035001-	491168	635606	Enclosure	KILTEEAN	T1	3056
87	KE010-035002-	491168	635606	Children's burial ground	KILTEEAN	T1	3056
88	KE010-034—	490859	635870	Children's burial ground	KILTEEAN	T1	3081
89	KE009-034—	487436	635906	Ringfort - rath	LEAGH	T1	3134
90	KE009-042002-	489605	636418	Mound	MWEEVUCK	T1	3154
91	KE009-042—	489603	636427	Ringfort - cashel	MWEEVUCK	T1	3163
92	KE009-042001-	489612	636426	Mound	MWEEVUCK	T1	3163
93	KE015-083—	488583	628047	Ringfort - rath	CUNNAGARE	T7	3163
94	KE015-083001-	488583	628047	Fulacht fia	CUNNAGARE	T7	3163
95	KE009-041—	489409	636453	Ringfort - rath	MWEEVUCK	T1	3168
96	KE009-061—	485618	633015	Ringfort - rath	BALLINBRAN HIG	T5	3189
97	KE009-061001-	485618	633015	Souterrain	BALLINBRAN HIG	T5	3189
98	KE010-033—	490458	636212	Ringfort - rath	AHASCRA	T1	3190
99	KE010-032—	490264	636292	Ringfort - rath	AHASCRA	T1	3191
100	KE009-043—	489829	636515	Ringfort - rath	MWEEVUCK	T1	3288
101	KE010-049—	492237	634883	Road - unclassified togher	DROMALUGH T,KILLARIDA	T2	3342
102	KE009-062004-	485237	632072	Well	KNOCKERCR EEVEEN	T5	3391

Map ID	RMP NO.	ITM E	ITM N	DESCRIPTION	TOWNLAND	WTG ID	DISTANCE (M)
103	KE009-062001-	485237	632072	House - indeterminate date	KNOCKERCREEVEEN	T5	3391
104	KE009-062002-	485237	632072	House - indeterminate date	KNOCKERCREEVEEN	T5	3391
105	KE009-062003-	485237	632072	Redundant record	KNOCKERCREEVEEN	T5	3391
106	KE009-062—	485237	632072	Ringfort - cashel	KNOCKERCREEVEEN	T5	3391
107	KE016-017—	491568	629387	Enclosure	CLOONCOLLA	T4	3392
108	KE009-033—	487470	636258	Ringfort - rath	ARDCULLEN, LEAGH	T1	3416
109	KE009-033001-	487470	636258	Souterrain	LEAGH	T1	3416
110	KE010-030—	490285	636536	Ringfort - rath	AHASCRA	T1	3428
111	KE009-040—	489637	636702	Ringfort - rath	MWEEVUCK	T1	3440
112	KE009-051—	485623	633797	Ringfort - cashel	RAHEALY	T5	3523
113	KE009-051001-	485608	633800	Souterrain	RAHEALY	T5	3537
114	KE015-088—	488914	627675	Ringfort - rath	LISCULLANE (Clanmaurice By., Kiltomy Par.)	T7	3539
115	KE015-087—	488539	627618	Ringfort - rath	LISCULLANE (Clanmaurice By., Kiltomy Par.)	T7	3594
116	KE016-020—	492310	629720	Ringfort - rath	BALLYHORGAN SOUTH	T4	3641
117	KE015-025—	484907	631925	Ringfort - rath	DROMMARTIN	T5	3719
118	KE016-018—	492078	629368	Ringfort - rath	BALLYHENNESSY	T4	3726
119	KE009-060001-	484895	632170	Souterrain	DROMMARTIN,KNOCKERCREEVEEN	T5	3737

Map ID	RMP NO.	ITM E	ITM N	DESCRIPTION	TOWNLAND	WTG ID	DISTANCE (M)
120	KE009-060—	484893	632168	Ringfort - cashel	DROMMARTIN,KNOCKERCREEVEEN	T5	3739
121	KE015-026—	484852	631806	Ringfort - rath	BALLINCROSSIG,DROMMARTIN	T5	3777
122	KE010-050—	493216	633693	Redundant record	DROMMURRIN	T2	3778
123	KE009-023—	488647	637043	Enclosure	DERRYCO	T1	3785
124	KE015-024—	484814	631851	Ringfort - rath	BALLINCROSSIG,DROMMARTIN	T5	3813
125	KE015-085—	487338	627633	Ringfort - rath	DEERPARK (Clanmaurice By.)	T7	3828
126	KE009-050—	485304	633906	Ringfort - cashel	ADDERGOWN	T5	3853
127	KE009-050001-	485304	633906	Souterrain	ADDERGOWN	T5	3853
128	KE016-022—	492813	630014	Ringfort - rath	BALLYHORGAN SOUTH	T4	3859
129	KE009-076—	488904	637151	Bridge	DERRYCO,MWEEVOO	T1	3866
130	KE016-021—	492601	629688	Ringfort - rath	BALLYHORGAN SOUTH	T4	3883
131	KE009-022001-	488506	637134	Graveyard	DERRYCO	T1	3897
132	KE009-022002-	488506	637134	Ecclesiastical enclosure	DERRYCO	T1	3897
133	KE009-022—	488509	637137	Church	DERRYCO	T1	3899
134	KE015-023—	484719	631758	Ringfort - rath	BALLINCROSSIG,TULLAGHNA	T5	3912
135	KE016-019—	491962	628992	Ringfort - rath	BALLYHENNESSY	T7	3939
136	KE015-086—	487364	627480	Fulacht fia	DEERPARK (Clanmaurice By.)	T7	3962

Map ID	RMP NO.	ITM E	ITM N	DESCRIPTION	TOWNLAND	WTG ID	DISTANCE (M)
137	KE015-081—	487195	627514	Ringfort - rath	DEERPARK (Clanmaurice By.)	T7	3991
138	KE016-024—	492334	629230	Enclosure	BALLYHORGAN SOUTH	T4	4001
139	KE015-089—	489168	627195	Enclosure	LISCULLANE (Clanmaurice By., Kilcaragh Par.)	T7	4039
140	KE009-083—	485000	633748	Fulacht fia	ADDERGOWN	T5	4045
141	KE010-004—	490368	637163	Children's burial ground	BALLYCONRY	T1	4050
142	KE009-017—	487154	636819	Ringfort - rath	KNOPPOGE NORTH	T1	4060
143	KE016-023—	492644	629463	Enclosure	BALLYHORGAN SOUTH	T4	4061
144	KE009-017001-	487159	636845	Road - road/trackway	KNOPPOGE NORTH	T1	4080
145	KE015-022—	484563	631529	Ringfort - rath	BALLINCROSSIG	T5	4085
146	KE009-032—	486739	636582	Ringfort - rath	KNOPPOGE (Clanmaurice By.)	T1	4088
147	KE009-090—	487384	637032	Ritual site - holy well	KNOPPOGE NORTH	T1	4142
148	KE015-126—	488145	627081	Ringfort - rath	LISCULLANE (Clanmaurice By., Kilcaragh Par.)	T7	4165
149	KE015-135—	484457	631721	Ringfort - rath	BALLINCROSSIG	T5	4175
150	KE010-037—	492672	635677	Ringfort - rath	DROMALUGHT	T2	4175
151	KE009-021—	487793	637281	Ringfort - rath	AYLE	T1	4217
152	KE015-020—	484406	631949	Ringfort - rath	TULLAGHNA	T5	4220

Map ID	RMP NO.	ITM E	ITM N	DESCRIPTION	TOWNLAND	WTG ID	DISTANCE (M)
153	KE015-080—	486922	627376	Ringfort - rath	GORTADRISLIG	T7	4227
154	KE010-051—	493605	634056	Ringfort - rath	DROMMURRIN	T2	4240
155	KE015-077—	485958	627931	Ringfort - rath	BALLINCLOHER EAST	T7	4276
156	KE015-021—	484318	631822	Ringfort - rath	TULLAGHNA	T5	4310
157	KE009-084—	487565	637303	Fulacht fia	AYLE	T1	4318
158	KE009-016—	486543	636815	Ringfort - rath	KNOPPOGE (Clanmaurice By.)	T1	4392
159	KE009-016001-	486543	636815	Souterrain	KNOPPOGE (Clanmaurice By.)	T1	4392
160	KE010-052—	493771	634123	Ringfort - rath	DROMMURRIN	T2	4418
161	KE015-121—	488655	626762	Ringfort - rath	LISCULLANE (Clanmaurice By., Kilcaragh Par.)	T7	4446
162	KE015-017—	484160	631956	Ringfort - rath	TULLAGHNA	T5	4466
163	KE015-076—	485805	627760	Ringfort - rath	BALLINCLOHER	T7	4506
164	KE015-018—	484130	631489	Ringfort - rath	BALLINCROSSIG	T5	4520
165	KE015-018001-	484130	631489	Hut site	BALLINCROSSIG	T5	4520
166	KE015-018002-	484130	631489	Hut site	BALLINCROSSIG	T5	4520
167	KE009-085—	484296	633529	Fulacht fia	BALLINBRANHIG	T5	4607
168	KE016-063—	490477	626950	Enclosure	BALLINCRAHEEN	T7	4612
169	KE016-063001-	490477	626950	Souterrain	BALLINCRAHEEN	T7	4612

Map ID	RMP NO.	ITM E	ITM N	DESCRIPTION	TOWNLAND	WTG ID	DISTANCE (M)
170	KE015-075—	485658	627742	Standing stone	BALLINCLOHER	T7	4615
171	KE009-086—	484256	633449	Fulacht fia	BALLINBRANHIG	T5	4618
172	KE009-015—	486555	637118	Souterrain	KNOPPOGE (Clanmaurice By.)	T1	4632
173	KE015-079—	486281	627252	Ringfort - rath	GRANSHAGH	T7	4640
174	KE016-035—	491858	627788	Ringfort - rath	CLONDOUGLAS	T7	4651
175	KE015-122—	488910	626556	Ringfort - rath	LISCULLANE (Clanmaurice By., Kilcaragh Par.)	T7	4656
176	KE009-049—	484434	634012	Ringfort - cashel	ADDERGOWN	T5	4669
177	KE015-118—	488112	626575	Enclosure	AGHACOORA	T7	4671
178	KE010-063—	494299	631827	Children's burial ground	KILLACRIM	T4	4712
179	KE016-036—	491550	627449	Ringfort - rath	CLONDOUGLAS	T7	4714
180	KE009-018—	488128	637906	Ringfort - rath	RAHOONAGH	T1	4728
181	KE015-120—	488387	626462	Fulacht fia	AGHACOORA	T7	4757
182	KE015-078—	486012	627279	Ringfort - rath	GRANSHAGH	T7	4764
183	KE015-016—	483853	631776	Ringfort - rath	TULLAGHNA	T5	4776
184	KE015-119—	488299	626448	Ringfort - rath	AGHACOORA	T7	4777
185	KE016-064—	490550	626738	Ringfort - rath	BALLYREEHAN EAST	T7	4835
186	KE009-020—	489915	638083	Enclosure	GORTAGURRANE WEST	T1	4847
187	KE016-025—	493015	628697	Ringfort - rath	MUCKENAGH (Clanmaurice By., Ballyhorgan ED)	T4	4857

Map ID	RMP NO.	ITM E	ITM N	DESCRIPTION	TOWNLAND	WTG ID	DISTANCE (M)
188	KE015-019—	483817	631256	Ringfort - rath	DROMKEEN EAST	T5	4859
189	KE015-019001-	483810	631260	House - indeterminate date	DROMKEEN EAST	T5	4865
190	KE010-038—	494359	633567	Ritual site - holy well	GORTACROS SANE	T2	4886
191	KE010-036—	492843	636527	Ringfort - rath	BALLYEGAN (Iraghticonnor By.)	T2	4890
192	KE016-037—	491806	627407	Ringfort - rath	CLONDOUGL AS	T7	4905
193	KE009-012—	486731	637551	Enclosure	KNOPPOGE (Clanmaurice By.)	T1	4905
194	KE009-080—	487084	637735	Souterrain	DERRYRA MORE	T1	4906
195	KE009-013—	486745	637563	Ritual site - holy well	KNOPPOGE (Clanmaurice By.)	T1	4909
196	KE010-053—	494399	633608	Enclosure	GORTACROS SANE	T2	4931
197	KE015-035—	483773	631037	Ringfort - cashel	DROMKEEN EAST	T7	4936
198	KE010-001—	490660	638053	Ringfort - rath	MOYBELLA NORTH	T1	4987
199	KE009-019—	489963	638221	Enclosure	LISLADRAUN	T1	4990

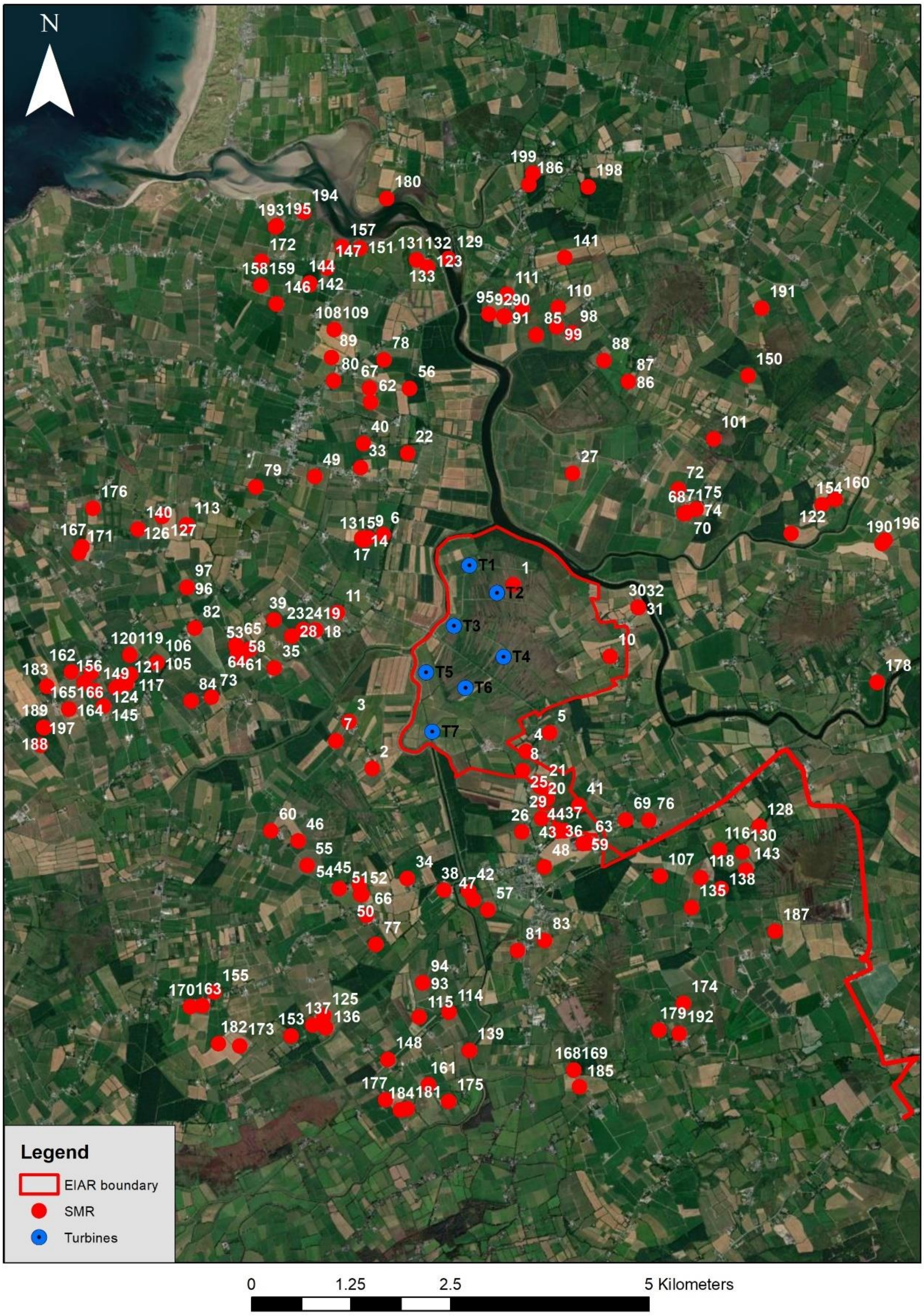


Figure 12.14: SMRs within 5km of the nearest proposed turbine.

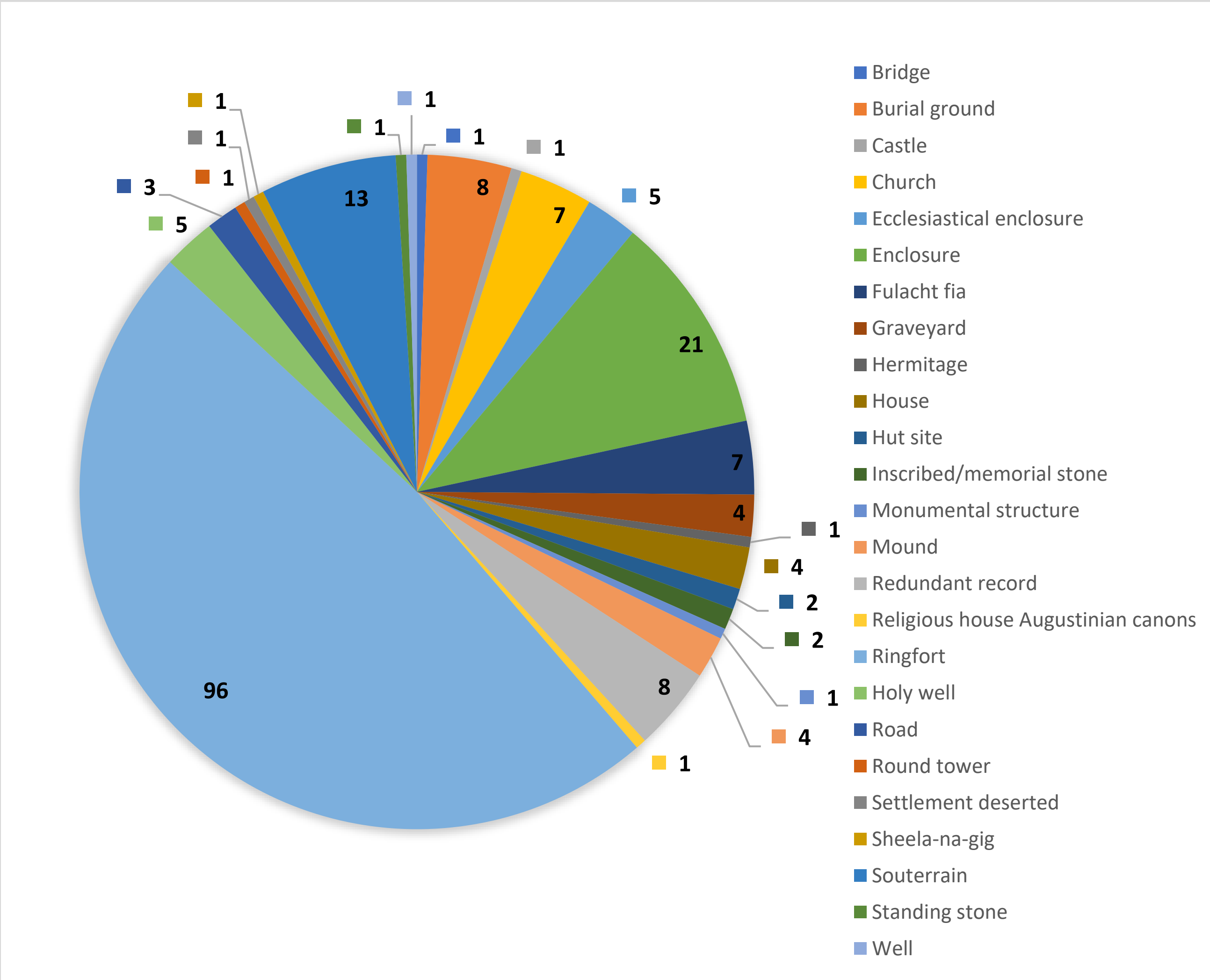


Figure 12.15: Monument numbers within 5km of the nearest proposed turbine.

12.3.1.4.1 *The Prehistoric Period*

The prehistoric period is represented only by seven fulacht fia and one standing stone. Fulacht fias may span from the Bronze Age (c. 2400-500 BC) to the early medieval period (5th - 12th century AD) but more typically are accepted to belong to the Bronze Age. They consist of a horseshoe, circular or irregularly shaped mound of material consisting of burnt stones, ash and charcoal with no surface evidence of a trough or depression. Levelled examples can appear as a spread containing burnt stones.

Standing stones are a common feature of the prehistoric Irish landscape consisting of single, upright stones. They are known by various names such as gallán, dallán and long stone. All standing stones are not necessarily of the same date or have the same function. Excavations of standing stones have shown that some mark prehistoric burials and some may have had a ritual or commemorative function. They have similar axis to standing stone pairs and may therefore date to the Bronze Age (2400-500BC).

A number of other monuments may date to the prehistoric period but their dates can span from prehistory through to the Medieval period. One such site type is hut sites of which two are located within 5km of the proposed turbines. The primary function and date of hut sites is slightly ambiguous. Examples of hut sites are known throughout the country, particularly in upland regions, and are frequently associated with the practice of transhumance or booleying. Transhumance refers to the practice of the seasonal movement of people and their livestock typically to higher pastures in the summer and lower valleys in the winter. In Ireland this practice is known as booleying and is believed to date to the early medieval period, although it continued well into the nineteenth and early twentieth century.

Other uses for hillside huts has been noted at Mount Brandon, County Kerry, where it is suggested that they functioned as temporary habitations for seabourne pilgrims. It is also thought that they were used as habitation sites such as booleying huts during the year when pilgrimage was not taking place. An extensive series of pre-bog walls was also noted on the southern slopes of Mount Brandon. It is noted in that instance that although pre-dating the bog, the peat may still have been growing well into the medieval period. In this regard, such walls could be early medieval in date rather than prehistoric (Archaeology Ireland Heritage Guide No. 29). Furthermore, the potentially lengthy chronology of hut sites means that while some may be prehistoric others may date to the early or later medieval period or indeed to more modern times (ibid.).

12.3.1.4.2 *The Early Medieval Period*

The majority of monuments within 5km of the nearest proposed turbine consist of those which may be definitively attributed to the Early Medieval period and comprise ringforts, enclosures and souterrains which dominate the archaeological landscape within the 5km study area. Ringforts comprise earthen monuments while cashels take a similar form to the latter but are constructed using stone. Enclosures may represent the remains of ringforts or cashels but may not retain enough features to classify them as such or fall outside the acceptable size range for these monuments. Ringforts consist of a circular or roughly circular area enclosed by an earthen bank formed by material thrown up from the digging of a concentric ditch on its outside. Ringforts are usually enclosed by a single bank (univallate) while bivallate or trivallate ringforts i.e. those enclosed by double or triple rings of banks are less common. The number of banks and ditches enclosing these monuments are considered to reflect the status of the site, rather than the strengthening of its defences. Archaeological excavation has shown that the majority of ringforts functioned as enclosed farmsteads, built during the Early Christian period (5th – 9th century A.D.). Excavation within the interior of the monuments has traced the remains of circular and rectangular dwelling houses as well as smaller huts probably used to stall animals. The enclosing earthworks would also have protected domestic livestock from natural predators such as wolves and foxes. Souterrains are frequently associated with ringforts, cashels and enclosures. Souterrains derive their name from the French *sous terrain* meaning 'underground' and comprise an underground structure consisting of one or more chambers connected by narrow passages or creepways, usually constructed of drystone-walling with a lintelled roof over the passages and a corbelled roof over the chambers. Most souterrains appear to have been built in the early medieval period by ringfort inhabitants (c. 500 - 1000 AD) as a defensive feature and/or for storage.

12.3.1.4.3 Sites with religious or ritual association

Burial Grounds including Children's Burial Grounds

Eight burial grounds, six of which are children's burial grounds, are located within 5km of the nearest proposed turbine. Burial grounds comprise an area of ground, set apart for the burial of the dead, not associated with a church and may date from the medieval period (5th - 16th centuries AD) onwards.

Children's burial grounds consist of an area of unconsecrated ground for the interment of unbaptised or stillborn children, often known under various Irish names: Cillín, Caldragh, Ceallúnach or Calluragh. The graves were generally marked by simple, low, upright stones or slabs almost invariably without any inscription or other carving. This burial practice may be medieval in origin and continued in Ireland until the 1960s.

All of the burial grounds within 5km of the nearest proposed turbine are located in excess of 2km from same.

Church and graveyards

Seven churches and four graveyards are located within 5km of the nearest proposed turbine. The nearest comprises the church and graveyard at Rattoo (Map ID 13 and 14) which are situated c. 1.3km from the nearest proposed turbine T1. These monuments are described above in section 12.3.1.2.1. Approximately 1.7km to the east of T2 is the church and graveyard at Dysert (Map ID 31 and 32) which are also associated with an ecclesiastical enclosure (Map ID 30 see below). Furthermore, the site at Dysert is believed to have been connected to the ecclesiastical site at Rattoo by 'Bohergarraunbaun' the togher KE009-088 which extends through the proposed wind farm. The church at Dysert is described on the HEV as follows:

KE010-062—
Class: Church
Townland: DYSERT
Scheduled for inclusion in the next revision of the RMP: Yes
Description: Dysert Church (in ruins), graveyard. This church stands at the N end of Dysert graveyard. The church is aligned E-W along the axis. It was originally rectangular but the full dimensions cannot be taken for the E wall has disappeared. It measures 6.5m wide externally and the walls are .6m thick. Only 7.3m of the N wall remains to c 1m high. The S wall rises to a maximum height of 3m. There is a gap of 3m, 2.2m from the W gable, which could possibly have been the entrance. The W wall is the highest remaining wall, rising to over 3m high, but it is extremely overgrown with ivy. The remains of a buttress can be seen at its N end. This buttress extends .35m from the wall and is 8.5m long. No trace of masonry suggesting windows or doors could be found in the walls themselves or in the surrounding graveyard. Both its name (Dysert) and its location would indicate that the site was a hermitage. The site is referred to in the Uí Fhiachrach genealogies (O'Donovan, 1844, 38-39). It is also mentioned as a parish church in later medieval sources. It was situated in the territory of the Alltraighe (Ó Corráin, 1969, 28).

Plate 12.11: Dysert church and graveyard KE010-062—, looking NNE.

Ecclesiastical Enclosures

Five ecclesiastical enclosures (Map ID 12, 21, 30, 70 and 132) are located within 5km of the nearest proposed turbine. Some are associated with extant churches, such as that at Dysert, while others including that at Ballynagare (Map ID 21) are not. Such enclosures generally comprise a large oval or roughly circular area, usually over 50m in diameter, defined by a bank/banks and external fosse/fosses or drystone wall/walls, enclosing an early medieval church or monastery and its associated areas of domestic and industrial activity. They date to the early medieval period (5th-12th centuries AD).

The ecclesiastical enclosure at Rattoo is situated c. 1.3km from the nearest proposed turbine, T1 and is described on the HEV as follows:

KE009-089—
Class: Ecclesiastical enclosure
Townland: RATTOO
Scheduled for inclusion in the next revision of the RMP: Yes
Description: The ecclesiastical enclosure at Rattoo was probably connected to the one at Dysert (KE010-062002-) by an ancient roadway or togher (KE009-088—); according to the OSNB (1841) 'An ancient road now called White Horse ridge extends from the old church of Dysert, through the bog, as far as Rattoo'. Hurley (1982, 321) states that the enclosure can be recognised by crop marks from aerial photographs. However, no surface remains of the enclosure survive today, though the church (KE009-056003-) and round tower (KE009-056001-) are in a good state of preservation.

Holy Wells

Five holy wells are located within 5km of the nearest proposed turbine. They comprise a well or spring, though in some unusual cases a natural rock basin, which usually bears a saint's name and is often reputed to possess miraculous healing properties. These may have their origins in prehistory but are associated with devotions from the medieval period (5th-16th centuries AD) onwards.

Round Tower

The round tower at Rattoo (Map ID 16) is situated c. 1.3km north-west of the nearest proposed turbine, T1 and is described above in section 12.3.1.2.1. It is associated with the aforementioned church, graveyard and ecclesiastical enclosure at Rattoo and is a dominant feature in the landscape surrounding the proposed wind farm.

Religious House – Augustinian canons

Also at Rattoo is a religious house – Augustinian canons (Map ID 6) which is situated c. 1.1 km to the north-west of the nearest proposed turbine T1. This monument is described in section 12.3.1.2.1 above. Religious houses of the Augustinian canons are listed in A. Gwynn and R.N. Hadcock 'Medieval Religious Houses Ireland' (1970) (Reprinted 1988). Irish Academic Press, Dublin. They date to the later medieval period (12th-16th centuries AD).

12.3.1.4.4 *Medieval Period*

Castles

One castle (Map ID 47) is located c. 2.1km south of the nearest proposed turbine T7 in the townland of Lixnaw. While the possible site of the castle can still be traced, few masonry remains survive. Masonry castles were constructed in Ireland by the Anglo-Normans between the late 12th and the early 14th century AD.

12.3.1.4.5 *Roads/Toghers*

Three roads/toghers are located within 5km of the nearest proposed turbine. The closest of these is ‘Bohergarraunbaun’ KE009-088 which extends through the proposed development site and reputedly provided a route across the marshes from the ecclesiastical site at Dysert to the important ecclesiastical centre at Rattoo. The monument is described above in section 12.3.1.3.1.

12.3.1.5 Excavations Database

The Excavations Database contains details regarding licensed excavations undertaken in Ireland from 1985-2020. The database was searched for any such excavations undertaken on or within close proximity to the proposed wind farm site. The only entry is for the townland of Rattoo to the north-west of the proposed development site as follows:

2011:339 - RATTOO, Kerry
County: Kerry Site name: RATTOO
Sites and Monuments Record No.: KE009:056 Licence number: C113; E4331
Author: Connie Kelleher
Site type: Round tower—monitoring
ITM: E 487815m, N 633635m
Latitude, Longitude (decimal degrees): 52.442658, -9.650170
Monitoring was carried out by the National Monuments Service in March 2011 during the digging of post-holes by the Office of Public Works for the erection of a safety fence within the ecclesiastical site and immediately adjacent to the round tower. A series of thirteen holes were hand-dug to take upright cement fencing posts.

Nothing of archaeological significance was encountered during the course of the work, apart from some fragments of metal that proved to be modern. The soil was a very rich brown earth and was loosely compact, indicative of ploughing activity in the area in the past. On average the fence post-holes measured c. 0.45m in width, while the depth ranged from 0.3m to 0.5m. One post-hole that was opened adjacent to the northern wall immediately outside the tower revealed the edge of the footings of the wall as well as signs of disturbance in the past. Fragments of mortared and unmortared stone were identified within the opening, as was silty, brownish-grey clay at the base. A thin layer of charcoal was also evident on top of the clay, but this was so slight that it did not present a viable sample for dating. Nothing else of cultural significance was identified during the course of the works.

District Archaeologist, National Monuments Service, Department of Arts, Heritage and the Gaeltacht.

12.3.1.6 Townlands and administrative boundaries

Townlands and administrative boundaries may indicate the presence of archaeological features within a development site. Administrative counties are subdivisions of pre-established counties which were formed for administrative purposes in the nineteenth and twentieth centuries. Baronies are administrative units larger than civil parishes and originally established as the primary subdivision of counties by the British administration in Ireland. Irish baronies which were formed at the time of the Norman conquest were usually named either after Irish territories, or from places which had been of importance in pre-Norman times. Irish baronies came into existence at different periods. The division of Ireland into counties and baronies was a process which continued down to the reign of James I. The original baronies in Ireland were the domains of the Norman barons; in the final stage of development they were divisions of counties created merely for greater convenience of administration. The word barony is of feudal origin, and was applied to a tenure of a baron, that is, of one who held his land by military service, either directly from the king, or from a superior feudal lord who exercised royal privileges. The origin of the Irish barony (a division of land corresponding to the English hundred) is to be found in the grants of lands which were made to the barons of Leinster and the barons of Meath (Liam Price, 'Ráith Oinn', Éigse VII, lch. 186-7). Civil parishes are administrative units larger than townlands and based on medieval ecclesiastical parishes. Civil parishes, modern Catholic parishes and Church of Ireland parishes may differ in extent and in nomenclature. Counties are administrative units larger than baronies and originally established by the British administration in Ireland between the twelfth and the seventeenth centuries. Some of these were subsequently subdivided into smaller administrative county units.

Townlands are the smallest land units which were determined and established in the Irish administrative system in the first half of the nineteenth century. Many of the townlands were in existence prior to that. Townland names are a valuable source of information, not only on the topography, land ownership and land use within the landscape, but also on its history, archaeological monuments and folklore. Logainm.ie was utilised to ascertain the origin of the townland names.

Table 12.5: Townlands in the vicinity and within the proposed development

Townland Name	Meaning
Ballynagare (Baile na nGearradh)	Town of the cuts
Dysert Marshes (Currach an Dísirt)	Hermitage of the marsh
Dysert (An Díseart)	The hermitage or wilderness
Curraghcroneen (Currach Chróinín)	Cronin's moor

Rattoo (Ráth Tuaidh)	North fort
Farrandeen (Fearann Doinn)	Dunne's land
Monument (An Leacht)	In the Townland of Monument Farm on a round hill which commands a fine prospect of the adjacent country, stands a monumental tower, in which the second last of the Earls of Kerry lies interred. This monument occupies the site of a church called Kilbinnaun, i.e. the Church of St. Benignus, from which the townland now called Monument Farm was formerly called Kilbinnaun, and which ought to be its name still as the monument is not a century old.

12.3.1.7 Topographical Museum Files

Some of the locational information for stray finds can be gleaned from Heritage Maps (heritage maps.ie) where the National Museum have provided such data. Further information may be held in the topographical files of the National Museum of Ireland (NMI). Information on finds from the following townlands was provided by the NMI.

Table 12.6: Finds listed in the topographical files of the NMI.

NMIRegisterNo	SimpleName	Component	Townland	FindPlace
2014:34	Sample	Wood	DYSERT MARSHES	Tidal River Brick
2014:35	Sample	Wood	DYSERT MARSHES	Tidal River Brick
2014:36	Sample	Wood	DYSERT MARSHES	Tidal River Brick
2014:33	Sample	Wood	SLEVEEN	Under Sleveen bridge on River Brick
1960:779	Handle	Wood	MUCKENAGH	"Upper Muckenagh"

12.3.1.8 Cartographic Evidence

12.3.1.8.1 Down Survey maps

The Down Survey is a mapped survey undertaken in the mid-17th century. Using the Civil Survey as a guide, teams of surveyors, mainly former soldiers, were sent out under Petty's direction to measure every townland to be forfeited to soldiers and adventurers. The resulting maps, made at a scale of 40 perches to one inch (the modern equivalent being 1:50,000), were the first systematic mapping of a large area on such a scale attempted anywhere. The primary purpose of these maps was to record the boundaries of each townland and to calculate their areas with great precision. The maps are also rich in other detail showing churches, roads, rivers, castles, houses and fortifications. Most towns are represented pictorially and the cartouches, the decorative titles, of each map in many cases reflect a specific characteristic of each barony.

The Down Survey map for the barony of Clanmaurice in which the proposed development is located does not show a great level of detail for the area. The description of the barony is as follows:

The Barony of Clanmorris. In the County of Kerry The Arable of this barony is generally good for all sorts of Corne being wel mannurd wth Land or Dung especially in ye heart of ye country about Ardfert and Lisnaw ye Lo of Kerryes chiefe Place. The Fireing of this Barony is Turfe digged in Boggs or Mountaines. There are noe notable Passes in this Barony only the Cassan River wch in time of Flood or Full sea People or castle are ferried over in boats. There are two rivers running through part of this barony videt the Rivers of Smearlagh running northward through the east part of this barony out of ye mount called Slewlogher is reced into the sd River of Fearle nere the demolised Castle Ballenruddy belonging to Tho Joy deced wch river is not very considerable in time of Floods.

12.3.1.8.2 1st and 2nd Edition OS maps

The Ordnance Survey came to Ireland in 1824 in order to carry-out a precise admeasurement of the country's 60,000 or so townlands as a preliminary to the larger task of reforming Ireland's local taxation system. The townland boundaries were demarcated by a Boundary Commission, and the Ordnance Survey had the task of measuring them. In addition to boundaries the maps are truly topographical in content. Drawn at the large scale of six inches-to-one-mile (1:10,560) it was important to mark all buildings, roads, streams, placenames, etc, that were required for valuation purposes. Ultimately the maps were used as a basis for the rateable valuation of land and buildings in what became known as Griffith's Valuation. Working from north to south, the survey began in Antrim and Derry in 1829 and was completed in Kerry in 1842. It was published as thirty-two county maps between 1832 and 1846, the number of sheets per county varied from 153 for County Cork to 28 for Dublin, each of the 1,994 sheets in the series depicting an area 21,000 by 32,000 feet on the ground. Each county was projected on a different central meridian and so the maps of adjacent counties do not fit neatly together at the edges. Map content stops at the county lines.

The First Edition

The early Ordnance Survey maps are an unrivalled source for the period immediately before the Great Irish Famine (1847-50) when the population was at the highest level ever recorded. The maps depict an open landscape in much of the area of the proposed turbines and associated infrastructure given their location in bogland. As outlined above, the togher KE009-088 'Bohergarraunbaun' is depicted and named on the 1st edition OS map (Figure 12.11).

A number of items of cultural heritage merit are also shown on this edition of the OS map and are discussed in Section 12.4.2.2 below.

The Second Edition

The second edition OS map depicts the proposed development area in a similar manner to the earlier edition, being largely open with field divisions around the fringes of the bog. Cultural heritage items indicated on this edition of the map are discussed below.

12.3.1.9 Description of the proposed Development Area

The description of the proposed development area and photographic record is presented in Appendix 12.1.

12.3.2 Architectural and Cultural Heritage

12.3.2.1 Protected Structures within the proposed development site boundary

No Protected Structures which are subject to statutory protection are located within the proposed wind farm EIAR boundary (Protected Structures along the proposed grid connection route are presented separately in Section 12.4.2.1).

12.3.2.2 Protected Structures within 5km of the nearest proposed turbines

The RPS for County Kerry was added to the project base mapping. Structures within 5km are included here (See Section 12.2.5 above for distance criteria). The RPS is largely based on the NIAH and therefore some repetition/overlap occurs between both datasets. Fourteen RPS structures are located within 5km of the nearest proposed turbine. They are listed in Table 12.7 and are also shown on Figure 12.16. The distances to the relevant turbines are also detailed. All but one of the structures is also included in the NIAH and are referenced by their NIAH Reg. numbers.

The majority of structures are located within the villages of Ballyduff and Lixnaw and therefore their visual settings do not extend beyond the limits of those settlements. The ZTV shows, however, that there will be visibility of the proposed turbines from these locations. Direct and Indirect Impacts are discussed in Section 12.5 below.

Table 12.7: RPS structures within 5km of the nearest proposed turbines

RPS ID	NAME / STRUCTURE	LOCATION 1	ITM E	ITM N	WTG ID	DISTANCE (M)
21300909	Rattoo House	Ballyduff	487912	633792	T1	1352
21301502	Lixnaw Bridge	Lixnaw	488974	629257	T7	1970
21301503	Old Court	Lixnaw	489127	629202	T7	2050
21301601	Saint Michael's Catholic Church	Lixnaw	489989	629433	T7	2190

RPS ID	NAME / STRUCTURE	LOCATION 1	ITM E	ITM N	WTG ID	DISTANCE (M)
21301602	Kerry Monument	Kilbinane Hill	490649	629802	T7	2398
RPS-KY-009-002	Dwelling House	The Square, Ballyduff	486928	634788	T1	2693
21300903	Purcell's Bar	Main Street, Ballyduff	486973	634870	T1	2703
21300901	J. Browne	Main Street, Ballyduff	486935	634824	T1	2707
21300902	McEllistrim	Main Street, Balyldfuff	486948	634933	T1	2760
21300905	Cottage	Lacka East, Ballyduff	487184	635308	T1	2828
21300911	The Arches	Corbally	485690	632597	T5	3005
21300907	Thatched Cottage	Ardculen	488347	636248	T1	3066
21300910	House	Ballinbranhig	485522	632822	T5	3222
21300912	Bushmount House	Ballyduff	485148	632034	T5	3479

Figure 12.16: Record of Protected Structures (RPS) within 5km of the nearest proposed turbine.

12.3.2.3 NIAH within 5km of the nearest proposed turbine

The National Inventory of Architectural Heritage (hereafter NIAH) for County Kerry was downloaded from the Historic Environment Viewer on to the project GIS base mapping. All NIAH structures within 5km of the nearest proposed turbines are included here for the purpose of assessing potential visual effects in the wider landscape setting of the architectural resource (See Section 12.2.5 above for distance criteria). Thirteen NIAH structures are located within 5km of the nearest proposed turbine, twelve of which are included in the RPS and are listed in Table 12.7 above. One additional NIAH structure not included in the RPS comprises a house (Reg. 21300906) in Derryco townland.

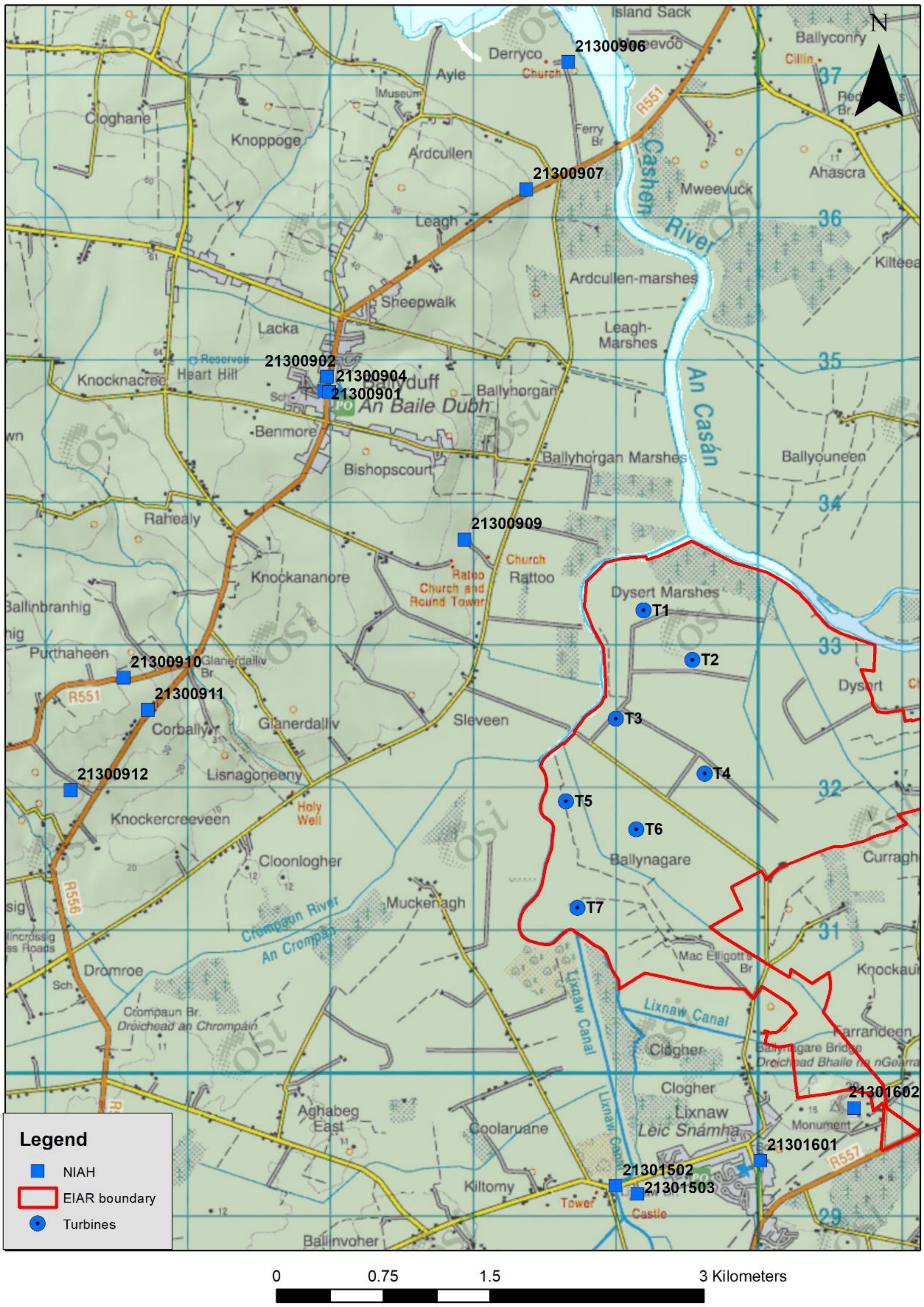


Figure 12.17: NIAH structures within 5km of the nearest proposed turbine.

12.3.2.4 Items of Cultural Heritage Merit

A review of the available historic mapping for the proposed development area revealed the presence of a number of items of potential cultural heritage merit such as lime kilns and other post-medieval structures located within the proposed wind farm EIAR boundary. The subsequent walk-over survey demonstrated that at least some of these features were no longer extant, while some features were still present. The features are listed in Table 12.8 below and shown on Figure 12.18.

The majority of the features are not located on or adjacent to any proposed infrastructure and therefore direct impacts are not anticipated. Two bridges, CH 9 and CH 10, indicated on both the 1st and 2nd edition OS maps are located adjacent to the proposed road which extends in a south-easterly direction to the proposed borrow pit and substation. CH 9 comprises Poulboy Bridge and spans the narrow watercourse beside which the proposed road extends. While a bridge is extant at this location the majority of the structure now comprises concrete. No impacts to the bridge are anticipated.

Plate 12.12: CH9 Poulboy Bridge, looking SE.

CH 10 consists of MacElligot's Bridge which is located on the same watercourse where the public road crosses same. It is indicated on both the 1st and 2nd edition OS map and comprises a single arch stone road bridge with poorly preserved parapet walls.

Plate 12.13: CH10 MacElligot's Bridge, looking SE.

Table 12.8: Cultural heritage structures within the proposed wind farm EIAR boundary.

CH No.	Name	ITM E	ITM N	Extant
1	Structure 1st ed	490364	632553	No
2	Structure 1st ed	490337	632532	No
3	Structure 1st ed	490343	632476	No
4	Settlement 1st ed	490965	632101	Yes
5	Lime kiln 1st ed	491003	632001	No
6	Structure 1st ed	488934	631387	No
7	Lime kiln 1st and 2nd ed	489196	631293	No
8	Ballynagare House 1st and 2nd ed	489350	630985	Yes
9	Poulboy Bridge 1st and 2nd ed	489585	631106	Yes, modern

CH No.	Name	ITM E	ITM N	Extant
10	MacElligott's Bridge 1st and 2nd ed	490039	630809	Yes
11	Stepping stones 2nd ed	490845	629954	?
12	Level crossing 2nd ed	490862	629843	No

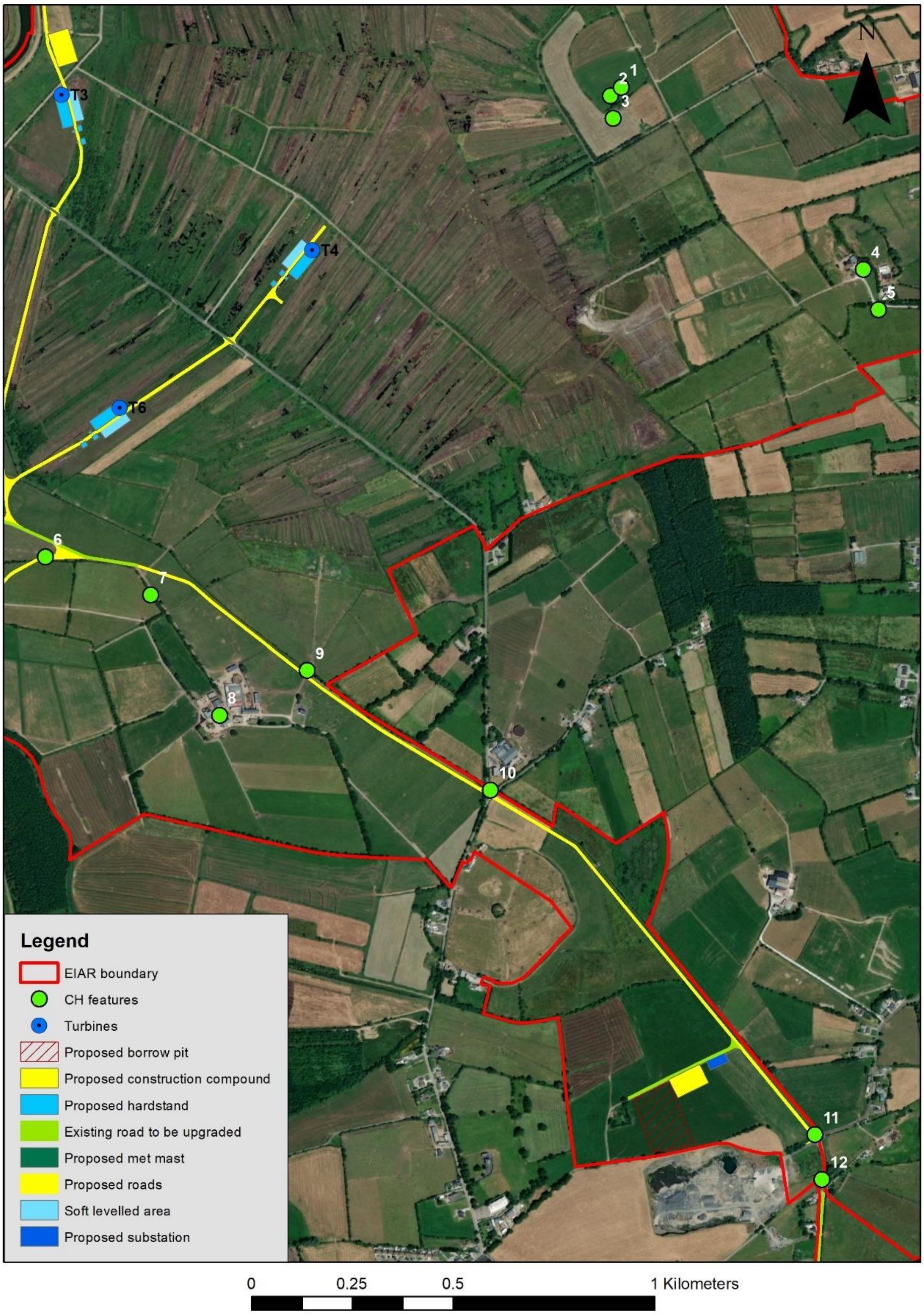


Figure 12.18: Cultural heritage features within the proposed wind farm EIAR boundary.

12.4 Existing Environment - Proposed Grid Connection Route

It is intended to connect to the National Grid via an underground cable connection running from the proposed onsite substation to the existing Clahane Substation, located approximately 7 kilometres to the southeast, in the townland of Pallas. The underground cabling will follow the route of existing public roadways. The grid connection cabling route will measure approximately 8.3km in length.

12.4.1 Archaeological Heritage

Archaeological heritage includes all recorded archaeological monuments listed in the RMP/SMR maps, National Monuments in State Care or subject to a Preservation Order and also includes newly discovered archaeological sites. All such monuments within 50m of the proposed Grid Connection Route Options are considered in this chapter.

12.4.1.1 National Monuments

No National Monuments in State Care or those subject to Preservation Orders are located along the proposed grid connection route.

12.4.1.2 Recorded Monuments

One recorded monument is situated within 50m of the proposed grid connection route. The monument is listed in Table 12.9 below with the distance to the proposed grid connection. It should be noted that distances are calculated from the centre points of the monuments and therefore the distance of the proposed grid connection from the outer extent of a monument may differ from that listed in the table. This is particularly relevant where the outer extents of monuments such as ringforts would be at a distance from the centre point of the fort. The monument within 50m of the proposed grid connection options is described and discussed below.

Table 12.9: SMR within 50m of the proposed grid connection route.

SMR	ITM E	ITM N	TYPE	TOWNLAND	DISTANCE (M)
KE016-043-—	494103	628137	Ringfort - rath	LISSAHANE	30

KE016-043—
Class: Ringfort - rath
Townland: LISSAHANE
Scheduled for inclusion in the next revision of the RMP: Yes
Description: This circular enclosure lies to the S of KE016-042— and is marked on the 1841-42 OS map. It does not appear on the later edition and no surface trace survives today.
On the 1st edition OS map this ringfort is depicted immediately south-east of the public road. The latter would appear to have truncated the outer extent of the monument at the north-west. It is possible, therefore that sub-surface remains associated with the ringfort survive beneath the public road. The proposed grid connection route extends through the Zone of Notification around the monument (Figure 12.19). Potential impacts and mitigation measures are discussed in Section 12.5.

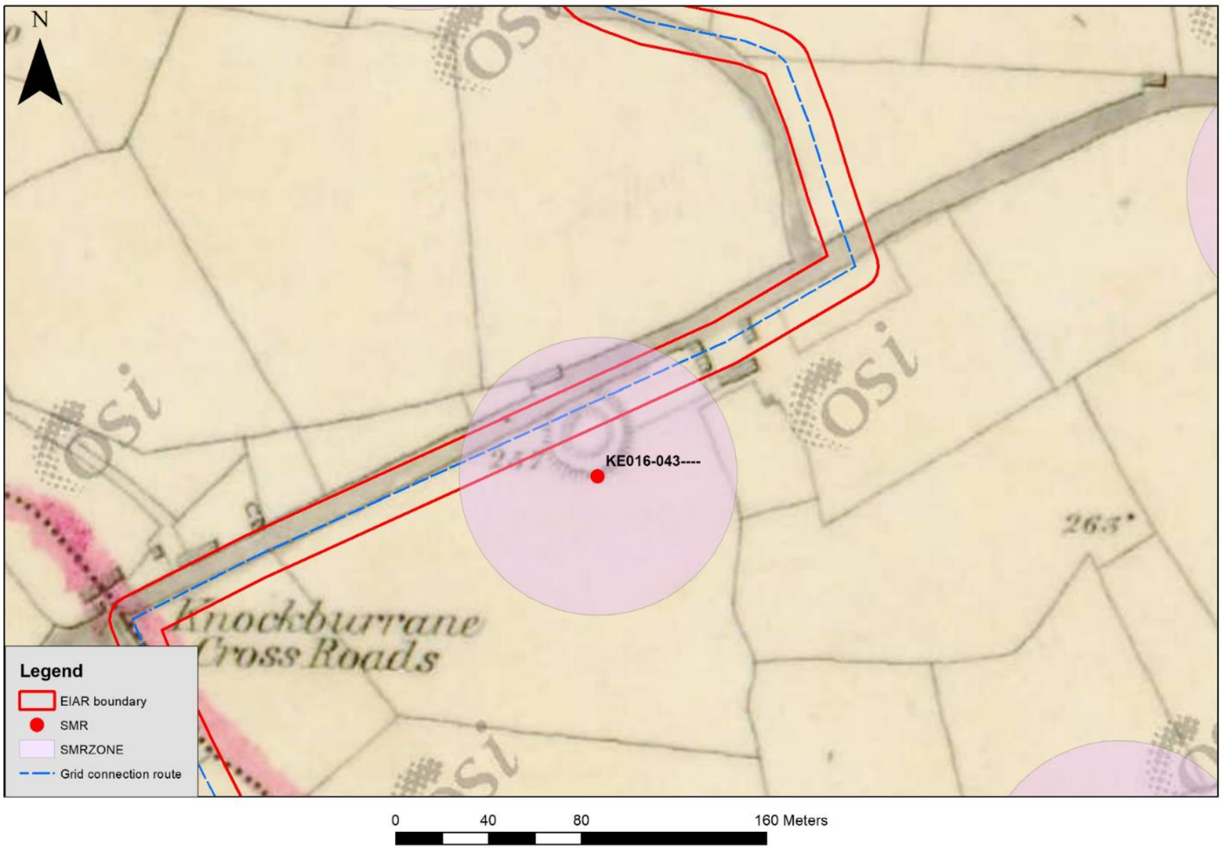


Figure 12.19: Grid connection route in relation to ringfort KE016-043. Note overlay discrepancy with 1st edition OS historic mapping.

12.4.2 Architectural and Cultural Heritage

12.4.2.1 Protected Structures and NIAH

No Protected Structures or those listed in the NIAH are located within 50m of the proposed grid connection route.

12.4.2.2 Items of Cultural Heritage Merit

A review of the available historic mapping along the proposed grid connection route options revealed the presence of a number of items of cultural heritage merit on or immediately adjacent to the proposed grid routes. The majority of items comprise named or unnamed bridges or culverts, with one gate lodge also present. The items are listed in

Table 12.10 and shown on Figure 12.20 and Figure 12.21 below. None of the items are subject to statutory protection by way of inclusion on the RPS nor are they included in the NIAH for the county. Potential impacts to such structures are discussed in section 12.5 below.

Table 12.10: CH features along the proposed grid connection route.

CH No.	ITM E	ITM N	Name
1	491267	629722	Ballintogher Bridge

CH No.	ITM E	ITM N	Name
2	492102	630186	Ballyhorgan Bridge
3	492715	630639	Gate lodge
4	494296	627277	Unnamed bridge/culvert
5	494558	626815	Unnamed bridge/culvert

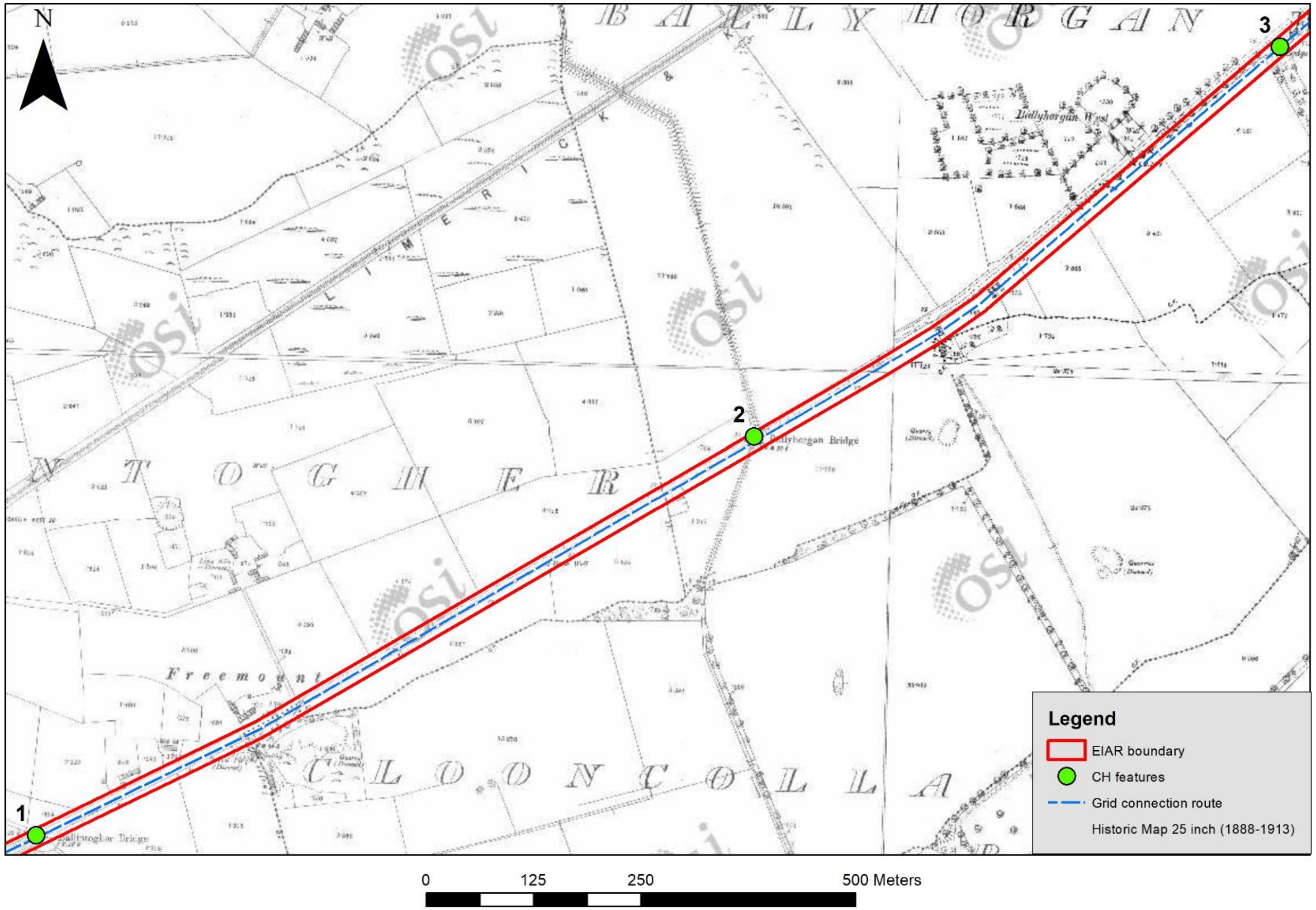


Figure 12.20: CH features 1-3 on the proposed grid connection route.

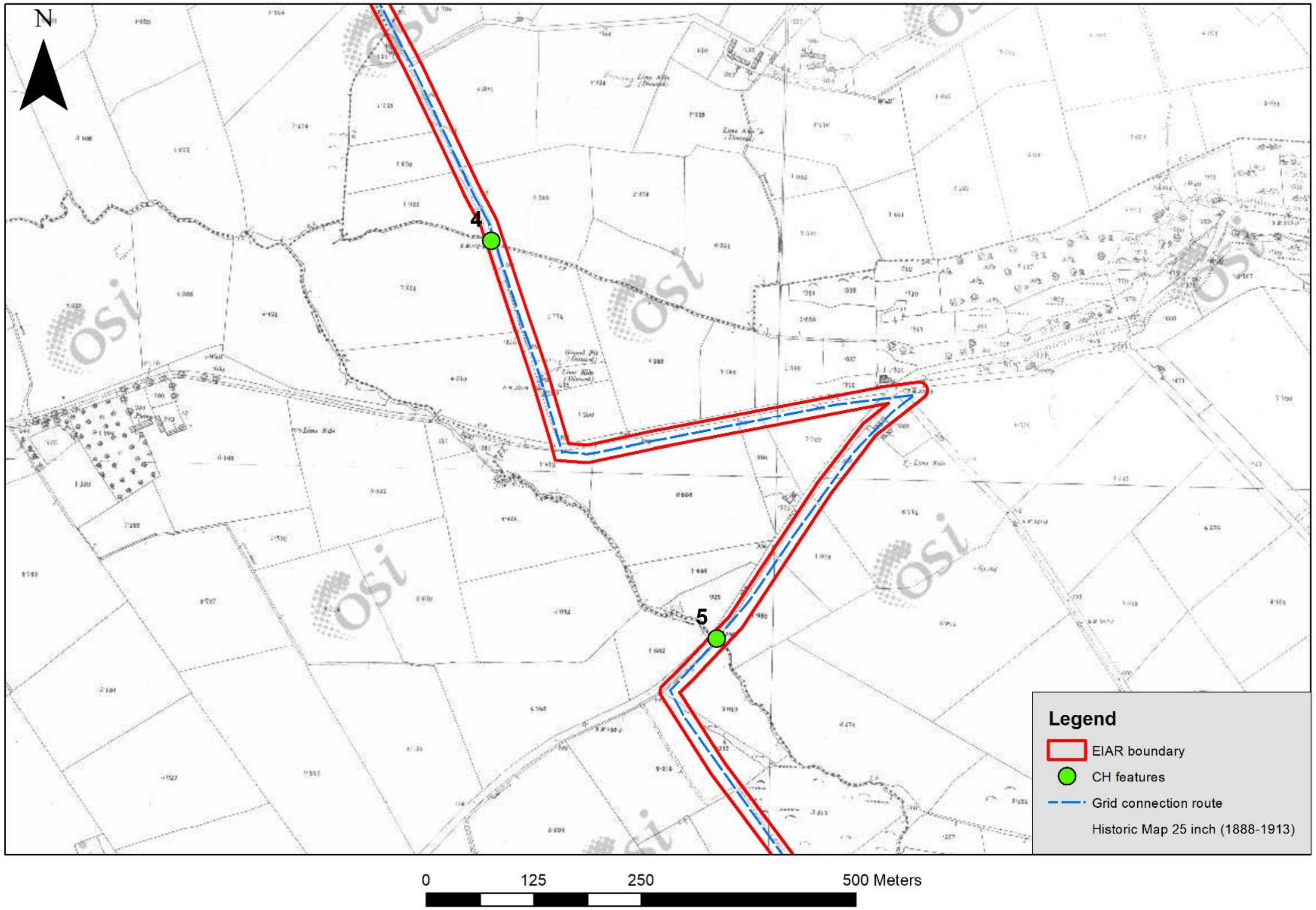


Figure 12.21: CH features 4-5 on proposed grid connection route.

12.5 Likely Significant Effects and Associated Mitigation Measures

12.5.1 Do Nothing Scenario

The do-nothing scenario seeks to describe the consequences that are reasonably likely to occur without the proposed project.

If the proposed development were not to proceed, the site would continue to be utilised as it is currently, with a mixture of agricultural use, commercial forestry, turf cutting, and recolonised peatland on which turf cutting previously took place.

Indirect effects to Cultural Heritage, in particular, in the wider landscape setting would not occur.

12.5.2 Construction Phase Potential Impacts – Indirect

Indirect effects, in terms of archaeology, architectural and cultural heritage are considered to be those effects which happen away from 'the site'. This includes impacts on visual setting of any cultural heritage asset in the wider landscape. Since these effects are only possible once the proposed turbines are constructed, they are considered operational effects and are therefore discussed in Section 12.5.4 below. No indirect effects were identified which would occur at the construction stage.

12.5.3 Construction Phase Potential Impacts (Direct)

Direct impact refers to a 'physical impact' on a monument or site. The construction phase of the development consists largely of earthmoving activities such as peat and topsoil removal. The potential impacts on the known and potential archaeological, architectural and cultural heritage of the area are outlined below with the suggested mitigation measures. The impacts are described according to each element of the Proposed Development, turbines, substation, grid connection, etc. Where any potential direct impacts do occur they are negated through the use of suitable mitigation measures such as exclusions zones (buffer zones), testing, monitoring, etc.

12.5.3.1 Turbines Bases, Hardstands and Met Mast (Direct Effects)

12.5.3.1.1 *Impact of proposed turbines on National Monuments, Recorded Monuments, Protected Structures, NIAH*

No National Monuments in State Ownership/Guardianship are located within the proposed development site boundary therefore no direct impacts on these aspects of the archaeological resource are identified.

A number of recorded monuments are located within the wind farm EIAR boundary as detailed in section 12.3.1.3 above. Potential direct impacts to the majority of these monuments have been mitigated by avoidance as they are not located within the footprint of the proposed turbine and met mast infrastructure. The proximity of the unclassified road/togher KE009-088 to the hardstand of T1 is such that ground works associated with the construction stage of the proposed development have the potential to directly impact on the recorded monument at this location. In the current proposed development layout the northern corner of the hardstand for T1 potentially abuts the suspected line of the togher, or is immediately adjacent to same. It should be noted that due to dense overgrowth the monument could not be identified on the ground at this location but was visible in pastureland further to the north-west.

No Protected Structures or NIAH structures are located within the footprint of any proposed turbine bases, hardstands or met mast therefore no direct impacts on these aspects of the architectural and cultural heritage resource will occur.

No cultural heritage features as identified from a review of the available historic mapping are located within the footprint of any proposed turbine, hardstand or met mast. Direct impacts to such features as a result of the construction of proposed turbines, hardstands or met mast are therefore not identified.

Pre-Mitigation Impact

As the exact location of the togher in the vicinity of the hardstand for T1 could not be determined during the visual inspection of the site a potential direct impact to a portion of KE009-088– Road – unclassified togher as a result of the construction of the hardstand for T1 has been identified. Without the implementation of appropriate mitigation measures the impact to the monument has the potential to be significant, negative and permanent.

Proposed Mitigation Measures

- Pre-development archaeological testing across the suspected route of togher KE009-088– Road adjacent to the hardstand at T1 should be carried out in order to determine its extent at this location. The testing will be carried out under licence from the National Monuments Service subject to the approval of the licence application and associated method statement.
- On foot of the results of the pre-development testing A buffer zone of 10m should be established between KE009-088– Road – unclassified togher and the hardstand for T1. No ground works or storage of peat/topsoil should take place within the buffer zone. The buffer zone should be defined by durable fencing for the duration of the construction phase of the project with 'Keep Out' signage placed on same.

Residual Impact

No residual impacts will occur if the proposed mitigation measures are implemented.

Significance of Effects

The construction of the turbine bases, hardstands and met mast will have no likely significant effects on national monuments, recorded monuments or built heritage.

12.5.3.1.2 *Impact of proposed turbine bases, hardstands and met masts on unrecorded potential sub-surface sites*

The presence of the recorded monuments within the proposed wind farm EIAR boundary is an indication that the bog and its environs is an area of archaeological potential.

It is considered that the potential exists for the proposed development area to contain as yet unrecorded sub-surface sites and artefacts. It is possible that such sites may be uncovered either within the peat/topsoil and/or at the level of the underlying natural subsoil. The excavation of topsoil /peat for the turbine bases and hardstands may impact on any new sites, if present.

Pre-Mitigation Impact

Should new sites or features be present within the site (currently not visible on the surface) the potential impact on same is likely to be significant, negative and permanent (i.e. the excavation by machinery would permanently remove the sites resulting in a significant negative impact).

Proposed Mitigation Measures

- Pre-development licensed archaeological testing of all turbine bases, hardstands and met mast foundation area should be undertaken. The areas to be tested will be chosen by the appointed archaeologist and the number of test trenches agreed between the archaeologist and the National Monuments Service (NMS) through the licensing system. Peat depth data and local ground conditions may dictate the number and location of test trenches to be excavated. A report on the testing will be compiled on completion of the work and submitted to the NMS and the Planning Authority for consideration.
- Archaeological monitoring of ground works during construction. If archaeological finds, features or deposits are uncovered during archaeological monitoring, the developer will be prepared to provide resources for the resolution of such features whether by preservation by record (excavation) or preservation in situ (avoidance). The National Monuments Service will be informed of such findings to discuss how best to proceed. Once the project is completed, a report on the results of the monitoring will be compiled and submitted to the relevant authorities.

Residual Impact

The sites/features, if detected, during testing and/or monitoring will be preserved by record (archaeologically excavated) or preserved in-situ (avoidance) and therefore a full record made of same. In this regard, the potential impact after the implementation of mitigation measures is likely to be permanent, slight, and of negative effect.

Significance of Effects

The construction of the proposed turbine bases, hardstands and met masts will have no likely significant effects on unrecorded potential sub-surface sites. The significance of the impacts, after the implementation of mitigation, is likely to be slight.

12.5.3.2 Proposed new roads, internal cable route, passing bays (direct effects)

12.5.3.2.1 *Impact on National Monuments, Recorded Monuments, Protected Structures, NIAH*

No National Monuments in State Ownership/Guardianship or subject to a Preservation Order are located within the proposed wind farm EIAR boundary therefore no direct impacts on this aspect of the archaeological resource will occur as a result of ground works associated with proposed roads, passing bays or the internal cable route.

A number of recorded monuments are located within the wind farm EIAR boundary as detailed in section 12.3.1.3 above. Potential direct impacts to the majority of these monuments have been mitigated by avoidance as they are not located within the footprint of proposed new roads, associated passing bays or the internal cable route. The proposed road from T1 to T2 at the north-west side of the proposed development site traverses recorded monument KE009-088– Road – unclassified togher at two locations. At the north-west, north-west of T1, the remains of the road are apparent as a low rise in pastureland. It is probable that the road has been levelled somewhat at this location as a result of agricultural practices, however, it is still extant with some above-ground remains. Further to the south-east, south-east of T1, the proposed road crosses the togher for a second time. Due to vegetative overgrowth and ground conditions the togher could not be traced on the ground at this location. It is possible, however, that either above-ground or subsurface remains of the monument are extant.

It is proposed to float the proposed roads at these locations therefore avoiding direct impacts to the monument. Some mitigation measures are proposed, however, to ensure any such impacts do not occur.

The site of enclosure KE016-005– is located immediately west of the proposed road which extends in a south-easterly direction to the proposed substation and borrow pit at the south-east side of the proposed development site. It no longer has any above-ground trace and the field inspection undertaken as part of this assessment did not detect any visible remains of the monument. It is indicated on the 1st edition OS map as a circular area, the outer extent of which is c. 12m south-west of the aforementioned proposed road. While potential direct impacts to the monument are not identified, some mitigation measures are proposed given the proximity of the enclosure to the proposed infrastructure.

No Protected Structures, NIAH structures or items of local cultural heritage merit are located within the footprint of the proposed new roads, associated passing bays or internal cable route. No impacts to such structures or items as a result of same are therefore identified.

Pre-Mitigation Impact

No direct impacts to either KE009-088– Road – unclassified togher or KE016-005– Enclosure as a result of the proposed new roads are identified. It is noted, however, that the proposed road traverses the togher KE009-088– in two places and that the ground works for same will not be required as the road will be floated.

The proximity of the proposed new road to the levelled enclosure KE016-005– is also noteworthy, particularly given that the monument no longer has any above-ground trace. While no direct impacts as a result of the adjacent road have been identified, some mitigation is recommended.

Proposed Mitigation Measures

- The construction methodology for the proposed new road where it crosses KE009-088– Road – unclassified togher should be submitted to the National Monuments Service and Kerry County Council Archaeologist for approval prior to the commencement of any development.
- Pre-development licensed archaeological testing of the proposed road where it extends past KE016-005– enclosure should be undertaken. In addition, the testing should, where possible, determine the location of the outer enclosing element of the monument. A report on the results of the testing will be compiled on completion of the work and illustrated with relevant plans and photographs. Further mitigation measures in the form of buffer zones, preservation in situ or preservation by record (excavation) may be required pending the results of the testing.

Residual Impact

No residual Impacts.

Significance of Effects

The construction of the proposed new roads, internal cable route, passing bay or site entrances will have no likely significant effects on national monuments, recorded monuments or items of built heritage.

12.5.3.2.2 *Impact on unrecorded potential sub-surface sites*

The potential effects on sub-surface archaeology as a result of proposed roads is the same as those resulting from turbine bases, hardstands etc (See Section 12.5.3.1.2 above). The potential exists for the development area to contain as yet unrecorded sub-surface sites and artefacts. It is possible that such sites may be uncovered either within the peat/topsoil and/or at the level of the underlying natural subsoil. The excavation of topsoil /peat for new road, passing bays, entrances and internal cable route may impact on any new sub-surface sites, if present. There will be a combination of both excavate and replace and floating roads used throughout the site depending on local ground conditions.

Pre-Mitigation Impact

Should new sites or features be present within the site (currently not visible on the surface) the impact is likely to be significant, negative and permanent (i.e. the excavation by machinery would permanently remove the sites resulting in a significant negative impact).

Proposed Mitigation Measures

- Pre-development testing (licensed by the National Monuments Service - NMS) in areas where peat depths allow a meaningful investigation. Testing should only be undertaken in areas where ground disturbance will take place as part of the development. For example, if roads are proposed to be floated, testing would not be required. Where peat depths become a limitation to testing, monitoring at the construction stage should be undertaken. The areas to be tested will be chosen by the appointed archaeologist and the number of test trenches agreed between the archaeologist and the National Monuments Service (NMS) through the licensing system. Peat depth data and local ground conditions may dictate the number and location of test trenches to be excavated.
- Licensed archaeological monitoring of the proposed roads, internal cable, passing bays and entrances during the construction phase of the development should be undertaken. If archaeological finds, features or deposits are uncovered during archaeological monitoring, the NMS will be informed of such findings and a method statement for the resolution of the archaeology will be provided, where relevant. The developer will be prepared to provide resources for the resolution of such features whether by preservation by record (excavation) or preservation in situ (avoidance). A report on the results of the monitoring will be compiled and submitted to the relevant authorities on completion of the project.

Residual Impact

The sites/features, if detected, during monitoring will be preserved by record (archaeologically excavated) or preserved in-situ (avoidance) and therefore a full record made of same. In this regard, the potential impact after the mitigation measures is likely to be long term, slight, and of negative effect.

Significance of Effects

The construction of the proposed new roads, internal cable route, passing bay or site entrances will have no significant effect on unrecorded potential sub-surface sites and the overall impact (after mitigation) will be slight.

12.5.3.3 Electricity Substation

12.5.3.3.1 *Impact of Substation on National Monuments, Recorded Monuments, Protected Structures, NIAH and items of Local Cultural Heritage Merit*

No National Monuments in State Ownership/Guardianship, those subject to Preservation Orders, Recorded Monuments, built heritage structures (RPS/NIAH) or items of local cultural heritage merit are located within the footprint of the proposed substation site therefore no direct impacts on these aspects of the cultural heritage resource will occur.

Pre-Mitigation Impact

The proposed substation works will have no direct effects on the known cultural heritage resource.

Proposed Mitigation Measures

No mitigation measures are required.

Residual Impact

No residual impacts will occur.

Significance of Effects

The construction of the proposed substation will have no likely significant effects on national monuments, recorded monuments or built heritage.

12.5.3.3.2 *Impact of Substation on unrecorded potential sub-surface sites*

Similar to any other aspect of the proposed development which involves ground disturbance and peat removal, the potential exists for the development area to contain as yet unrecorded sub-surface sites and artefacts. It is possible that such sites may be uncovered either within the peat/topsoil and/or at the level of the underlying natural subsoil. The excavation of topsoil /peat for the proposed substation site may impact on any new sites, if present.

Pre-Mitigation Impact

Should new sites or features be present within the footprint of the proposed substation (currently not visible above-ground) the impact is likely to be significant, negative and permanent (i.e. the excavation by machinery would permanently remove the sites resulting in a significant negative impact).

Proposed Mitigation Measures

- Pre-development licensed testing of the area of the substation. The area to be tested will be chosen by the appointed archaeologist and the number of test trenches agreed between the archaeologist and the National Monuments Service (NMS) through the licensing system. Peat depth data and local ground conditions may dictate the number and location of test trenches to be excavated.
- Licensed archaeological monitoring of ground works during construction stage of the development. If archaeological finds, features or deposits are uncovered during archaeological monitoring, the NMS will be informed of such findings and a method statement for the resolution of the archaeology will be provided. The developer will be prepared to provide resources for the resolution of such features whether by preservation by record (excavation) or preservation in situ (avoidance). A report on the results of the monitoring will be compiled and submitted to the relevant authorities on completion of the project.

Residual Impact

The sites/features, if detected, during testing and/or monitoring will be preserved by record (archaeologically excavated) or preserved in-situ (avoidance) and therefore a full record made of same. In this regard, the potential impact after the mitigation measures is likely to be slight.

Significance of Effects

The construction of the proposed substation will have no significant effects on unrecorded potential sub-surface sites and the overall impact (after mitigation) will be permanent, slight, and of negative effect.

12.5.3.4 Construction Compounds

12.5.3.4.1 *Impact of Compounds on National Monuments, Recorded Monuments, Protected Structures, NIAH*

No National Monuments in State Ownership/Guardianship, those subject to Preservation Orders, Recorded Monuments, built heritage structures (RPS/NIAH) or items of local cultural heritage merit are located within the footprint of the proposed compounds therefore no direct impacts on these aspects of the cultural heritage resource will occur.

Pre-Mitigation Impact

There will be no direct effects to the known cultural heritage resource as a result of the proposed compounds.

Proposed Mitigation Measures

Mitigation measures are not required.

Residual Impact

No residual impacts.

Significance of Effects

The construction of the proposed compounds will have no likely significant effects on national monuments, recorded monuments or built heritage.

12.5.3.4.2 *Impact of Compounds on unrecorded potential sub-surface sites*

Similar to any other aspect of the proposed development which involves ground disturbance and peat/topsoil removal, the potential exists for the development area to contain as yet unrecorded sub-surface sites and artefacts. It is possible that such sites may be uncovered either within the peat/topsoil and/or at the level of the underlying natural subsoil. The excavation of topsoil /peat for the proposed compounds may impact on any new sites, if present.

Pre-Mitigation Impact

Should new sites or features be present within the footprint of the proposed compounds (currently not visible above-ground) the impact is likely to be significant, negative and permanent (i.e. the excavation by machinery would permanently remove the sites resulting in a significant negative impact).

Proposed Mitigation Measures

- Pre-development licensed archaeological testing of the area of the proposed compounds. The areas to be tested will be chosen by the appointed archaeologist and the number of test trenches agreed between the archaeologist and the National Monuments Service (NMS) through the licensing system. Peat depth data and local ground conditions may dictate the number and location of test trenches to be excavated.
- Licensed archaeological monitoring of ground works in the area of the proposed compounds during the construction stage of the development should be undertaken. If archaeological finds, features or deposits are uncovered during archaeological monitoring, the NMS will be informed of such findings and a method statement for the resolution of the archaeology will be provided. The developer will be prepared to provide resources for the resolution of such features whether by preservation by record (excavation) or preservation in situ (avoidance). A report on the results of the monitoring will be compiled and submitted to the relevant authorities on completion of the project.

Residual Impact

The sites/features, if detected, during testing and/or monitoring will be preserved by record (archaeologically excavated) or preserved in-situ (avoidance) and therefore a full record made of same. In this regard, the potential impact after the mitigation measures is likely to be permanent, slight, and of negative effect.

Significance of Effects

The construction of the proposed compounds will have no significant effects on unrecorded potential sub-surface sites and the overall impact (after mitigation) is likely to be permanent, slight and of negative effect.

12.5.3.5 Borrow Pit

12.5.3.5.1 *Impact of Borrow Pit on National Monuments, Recorded Monuments, Protected Structures, NIAH*

No National Monuments in State Ownership/Guardianship, those subject to Preservation Orders, Recorded Monuments, built heritage structures (RPS/NIAH) or items of local cultural heritage merit are located within the footprint of the proposed borrow pit therefore no direct impacts to these aspects of the cultural heritage resource will occur.

Pre-Mitigation Impact

There will be no direct effects to the known cultural heritage resource as a result of the proposed borrow pit.

Proposed Mitigation Measures

No mitigation measures are required.

Residual Impact

There will be no residual impacts.

Significance of Effects

The construction of the proposed borrow pit will have no likely significant effects on national monuments, recorded monuments or built heritage.

12.5.3.5.2 *Impact of the Borrow Pit on unrecorded potential sub-surface sites*

Similar to any other aspect of the proposed development which involves ground disturbance and peat/topsoil removal, the potential exists for the borrow pit area to contain as yet unrecorded sub-surface sites and artefacts. It is possible that such sites may be uncovered either within the peat/topsoil and/or at the level of the underlying natural subsoil. The excavation of topsoil /peat for the proposed borrow pit may impact on any new sites, if present.

Pre-Mitigation Impact

Should new sites or features be present within the footprint of the proposed borrow pit (currently not visible above-ground) the impact is likely to be significant, negative and permanent (i.e. the excavation by machinery would permanently remove the sites resulting in a significant negative impact).

Proposed Mitigation Measures

- Pre-development licensed archaeological testing of the area of the proposed borrow pit. The areas to be tested will be chosen by the appointed archaeologist and the number of test trenches agreed between the archaeologist and the National Monuments Service (NMS) through the licensing system. Peat depth data and local ground conditions may dictate the number and location of test trenches to be excavated.

- Licensed archaeological monitoring of ground works in the area of the proposed borrow pit during the construction stage of the development should be undertaken. If archaeological finds, features or deposits are uncovered during archaeological monitoring, the NMS will be informed of such findings and a method statement for the resolution of the archaeology will be provided. The developer will be prepared to provide resources for the resolution of such features whether by preservation by record (excavation) or preservation in situ (avoidance). A report on the results of the monitoring will be compiled and submitted to the relevant authorities on completion of the project.

Residual Impact

The sites/features, if detected, during testing and/or monitoring will be preserved by record (archaeologically excavated) or preserved in-situ (avoidance) and therefore a full record made of same. In this regard, the potential impact after the mitigation measures is likely to be permanent, slight, and of negative effect.

Significance of Effects

The construction of the proposed borrow pit will have no likely significant effects on unrecorded potential sub-surface sites and the overall impact (after mitigation) is considered to be permanent, slight and of negative effect.

12.5.3.6 Grid Connection

12.5.3.6.1 *Impact of grid connection on National Monuments, Recorded Monuments, Protected Structures, NIAH*

No known documented constraints such as National Monuments in State Ownership/Guardianship, those subject to Preservation Orders, Recorded Monuments or built heritage structures listed in the RPS or NIAH are located within the footprint of the proposed grid connection route options. No direct impacts on these aspects of the cultural heritage resource will occur therefore.

The proposed grid connection route extends through the zone of notification around KE016-043— ringfort. The public road along which the proposed grid route extends past these monuments would appear to have truncated the outer enclosing elements of the ringfort. In this regard sub-surface archaeological features or deposits associated with the fort may survive beneath the road. Ground works associated with the construction of the grid connection has the potential to impact directly on such features, if present.

Pre-Mitigation Impact

There will be no direct effects to the known cultural heritage resource as a result of the construction of the proposed grid connection route. Potential direct effects to sub-surface features or deposits associated with recorded monument KE016-043– which may survive beneath the public road have been identified, however, and in the absence of mitigation would be significant, negative and permanent.

Proposed Mitigation Measures

- Archaeological monitoring (under licence from the National Monuments Service) of ground works associated with the proposed grid connection route where it extends through the zone of notification around recorded monument KE016-043– should be undertaken. A report on the monitoring will be complied on completion of the work and submitted to the relevant authorities.

Residual Impact

No residual impacts.

Significance of Effects

The construction of the grid connection will have no likely significant effects on national monuments, recorded monuments or built heritage.

12.5.3.6.2 *Impact of Grid Connection on items of Local Cultural Heritage Merit*

A number of items of local cultural heritage merit (not included in the RPs or NIAH) are located along the proposed grid connection route (see section 12.4.2.2 above). They mainly comprise named and unnamed bridges/culverts. The proposed grid connection cable will either be laid in the road over such bridges or, where relevant, directional drilling will be utilised. In either case direct impacts to the bridge or culvert structures are not anticipated.

Pre-Mitigation Impact

No impacts are identified.

Proposed Mitigation Measures

No mitigation measures are proposed.

Residual Impact

No residual impacts are identified.

Significance of Effects

No likely significant effects to the items of cultural heritage merit along the proposed grid connection are identified.

12.5.4 Operational Phase Potential Impacts (Direct)

In terms of archaeology, architecture and cultural heritage, since peat/topsoil removal and groundworks would be complete, it is considered that no direct effects would occur at the operational stage of the proposed development.

12.5.5 Operational Phase Potential Impacts (Indirect)

Indirect impacts are where a feature or site of archaeological, architectural heritage merit or their setting is located in close proximity to a proposed development. Indirect impacts here are mainly concerned with impacts on setting. Impacts on settings of sites may arise when a development is proposed immediately adjacent to a recorded monument or cluster of monuments or any cultural heritage asset. While the proposed development may not physically impact on a site, it may alter the setting of a monument or group of monuments. There is no standardised Irish industry-wide approach for assessing the degree of impact to the setting of a monument. The assessment is based on previous experience, Geographical Information Systems (in particular Viewshed Analysis) and the '*Guidance on Setting and the Historical Environment*' (Historic Environment Division Northern Ireland) was utilised. The methodology through which indirect impact is assessed is presented in Section 12.2.5 above. According to the aforementioned document '*A range of tools may be employed in defining and assessing changes to setting, for example historic landscape analysis using Geographical Information Systems (GIS), which may include viewshed analysis*'.

Potential impact to the visual amenity of a site or area and the significance of same is dependent on a number of factors regarding the sensitivity of the location or 'receptor' and the scale or magnitude of the proposed development.

Potential operational impacts are discussed below according to each element of the proposed development. Those elements of the proposed development which are not capable of impacting on the visual setting of monuments (such as proposed roads, underground cables etc.) are scoped out of this section of the EIAR. Those elements which are deemed to be more likely to impact on visual setting such as turbines and substation buildings are discussed below.

12.5.5.1 Impact of proposed turbines on setting of National Monuments in State Care or those subject to Preservation Orders

A review of all National Monuments in State Care within 10km of the proposed turbines was undertaken as part of the assessment in order to ascertain any potential impacts on their setting as a result of the proposed development. No National Monuments are located within the proposed development site boundary.

12.5.5.1.1 *National Monument No. 55 Rattoo Ecclesiastical Site*

A number of monuments are located at the Early Medieval ecclesiastical site at Rattoo which is situated c. 1.1km north-west of the nearest proposed turbine, T1. The National Monument (No. 55) includes the round tower KE009-056001, church KE009-056003 and religious house -Augustinian canons KE009-056004.

The viewshed analysis results show that theoretically, turbines T1, T2, T3, T5 and T6 could be seen in full (from base to tip height) from Rattoo ecclesiastical site, with the remainder visible approximately from mid-shaft upwards (see section 12.3.1.2.1 above). This assumes no vegetation, buildings, natural screening such as field boundaries and therefore is a worst case scenario. The Zone of Theoretical Visibility (hereafter ZTV) utilised in the LVIA shows that 6-7 turbines will be visible from this area and accords with the results of the viewshed analysis. Furthermore, Photomontage 1 taken from the church and round tower at Rattoo demonstrates how the proposed turbines will appear in the landscape from this viewpoint. It clearly shows that all seven of the proposed turbines will be visible from the National Monument, be it in full or the upper portions of same.

While the immediate setting of the ecclesiastical site will not be impacted by the proposed turbines given the separation of over 1km between the National Monument and same, their proximity and prominence in the landscape is such that an impact on the wider setting of the ecclesiastical site is identified. The round tower at Rattoo is a dominant and highly visible feature in the landscape surrounding the proposed wind farm and from within the wind farm itself. The introduction of the proposed turbines to this area will undoubtedly alter views of the tower from the wider landscape surrounding the site. Also, the experience of the visitor to the National Monument has the potential to change with the introduction of the proposed turbines given that the views from the ecclesiastical site looking east will change (See Photomontage 1 and Plate 12.14). In this regard, a moderate-significant impact to the wider landscape setting of the ecclesiastical site at Rattoo as a result of the proposed turbines is identified.

Pre-Mitigation Impact

A moderate-significant impact to the wider landscape setting of the National Monument at Rattoo as a result of the introduction of the proposed turbines is identified.

Proposed Mitigation Measures

No mitigation measures are proposed.

Residual Impact

A long term, moderate-significant, negative residual impact is identified but is reversible should the turbines be decommissioned after the permitted life-time of the proposed development.

Significance of Effects

The operation of the proposed turbines will have a moderate-significant effect on the wider setting of the National Monument at Rattoo. This effect is reversible should the turbines be decommissioned after the permitted life time of the proposed development.

Plate 12.14: View of the proposed wind farm site from the graveyard at Rattoo ecclesiastical site (Nat. Mon. No. 55), looking SE.

12.5.5.1.2 National Monument No. 303 Tonaknock Cross

The viewshed analysis results show that theoretically T7 may be seen from mid shaft upwards from Tonaknock Cross with the upper portion of the remaining turbines also visible. This assumes no vegetation, buildings, natural screening such as field boundaries and therefore is a worst case scenario. The Zone of Theoretical Visibility (thereafter ZTV) utilised in the LVIA also shows that 6-7 turbines may theoretically be visible from this area. Given the distance of nearly 6km from the National Monument to the nearest proposed turbine, T7, impacts to the immediate setting of the cross will not occur. A change to the wider setting of the monument as a result of the proposed turbines is acknowledged but it regarded as Not Significant (an effect which causes noticeable changes in the character of the environment but without significant consequences).

Pre-Mitigation Impact

A long term, Not Significant, negative impact to the wider landscape setting of the National Monument at Tonaknock as a result of the introduction of the proposed turbines is identified.

Proposed Mitigation Measures

No mitigation measures are proposed.

Residual Impact

A long term, Not Significant, negative residual impact is identified. This effect is reversible should the turbines be decommissioned after the permitted life time of the proposed development.

Significance of Effects

The likely significance of effects on the wider setting of National Monument 303 is regarded as Not Significant. This effect is reversible should the turbines be decommissioned after the permitted life time of the proposed development.

12.5.5.1.3 National Monument No. 260 Listowel Castle

The viewshed results show that theoretically, Turbines T1 – T7 may be seen from Listowel Castle from approximately mid-shaft upwards. This assumes no vegetation, buildings, natural screening such as field boundaries and therefore is a worst case scenario. The Zone of Theoretical Visibility (hereafter ZTV) utilised in the LVIA also shows that 6-7 turbines would theoretically be visible from this area. Given the distance of over 9km from this National Monument to the nearest proposed turbine (T2) the potential impact to the wider setting of this monument is regarded as Not Significant.

Pre-Mitigation Impact

A long term, Not Significant, negative impact to the wider landscape setting of Listowel Castle National Monument as a result of the introduction of the proposed turbines is identified.

Proposed Mitigation Measures

No mitigation measures are proposed.

Residual Impact

A long term, Not Significant, negative residual impact is identified. This effect is reversible should the turbines be decommissioned after the permitted life time of the proposed development.

Significance of Effects

The likely significance of effects on the wider setting of National Monument 260 is regarded as Not Significant. This effect is reversible should the turbines be decommissioned after the permitted life time of the proposed development.

12.5.5.1.4 Preservation Order No. 3/2008, 1/2008 Ringfort and Souterrain

The viewshed analysis from this monument shows that theoretically none of the proposed turbines will be visible from this area. This accords with the ZTV which also shows that theoretically no proposed turbines will be visible from this area.

Pre-Mitigation Impact

The potential impact to the wider setting of the ringfort and souterrain is regarded as Imperceptible.

Proposed Mitigation Measures

No mitigation measures are proposed.

Residual Impact

The residual impact will be long term, Imperceptible, and neutral.

Significance of Effects

The likely significance of effects to these monuments is regarded as Imperceptible.

12.5.5.2 Impact of proposed turbines on setting of Recorded Monuments within the proposed wind farm EIAR boundary

Ten recorded monuments are located within the wind farm EIAR site boundary. Of these monuments, KE009-088 road – unclassified togher is located immediately adjacent to T1 and its associated hardstand (Figure 12.8 and Figure 12.10). The road should be regarded as an upstanding monument, although its extent was difficult to determine within the portions of the proposed development site comprising recolonised bog. It is, however, a low-visibility monument and is not readily discernible in the landscape. Notwithstanding this the proximity of T1 to the monument will result in a change to the immediate setting of a portion of the togher and is regarded as Slight.

The remaining monuments within the proposed wind farm EIAR boundary are not located in close proximity to any proposed turbines. The ZTV shows that all seven turbines will theoretically be visible from all locations within the EIAR boundary. A change to the wider setting of the recorded monuments therein is therefore acknowledged and is regarded as Not Significant.

Pre-Mitigation Impacts

A change to the immediate setting of a portion of KE009-088– resulting in a Slight visual impact is identified. A change to the wider setting of the remaining recorded monuments within the EIAR boundary is acknowledged and regarded as Not Significant.

Proposed Mitigation Measures

No mitigation measures are proposed.

Residual Impacts

A long term, Slight-Not Significant, negative residual impact is identified. This effect is reversible should the turbines be decommissioned after the permitted life time of the proposed development.

Significance of Effects

The likely significance of effects on the setting of recorded monuments within the wind farm EIAR boundary is regarded as Slight-Not Significant. This effect is reversible should the turbines be decommissioned after the permitted life time of the proposed development.

12.5.5.2.2 *Impact of proposed turbines on Recorded Monuments within 5km*

One hundred and ninety-nine (199) monuments are located within 5km of the nearest proposed turbine. Only two of the 199 monuments are located within 1km of the nearest proposed turbine. Thirty-six monuments are located between 1 and 2km from the nearest proposed turbine. Forty-six are located between 2 and 3km of the nearest proposed turbine with 53 monuments located between 3 and

4km from the nearest proposed turbine. The remaining sixty-two monuments are located between 4 and 5km from the nearest proposed turbine. The majority of monument types within 5km of the nearest proposed turbine are ringforts (96), enclosures (21) and souterrains (13), all of which date to the early medieval period. Monuments with religious associations including churches, graveyards, burial grounds (including children's burial grounds), graveyards, ecclesiastical enclosures, holy wells and round towers are also well represented, accounting for thirty-two of the total.

The ZTV demonstrates that 6-7 turbines will be visible from the majority of locations within 5km. It is not possible to ascertain exactly what may be seen from various monuments within 5km as the majority are inaccessible to the public being located on private land. The potential to view turbines from various monuments depends on season (full vegetative growth in summer), buildings, forestry etc. The ZTV does not take natural screening, buildings or boundaries into consideration and therefore is a worst case scenario. An impact to the wider setting of recorded monuments within 5km is acknowledged and is regarded as Slight-Not Significant.

Pre-Mitigation Impacts

Potential impact on visual setting of the recorded monuments within 5km of the proposed turbines is considered to be Slight-Not significant.

Proposed Mitigation Measures

As it is not possible to mitigate the indirect effects of the turbines on monuments within 5km there are no mitigation measures for this potential impact.

Residual Impacts

Since mitigation measures are not possible, the residual impact will remain the same as the pre-mitigation impact which is long term, Slight-Not significant, and of negative effect. This effect is reversible should the turbines be decommissioned after the permitted life time of the proposed development.

Significance of Effects

The operation of the proposed turbines will have no likely significant effect on Recorded Monuments within 5km of the proposed development. The significance of effects is considered to be long term, Slight-not Significant and of negative effect. This effect is reversible should the turbines be decommissioned after the permitted life time of the proposed development.

12.5.5.2.3 *Impact of proposed turbines on setting of NIAH/RPS structures within 5km*

Fourteen structures listed in the Record of Protected Structures and thirteen structures listed in the NIAH are located within 5km of the nearest proposed turbine. The majority of structures are located within the villages of Ballyduff and Lixnaw and therefore their visual settings do not extend beyond the limits of those settlements. The ZTV shows, however, that there will be visibility of the proposed turbines from these locations. No impacts to the immediate setting of any RPS or NIAH structures will occur, however, a change to their wider setting is acknowledged and is regarded as Slight-Not Significant.

Pre-Mitigation Impact

Slight-Not Significant impacts in the wider landscape setting of RPS and NIAH structures may occur since some turbines will theoretically be visible from some locations. Factors such as distance, screening, buildings, boundaries in the landscape may vary from summer to winter and the impact may vary accordingly.

Proposed Mitigation Measures

As it is not possible to mitigate the indirect effects of turbines on NIAH/RPS structures within 5km there are no mitigation measures for this potential impact.

Residual Impact

Since no mitigation measures can be implemented, the residual impact will remain the same as the per-mitigation impact which is long term, Slight-Not significant, and of negative effect. This effect is reversible should the turbines be decommissioned after the permitted life time of the proposed development.

Significance of Effects

The operation of the proposed turbines will have no likely significant effect on NIAH/RPS structures within 5km of the proposed development. The significance of effects is considered to be long term, Slight-Not significant, and of negative effect. This effect is reversible should the turbines be decommissioned after the permitted life time of the proposed development.

12.5.5.2.4 *Impact of proposed turbines on items of Cultural Heritage Merit*

Through a review of the available historic mapping for the area eleven items of cultural heritage merit not included in the RPS or NIAH were identified within the proposed wind farm EIAR boundary. The majority of these items are no longer extant. Of those that are remaining, none are located in close proximity to the proposed turbines, therefore impacts to their immediate setting will not occur. A change to their wider setting as a result of the proposed turbines is acknowledged and is regarded as Imperceptible.

Pre-Mitigation Impact

An Imperceptible impact in the wider landscape setting of items of cultural heritage merit may occur since some turbines will theoretically be visible from some locations. Factors such as distance, screening, buildings, boundaries in the landscape may vary from summer to winter and the impact may vary accordingly.

Proposed Mitigation Measures

No mitigation measures are proposed.

Residual Impact

The residual impact is regarded as long term, Imperceptible, and of neutral effect.

Significance of Effects

The proposed turbines will not have a likely significant effect on the wider setting of items of cultural heritage merit. The significance of effects is considered to be long term, Imperceptible, and of neutral effect.

12.5.5.3 Electricity Substation

12.5.5.3.1 *Impacts on setting of National Monuments, Recorded Monuments*

The proposed electricity substation is located towards the south-east side of the proposed wind farm EIAR boundary. The substation area is relatively small in scale (c. 49m NE/SW x 25m NW/SE) from a wider landscape perspective and is likely to have localised effects rather than effects on the wider cultural heritage landscape setting.

No National Monuments are located in close proximity to the proposed substation, with the nearest comprising Rattoo ecclesiastical site over 4km to the north-west. The nearest recorded monument is situated c. 145m to the north north-west and comprises a levelled enclosure (KE016-005---) which no longer has any above-ground remains. Similarly, further to the south-west, ringfort KE016-013--- is located c. 274m from the proposed substation. It also no longer has any above-ground remains. A change to the wider setting of these monuments as a result of the proposed substation is acknowledged but given that they are levelled the impact is regarded as Imperceptible.

Pre-Mitigation Impact

An Imperceptible impact to the wider setting of nearby recorded monuments is identified.

Proposed Mitigation Measures

No mitigation measures are proposed.

Residual Impact

The residual impact is regarded as long term, Imperceptible, and of neutral effect.

Significance of Effects

The operation of the proposed substation will have no likely significant effect on the setting of National Monuments or Recorded Monuments. The significance of effects is considered to be long term, Imperceptible, and of neutral effect.

12.5.5.3.2 *Impacts on setting of NIAH/RPS and items of Cultural Heritage Merit*

No Protected Structures, NIAH structures or items of cultural heritage merit are located in close proximity to the proposed substation. The nearest RPS/NIAH structure (Reg. 21301602) is situated c. 326m to the south and comprises the site of a granite monument which was removed in the 1960s. No impacts to the immediate setting of this monument will occur and while a change to its wider setting is acknowledged the impact is regarded as Imperceptible.

Pre-Mitigation Impact

An Imperceptible impact to the wider setting of nearby RPS/NIAH structures is acknowledged.

Proposed Mitigation Measures

No mitigation measures are proposed.

Residual Impact

The residual impact is regarded as long term, Imperceptible, and of neutral effect.

Significance of Effects

The operation of the proposed substation will have no likely significant effect on the setting of NIAH/RPS structures. The significance of effects is considered to be long term, Imperceptible, and of neutral effect.

12.5.5.4 Borrow Pit

12.5.5.4.1 *Impact on setting of National Monuments, Recorded Monuments*

The proposed borrow pit is located towards the south-east side of the proposed wind farm EIAR boundary. The borrow pit area measures c. 170m in length NW/SE x 106m in width E/W and from a wider landscape perspective and is likely to have localised effects rather than effects on the wider cultural heritage landscape setting.

No National Monuments are located in close proximity to the proposed borrow pit, with the nearest comprising Rattoo ecclesiastical site over 4km to the north-west. The nearest recorded monument is situated c. 60m to the west and comprises a levelled ringfort KE016-013– which no longer has any above-ground remains. Further to the west at a distance of c. 142m is KE016-076– ringfort and KE016-076001- souterrain. Neither monument has any above-ground remains. A change to the wider setting of these monuments as a result of the proposed borrow pit is acknowledged but given that they are levelled the impact is regarded as Imperceptible.

Pre-Mitigation Impact

An Imperceptible impact to the wider setting of nearby recorded monuments is identified.

Proposed Mitigation Measures

No mitigation measures are proposed.

Residual Impact

The residual impact is regarded as long term, Imperceptible, and of neutral effect..

Significance of Effects

The operation of the proposed borrow pit will have no likely significant effect on the setting of National Monuments or Recorded Monuments. The significance of effects is considered to be long term, Imperceptible, and of neutral effect.

12.5.5.4.2 *Impact on setting of RPS/NIAH structures and items of Cultural Heritage Merit*

No Protected Structures, NIAH structures or items of cultural heritage merit are located in close proximity to the proposed borrow pit. The nearest RPS/NIAH structure (Reg. 21301602) is situated c. 164m to the south-east and comprises the site of a granite monument which was removed in the 1960s.

No impacts to the immediate setting of this monument will occur and while a change to its wider setting is acknowledged the impact is regarded as Imperceptible.

Pre-Mitigation Impact

An Imperceptible impact to the wider setting of nearby RPS/NIAH structures is acknowledged.

Proposed Mitigation Measures

No mitigation measures are proposed.

Residual Impact

The residual impact is regarded as long term, Imperceptible, and of neutral effect.

Significance of Effects

The operation of the proposed borrow pit will have no likely significant effect on the setting of NIAH/RPS structures or other items of cultural heritage merit. The significance of effects is considered to be long term, Imperceptible, and of neutral effect.

12.6 Decommissioning Phase

There will be no significant potential impacts on the archaeological, architectural and cultural heritage resource during the decommissioning phase of the proposed development. Any potential direct impacts will already have been resolved through mitigation measures during the construction phase.

12.7 Cumulative Impacts

Cumulative impact is defined as 'The addition of many small impacts to create one larger, more significant, impact' (EPA 2017). Cumulative impacts encompass the combined effects of multiple developments or activities on a range of receptors. In this case, the receptors are the archaeological monuments and architectural/cultural heritage sites in the immediate vicinity of the Proposed development. Cumulative Impacts at the Construction and Operational Stages are considered.

12.7.1 Cumulative Impacts (Direct Impacts – Construction stage)

The addition of other projects to the proposed development project was considered in order to assess Cumulative Impacts. These include all other wind farms within 20km of the proposed development.

12.7.1.1 Cumulative impacts (direct) considering other windfarms within 20km

12.7.1.1.1 *Cumulative impacts to Recorded Monuments, National Monuments, NIAH or RPS*

No direct impacts to National Monuments or those subject to Preservation Orders has been identified as a result of the proposed Ballynagare Wind Farm development. In this regard no cumulative direct impacts to this aspect of the archaeological resource will occur.

A potential direct impact to recorded monument KE009-088 Road – unclassified togher as a result of ground works associated with the construction of the hardstand for T1 has been identified. Through the implementation of the recommended mitigation measures, however, this impact will be ameliorated and when considered with the other wind farms within 20km, no cumulative direct impacts will occur.

12.7.1.1.2 *Cumulative impact to potential unknown sub-surface sites*

Direct effects to sub-surface archaeological features/sites can occur as a result of peat/topsoil removal and groundworks. The proposed development in combination with other developments, could result in potential increased negative effects to sub-surface archaeological features (i.e. cumulative impacts). Since all projects have been assessed from a cultural heritage perspective through the EIAR process, all potential negative effects of other projects are deemed to have been dealt with through the use of effective mitigation measures and planning conditions issued through the Planning Authorities.

If the mitigation measures prescribed in this EIAR are implemented then direct effects to unknown sub-surface archaeology will not occur as a result of this project. Therefore, cumulative effects will not occur.

12.7.2 Cumulative Impacts (Indirect Impact on Setting)

Indirect impacts on setting occur at the operational stage of the development (when turbines are operational). In this regard in order to assess overall cumulative effects on archaeology and cultural heritage, the proposed project is considered in the context of other developments, in particular other permitted and proposed wind farms.

12.7.2.1 National Monuments

When considered cumulatively, the proposed Ballynagare turbines along with the permitted, existing and proposed turbines within 20km could result in an increase in effects on the visual setting of the cultural heritage resource. If all of the turbines were constructed, it may result in more turbines being seen from various locations in the wider landscape setting.

12.7.2.1.1 *National Monument No. 55 Rattoo Ecclesiastical Site*

In terms of cumulative visual impacts on the Rattoo ecclesiastical site, viewshed analysis shows that all of the proposed turbines will be visible from this National Monument and a Moderate-Significant effect on setting was identified. In this regard, when considered with the other permitted, existing and proposed wind farms within 20km a cumulative impact on setting is acknowledged and likely effects on setting increase from Moderate-Significant to Significant. These effects are reversible should the turbines be decommissioned after the permitted lifetime of the proposed development.

12.7.2.1.2 *National Monument No. 303 Tonaknock Cross*

The likely visual impacts on this monument arising from the proposed Ballynagare turbines is considered to be Not Significant. The proposed Ballyhorgan turbines, existing Pallas/Clahane turbines, existing Tursillagh, Knocknagoum and Stack's Mountain are all within the viewshed from this monument. In this regard when considered cumulatively likely effects on setting may increase from Not Significant to Slight. These effects are reversible should the turbines be decommissioned after the permitted lifetime of the proposed development.

12.7.2.1.3 *National Monument No. 260 Listowel Castle*

The likely visual impacts on this monument arising from the proposed Ballynagare turbines is considered to be Not Significant. The existing Tullahennel North turbines, proposed Ballyhorgan turbines and some of the existing Pallas/Clahane and Tursillagh turbines all fall within the viewshed from this monument. In this regard when considered cumulatively likely effects on setting may increase from Not Significant to Slight. These effects are reversible should the turbines be decommissioned after the permitted lifetime of the proposed development.

12.7.2.1.4 Preservation Order No. 3/2008, 1/2008 Ringfort and Souterrain

Imperceptible impacts on the setting of these monuments as a result of the proposed Ballynagare turbines were identified as both the viewshed analysis and the ZTV demonstrate no visibility of the proposed turbines from this area. In this regard no cumulative impacts on setting are identified.

12.7.2.2 Cumulative (Indirect) Impacts to Recorded Monuments, RPS/NIAH structures and items of Cultural Heritage Merit

The likely indirect impacts to recorded monuments within the proposed development EIAR boundary and in the wider landscape of 5km has been considered in this assessment. Impacts to the setting of such monuments has been identified as Slight-Not Significant. When considered cumulatively with the other permitted, proposed and existing turbines within 20km effects on setting have the potential to increase from Slight-Not Significant to Slight.

A similar scenario is identified for RPS and NIAH structures within 5km of the proposed development, in particular turbines, for which a Slight-Not significant impact to their wider setting had been identified. This may increase to Slight when considered with permitted, existing and proposed turbines within 20km.

The likely impact to the setting of cultural heritage items not included in the RPS or NIAH as a result of the Ballynagare turbines is regarded as Imperceptible. When considered cumulatively with the existing, permitted and proposed turbines within 20km this has the potential to increase to Not Significant. These effects are reversible should the turbines be decommissioned after the permitted lifetime of the proposed development.

12.8 Conclusion

This chapter comprises an assessment of the potential impact of the proposed development on the Cultural Heritage resource. Cultural heritage includes archaeology, architectural heritage and any other tangible assets. The assessment was based on GIS based mapping, ZTV and Viewshed analysis to assist with the assessment of impacts on setting followed by a desktop analysis of all baseline data and a comprehensive programme of field inspection of the proposed infrastructure within the proposed development site boundary.

Ten recorded monuments are located within the wind farm EIAR site boundary while 199 monuments are situated within 5km of the nearest proposed turbine. This is considered to be a relatively high density of monuments. Of those monuments located within the proposed wind farm EIAR boundary, only one KE009-088 Road – unclassified togher is located at or in close proximity to proposed infrastructure. A number of mitigation measures have been recommended in order to ameliorate any potential impacts to this monument.

The potential impacts on unknown sub-surface features which may exist within the proposed wind farm site is addressed by means of pre-development archaeological testing and construction stage monitoring.

Indirect effects on the setting of National Monuments within 10km, RMPs within 5km and RPS/NIAH within 5km were included in order to assess impacts on setting in the wider landscape. Viewshed analysis and a review of the ZTV was undertaken to establish the nature and degree of impacts on the setting of National Monuments. The potential visual impact to National Monument No. 55 Rattoo ecclesiastical site as a result of the proposed Ballynagare turbines is regarded as Moderate-Significant.

Potential visual effects on recorded monuments, RPS and NIAH structures within 5km of the proposed turbines was also assessed and is regarded as Slight-Not Significant.

The grid connection route was also assessed and included in the assessment. Mitigation in the form of site monitoring of ground works where it extends through the zone of notification around an adjacent recorded monument is recommended.

An assessment of cumulative impacts was also undertaken taking into consideration projects within 20km of the proposed development. This included all permitted, proposed and existing turbines, as well as other projects listed in Chapter 2 of this EIAR. No direct cumulative impacts will occur. Some increases in impacts to the visual setting of some cultural heritage sites will occur taking into consideration all turbines (if constructed). These effects are reversible should the turbines be decommissioned after the permitted lifetime of the proposed development.

12.9 References

Architectural Heritage Guidelines for Planning Authorities (2011)

Bennett, I. (ed.) Excavations.ie, database of Irish excavation reports. Available at http://www.excavations.ie.

Department of Arts, Heritage, Gaeltacht and the Islands, 1999, Framework and Principles for the Protection of the Archaeological Heritage, 1999.

Guidelines on the information to be contained in Environmental Impact Statements, EPA 2017.

Kerry County Development Plan 2015-2021

Guidance on Setting and the Historic Environment, Historic Environment Division, February 2018

Other Sources

Record of Monuments and Places (RMP) for County Kerry.

1st Edition 6 inch OS maps (1835)

2nd Edition 25 inch OS maps (1903)

www.webgis.archaeology.ie/historicenvironment

www.excavations.ie

www.buildingsofireland.ie

www.logainm.ie

13. LANDSCAPE AND VISUAL

13.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) addresses the potential landscape and visual impacts of the proposed Ballynagare Wind Farm. The emphasis in this chapter is on the likely significant direct and indirect effects of the proposed development and includes an assessment of the proposed 7-turbine layout. It covers the assessment methodology, a description of the proposed development and the existing landscape based on relevant guidance. It includes a description of the landscape policy with specific reference to wind energy and the study area in which the proposed development site is located.

The landscape of the area is described in terms of its existing character, which includes a description of landscape values and the landscape's sensitivity to change. The landscape and visual impact assessment of the proposed wind farm uses visibility mapping, representative viewpoints and photomontages. The potential impacts in both landscape and visual terms are then assessed, including cumulative impacts.

A full description of the proposed development is provided in Chapter 4 of this EIAR.

13.2 Statement of Authority

This EIAR chapter was written by Audrey Williams, a Landscape Architect with McCarthy Keville O'Sullivan (MKO) Ltd. Audrey has over three years of landscape design and project management experience from Ireland, Sweden and Canada, with a focus on residential and park planning design and renewable energy projects. Audrey specialises in preparing Landscape and Visual Impact Assessment Reports for large-scale renewable energy projects including wind farms, solar farms, quarry extraction and strategic housing schemes, as well as preparing landscape masterplans for residential and commercial spaces. Audrey has extensive project management experience in landscape design and master planning and preparing landscape feasibility reports for large wind farm projects. Audrey was also aided by Michael Watson, a qualified Environmental Scientist and environmental consultant with 20 years' experience of EIA and LVIA.

13.2.1 'Do-Nothing' Scenario

In the Do-Nothing scenario, the proposed development would not take place. The opportunity to capture an even greater part of County Kerry's valuable renewable energy resource would be lost. The existing uses of the site for agriculture and turbary would continue. Therefore, there would be no landscape or visual effects in the 'do-nothing' scenario.

13.2.2 Proposed Development Description

Ballynagare Wind Farm Limited (the Applicant) is seeking planning permission to construct a wind energy development on land at Ballynagare, approximately 9km west of Listowel and approximately 2km north of Lixnaw County Kerry. The development is located in the townlands of Ballynagare, Dysert Marshes, Farrandeen, Monument. Knockaunacurraheen, Ballintogher, Ballnageragh, Clooncolla, Ballyhorgan West, Ballyhorgan East, Lissahane, Knockburrane, Ballygarret, Banemore, and Pallas.

The development comprises:

- Construction of 7 no. wind turbines with the following maximum and minimum parameters:

    - Overall ground to blade tip height in the range of 170m maximum to 169.5m minimum
    - Hub height of 95m
    - Rotor diameter in the range of 150m maximum to 149m minimum
- Turbine hardstand areas
- Provision of 1 no. permanent meteorological mast with a height of 110 metres
- Upgrade of existing roads and access junctions
- Provision of new site entrances, roads and hardstand areas
- 2 no. temporary peat storage areas
- 2 no. temporary construction compounds
- 1 no. borrow pit
- All site drainage works
- 1 no. onsite 38kV substation, control building and plant, associated security fencing and wastewater holding tank
- All associated underground electrical and communication cabling connecting the turbines to the proposed on-site substation
- Connection of the proposed 38kV on-site substation via underground cable in the public road to the entrance of the existing Clahane 110kV substation in the townland of Pallas
- All ancillary site and ground works, apparatus and signage

The application is seeking a ten-year planning permission and 35 year operational life from the date of commissioning of the wind farm.

A full description of the proposed project is further outlined in Chapter 4 of this report.

13.2.3 Mitigation by Good Design

Through the iterative project design process, informed by early-stage impact assessment work, landscape modelling, ZTV mapping and photomontage preparation in 2012 and again in 2020, every effort has been made to bring forward the optimum design for the proposed development with respect to landscape and visual factors. The project layout that is the subject of this LVIA, already incorporates the following landscape and visual design considerations for good wind farm design:

- The turbines have been located within a flat site surrounded by lands of similar elevations which limits open views of the project, particularly from potentially sensitive receptors such as settlements (Note the Photomontage outputs).
- The turbine layout has been designed to create a coherent cluster, contiguous and connected to each other visually and with consistent spacing.
- The proposed connection to the national electricity grid is underground thereby eliminating potential landscape and visual effects during the operational phase.

The internal site road layout makes use of the existing tracks wherever possible (to be upgraded for construction and the delivery of wind turbine components), to minimise the requirement for new tracks within the site. The site location and current layout minimises the potential for visibility from sensitive receptors and the site visits and assessment tools show that the actual visibility is far less than the theory. Where visibility does occur, the design is in accordance with best practice and a coherent project is evident.

13.2.4 Scoping Replies/Pre-Planning Meetings

A scoping and consultation exercise has been carried out by MKO, as detailed in Chapter 2 of this EIAR. A pre-planning meeting with Kerry CC occurred on June 2nd, 2021. Responses to the scoping exercise are summarised in chapter 2 and are included in full in Appendix 2-1.

13.3 Brief Methodology and Assessment Criteria

This section broadly outlines the methodology and the guidance used to undertake the landscape and visual impact assessment of the proposed development; a more detailed description of the methodology is outlined in Appendix 13-1. There are four main sections to this assessment:

- Landscape Baseline
- Visual Baseline
- Cumulative Baseline
- Likely and Significant Effects – outlining the assessment of landscape, visual and cumulative effects

13.3.1 Scope and Definition of Landscape and Visual Impact (LVIA) Study Area

For the purposes of this chapter, where the 'proposed development site' or 'the site' is referred to, this relates to the primary study area for the proposed development, as shown on Figure 13- 1 of Chapter 13. The proposed development site is discussed in some detail in terms of its landscape character.

However, the landscape and visual baseline mapping and viewpoint selection are based on wider study areas. On the basis of the desktop study and survey work undertaken, the professional judgement of the assessment team, experience from other relevant projects and policy guidance or standards (Appendix 3, DoHPLG 'Draft Revised Wind Energy Development Guidelines' 2019 and Landscape Institute, 'Guidelines for Landscape and Visual Impact Assessment' ("GLVIA") 2013, see below) the LVIA study area has been chosen as 20 kilometres for visual and landscape effects and 15 kilometres from the proposed wind turbines for effects on landscape character. These are the study areas for which the baseline maps and viewpoint locations are produced and are referred to as the 'study area'. Furthermore, on the basis of desk studies and survey work undertaken, the professional judgement of the assessment team, experience from other relevant projects and policy guidance or standards, the following topic areas have been scoped out of the assessment:

- Effects on landscape and visual receptors that have minimal or no theoretical visibility (as predicted by the ZTV) and/or very distant visibility, and are therefore unlikely to be subject to significant effects;
- Effects on designated landscapes beyond a 20km radius from the proposed development, from where it is judged that potential significant effects on key characteristics and/or special qualities, or views are judged unlikely to occur;
- Effects on landscape character beyond a 15km radius from the proposed development, where it is judged that potential significant effects on landscape character are unlikely to occur;
- Effects on visual receptors beyond a 20km radius from the proposed development, where it is judged that potential significant effects are unlikely to occur;
- Cumulative effects in relation to single turbines (except where otherwise stated);
- Cumulative landscape effects beyond a 15km radius and cumulative visual effects beyond a 20km radius from the proposed development, where it is judged that potential significant effects on landscape character are unlikely to occur;

13.3.2 Guidelines

While the legislation and general guidance on Environmental Impact Assessment is set out in Chapter 1 of this report, guidance specifically pertaining to the Landscape and Visual Impact are outlined in the Methodology Appendix – Appendix 13-1.

13.3.3 Baseline Landscape and Visual Information

In order to carry out this assessment, an initial desk study was undertaken which identified:

Landscape

- Landscape Receptors
- Policies and objectives contained in the relevant county development plans pertaining to landscape and wind energy
- Landscape designations in the study area
- Landscape character of the study area
- Landscape character of the proposed development site based on
    - Site Surveys undertaken in Fall 2020
    - Landscape Character Types identified in 'Landscape and Landscape Assessment: Consultation Draft of Guidelines for Planning Authorities' (Department of the Environment and Local Government, 2006)

Visual

- Zone of Theoretical Visibility (ZTV) mapping
- Route Screening Analysis
- Identification of Visual Receptors

13.3.4 Assessment of Potential Impacts

The methodology includes clearly documented methods based on the GLVIA guidelines, in order to arrive at an assessment. These include consideration of landscape and visual sensitivity balanced with the magnitude of the effect to determine the significance of effects. Mitigating factors are then taken into consideration to arrive at residual landscape and visual effects. Throughout this chapter 'theoretical visibility' is referred to. This is based on Zone of Theoretical Visibility (ZTV) mapping. Further details of which along with other information on the methodology of landscape and visual impact assessment are presented in Appendix 13-1.

13.4 Visibility of the Proposed Development

13.4.1 ZTV Mapping: Theoretical Visibility of the proposed development

The ZTV mapping methodology outlined in Section 13.2.2 of Appendix 13-1 was used to examine the theoretical visibility of the 7 No. proposed turbines from all landscape and visual receptors within the LVIA study area, using the half blade height of the wind turbines as points of reference. As noted in Appendix 13-1, actual visibility on the ground is significantly less than predicted by the ZTV mapping due to intervening factors such as: on site screening from natural and man-made features, atmospheric weather and/or localised topography.

Separate colour bands are used on the ZTV map to indicate the number of turbines of which the half blade will potentially be visible, shown on Figure 13-1. The legend on Figure 13-1 shows the number of visible turbines for each corresponding colour, which are as follows:

- Teal: 1-2 turbines visible
- Yellow: 3-5 turbines visible
- Navy Blue: 6-7 turbines visible

Figure 13-1 illustrates that full theoretical visibility of the 7 turbines occupies a relatively small proportion of the overall LVIA study area covered by the ZTV. Overall, concentrated areas of full theoretical visibility are constrained to areas in close proximity to the proposed development and areas 10 km north and south-west of the proposed development site.

Visibility within 10 kilometres of the proposed development is generally full theoretical visibility, with patches of no visibility. Beyond the 10-kilometre study boundary, the ZTV indicates that visibility will be patchy and limited in areas of higher elevation to the south, west and east. There are large areas of no visibility to the south, southeast and north and small patches of full theoretical visibility to the northeast and southwest beyond the 10-kilometre boundary. Theoretical visibility is extremely limited beyond the 20 km study boundary in all directions. Due to the position of the topographical elevations of Stacks Mountain to the south and Knockanore Mountain to the north, visibility is mainly retained to the west beyond the 10km boundary.

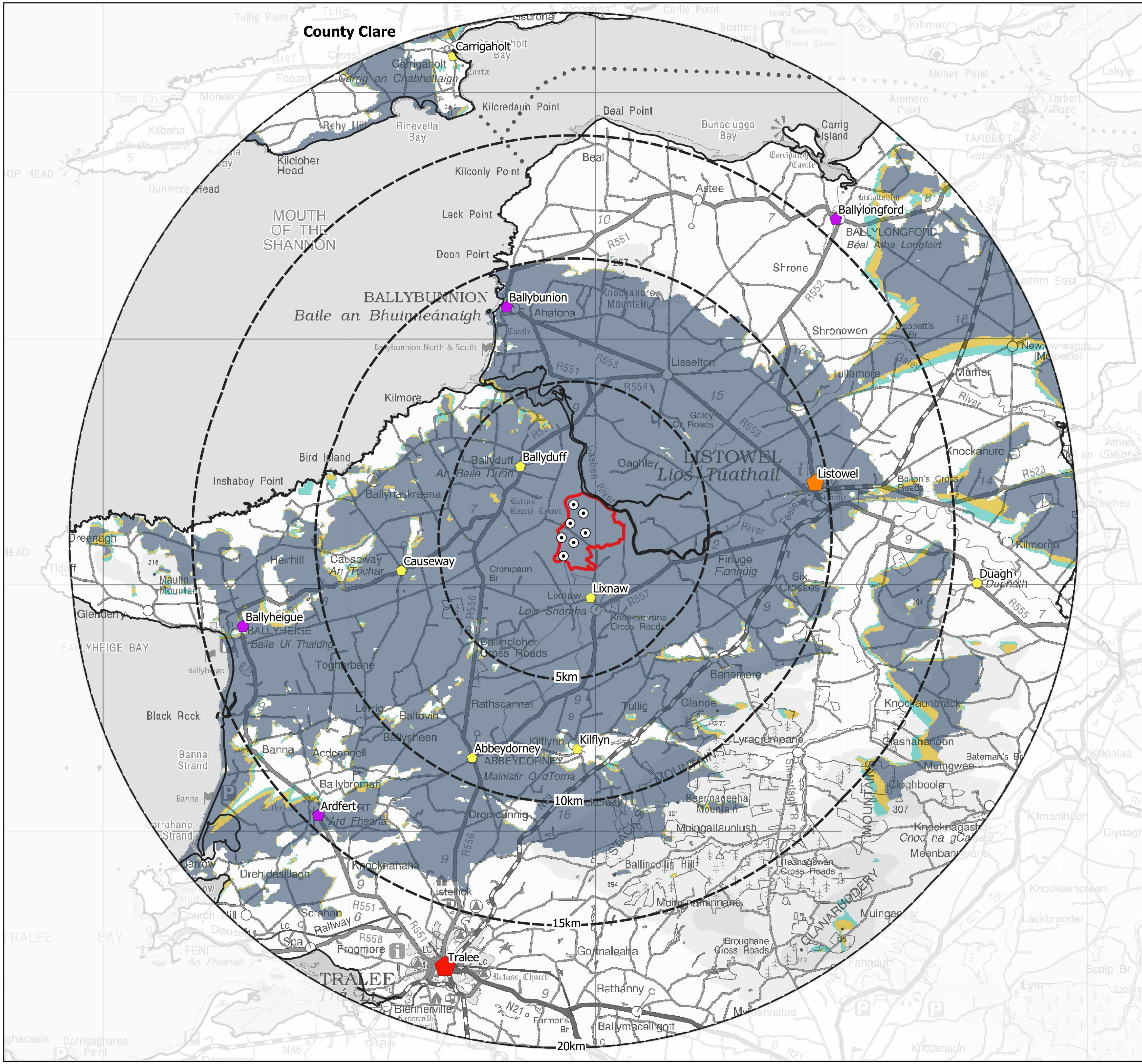
Theoretical visibility of the proposed development is significantly screened by hilly and mountainous topography of the landscape to the south, southeast and north of the site. Furthermore, the ZTV model assumes an absence of any landcover, and therefore does not take account of additional screening that will also be afforded by forestry, other vegetation and buildings.

To the south and southeast, there is a large area of the landscape which falls outside the ZTV i.e. within 20km but there is no visibility possible. The hilly topography that occurs to the east around the townland of Duagh will provide large areas of screening of the proposed wind farm and moving further south and north in the other direction, small pockets of theoretical visibility are shown.

As demonstrated in Figure 13- 1, only a small pocket of full theoretical visibility occurs in County Clare to the north of the proposed development. The small area of full theoretical visibility that falls within the LVIA study area of County Clare is limited to a small pocket north of Rinevella Bay and small strip along the western coast of Rinevella Bay.

The rolling topography that occurs northeast of the site and east of Ballylongford allows for patches of theoretical visibility of the proposed site. This patch of theoretical visibility, which runs adjacent to the Galey River, will provide some screening of the turbines and areas where a reduced number of turbines will be visible.

Additional ZTV mapping exercises were conducted to assess the theoretical visibility of the proposed development cumulatively with all other existing, permitted and proposed wind farm developments located within the 20 km LVIA study area. These ZTV maps are presented and discussed in Section 13.7 of this Chapter, *Cumulative Baseline.*



Map Legend

- Site Boundary
- Propsoed Ballynagare Turbine Locations
- County Boundary

Half-Blade ZTV

- 1-2 Turbines
- 3-5 Turbines
- 6-7 Turbines

Co. Clare Settlement Hierarchy

- Large Village

Co. Kerry Settlement Hierarchy

- Hub Town
- Regional Town
- District Town
- Village

N

Drawing Title	Half Blade ZTV
Project Title	Ballynagare Wind Farm
Drawn By: AW	Checked By: TB
Project No.: 200512	Drawing No.: Figure 13-1
Scale: 1:150000	Date: 2021.05.31

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13.4.2 Views and Viewsheds

The landscape in the immediate environs of the Ballynagare site is viewed as three distinctive types of viewsheds, depending on where the landscape is viewed from. The three distinctive viewsheds are heavily influenced by topography, elevation and landcover, and the distinction between the three types is very important in understanding how the proposed Ballynagare wind farm will appear in the landscape.

Views in Immediate Area Around Site

The views in the immediate area around the site are very small in scale, with short, enclosed views of pasture and stone hedgebanks as the defining landscape characteristics. This was reflected in the Co. Kerry Landscape Character Assessment's categorising this landscape as being "*a generally flat river valley with prominent features including the Stacks Mountain and Knockanore Mountain*". On occasion, more open views over longer distances are achievable, but such views tend to be of a similar character, eventually ending in a view of dense hedgerows or mature tree-lined field boundaries.

Within the proposed site, including from roads that pass through the site, there are several types of views. Open and unrestricted views with no screening and restricted and small-scale views screened by vegetation, which is to be expected given that the site is surrounding an area of cutaway peatland where screening is quite sparse.

Plate 13-1 Restricted small-scale views within the site boundary defined by tall shrubs and hedgerows.

Plate 13-2 More open, unrestricted view across portion of site.

Plate 13-3 View towards site from Wild Atlantic Way looking southeast, screening by vegetation and evidence of overhead electricity lines.

Views Through the Site from South to North

Views from the south in a northernly direction in the local wider landscape area surrounding the Ballynagare site are smaller in scale and are framed by undulating hills and large agricultural fields outlined by mature hedgerows. Longer distance views illustrate the disproportionate screening effect that relatively small screening features such as treelines and topographical changes in landform, can have in limiting the view of the proposed turbines. The view shown Plate 13.4 is representative of the open and expansive views from south to north, showing large grass fields ending in a dense treeline or hedgerow.

Plate 13-4 Northernly view from local road through towards Ballynagare site framed by hedgerows in the background.

Views Through Site from North to South

The higher elevated landscape south of the site on Stacks Mountain and north of the site at Knockanore Mountain, present a very different view of the landscape from that experienced in the immediate area around the site. The landscape in this locality viewed from Knockanore Mountain of the Ballynagare site, is much larger in scale, with expansive views being regularly available in a southernly direction over the flat Listowel Plain extending from the northwest Kerry coastline and the Shannon Estuary in the direction of the Stacks Mountains. The higher elevations suppress the dominance of the landcover vegetation found at the lower elevations in the immediate environs of the wind farm site.

Plate 13-5 Southernly view from Knockanore Mountain overlooking the lower lands of the Cashel River plain, landscape framed by Stack's Mountain in the skyline.

13.4.3 Factors Influencing Turbine Visibility

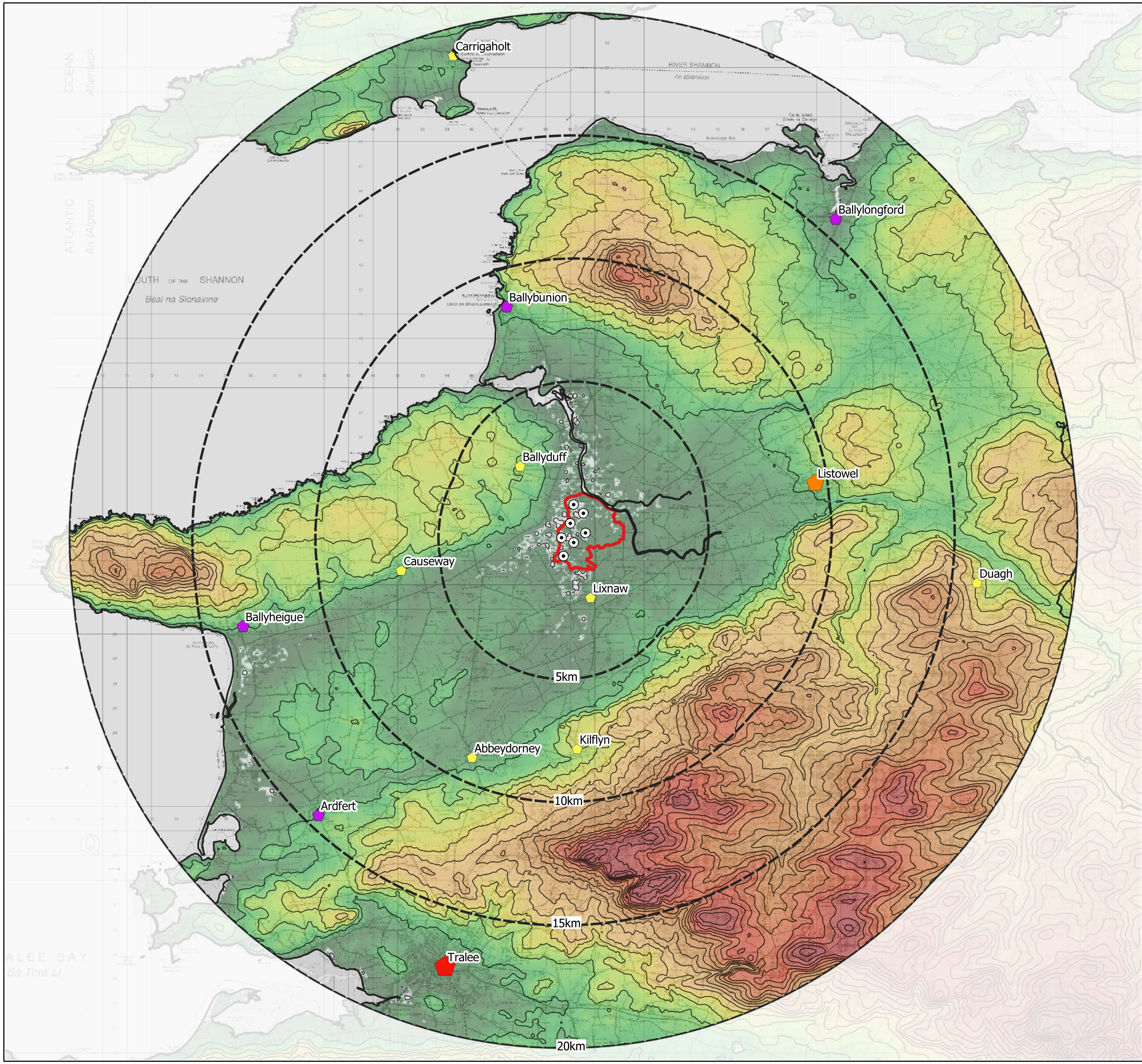
Topography and Elevation

The proposed wind farm site is located within a flat landscape and at a low elevation, which in itself will assist in screening the proposed turbines from view. Various wind farms have been consented and constructed within topography such as this throughout Ireland and a common feature is that smaller screening vegetation in the intervening landscape can have a disproportionate screening effect on turbine visibility. It also means that distance becomes very important as the turbines are not located at higher elevations and so the turbines appear smaller in scale quickly when viewed in this planar view. This topographic feature of the site mitigates the potential for overbearing or domineering effects provided sufficient setback from receptors are designed into the project. The low-lying elevation and flat topography of the Ballynagare site and surrounding Listowel Plain, contributes to the landscape's capacity to accommodate a wind farm. This is shown in the photomontages created from Viewpoints

01, 24, 23 and 26 (See Volume 2 Photomontage Booklet and Appendix 13-3), which even at close distances from the site, show how the flat topography and the screening landcover thereon, serve to reduce the visibility of the turbines.

Vegetation Screening

The small scale of the landscape in the Listowel Plain around the site of the proposed development and the historical land management and farming practices, have resulted in landcover in the form of hedgerows and tree lines in particular along roadways. The vegetation screening found throughout much of the study area create sufficient screening from visual receptors.



Map Legend

Site Boundary
County Boundary

Ballynagare Turbine Locations
20m Contours

Co. Kerry Settlement Hierarchy
Hub Town
Regional Town
District Town
Village

Co. Clare Settlement Hierarchy
Large Village

Elevation Model
1m
25m
50m
75m
100m
150m
200m
250m
300m

Drawing Title	
Topography	
Project Title	
Ballynagare Wind Farm	
Drawn By: AW	Checked By: TB
Project No.: 200512	Drawing No.: Figure 13-2
Scale: 1:150000	Date: 2021.05.31

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13.4.4 Route Screening Analysis

In order to comprehensively demonstrate the varying characteristics of the roads and to record the actual visibility in comparison to the theoretical visibility, a methodology was developed termed Route Screening Analysis, and this was undertaken from all roads within a three-kilometre radius of the proposed turbines. Additional route screening analysis was undertaken from roads between 3km and 5km where visual receptor sensitivity was considered high (i.e. the roads around the Villages of Lixnaw and Ballyduff, as well as Scenic Route 1 at Ferry Bridge). The full methodology is outlined in Appendix 13.1 and the categories recorded were as follows:

- Little/No Screening – mainly open and with some very light vegetation (see Plate 13-6 and Plate 13-7 below)
- Intermittent/Partial Screening – light deciduous roadside vegetation and vegetation with short gaps which would allow intermittent or partial views (see Plate 13-8 and 13-9 below)
- Full Screening – vegetation which is dense enough to block views e.g. coniferous forestry (see Plate 13-10 and Plate 13-11 below)

Plate 13-8 below was taken east of Knockercreeveen and outlines the route screening within a three-kilometre radius of the proposed turbines. This figure indicates that the majority of the roads within 3 kilometres of the site have 'Intermittent/Partial Screening'. Therefore, the full theoretical visibility indicated by the ZTV for these roads will be substantially reduced by roadside screening. The presence of roadside screening is particularly important in contexts such as the proposed development site, where the site is at the same elevation to the surrounding roads.

Plate 13-6 Example of 'Little/No Screening' near Killomy

Plate 13-7 Example of 'Little/No Screening' near Ballyouneen

Plate 13-8 Example of 'Intermittent/Partial Screening' near Knockercreeveen

Plate 13-9 Example of 'Intermittent/Partial Screening' near Muckenaugh Lower

Plate 13-10 Example of 'Full Screening' near Ballyouneen

Plate 13-11 Example of 'Full Screening' near Curraghdroneen

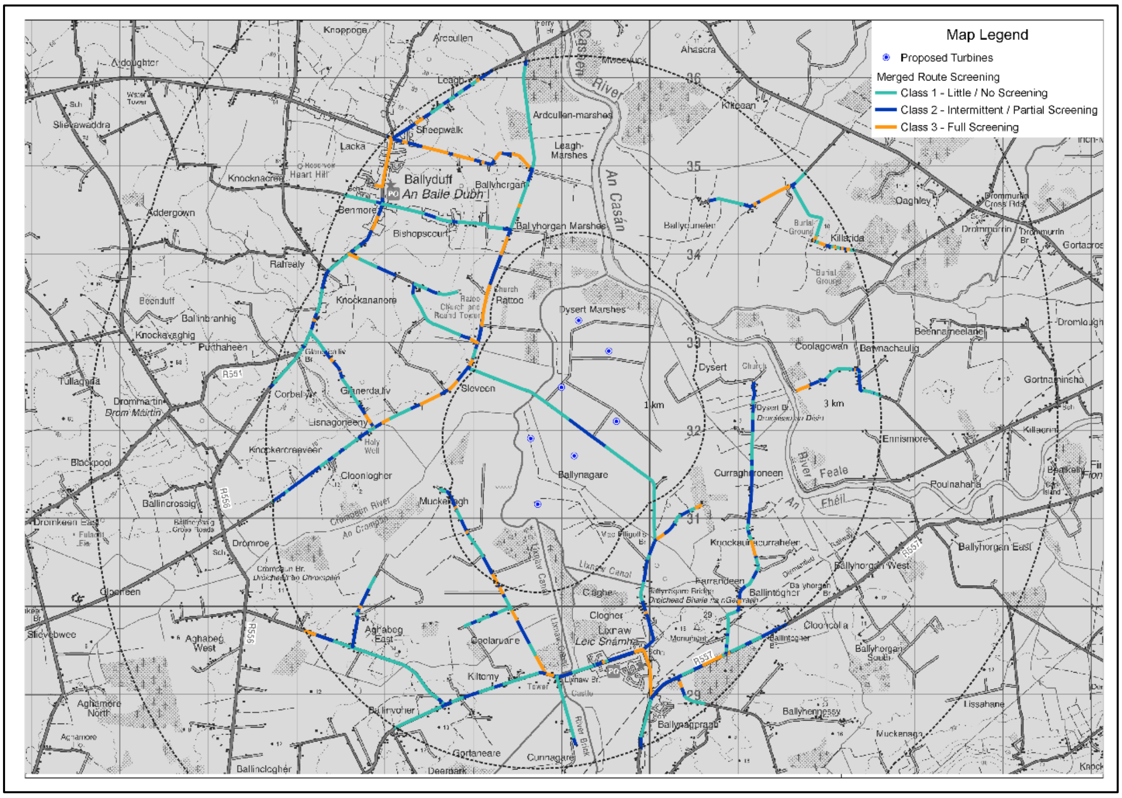


Figure 13- 3: Route Screening Analysis – Inner Perimeter Route

Inner Perimeter Roads

There are very few roads within 1 km of the proposed development site, with only the local road that runs between the two clusters of turbines and a small section of a local cul-de-sac road to the south-west of the proposed turbines. Plate 13-8 Example of 'Intermittent/Partial Screening' near Plate 13-9 Example of 'Intermittent/Partial Screening' near Knockercreeveen

above demonstrates the extent of limited screening towards the optimised turbines from the local cul-de-sac road south-west of the turbines. The dominant screening type is 'Little/No Screening' on these roads due to the limited screening on the local road running through the site. The cul-de-sac contains a mix of 'Little/No Screening' and 'Intermittent/Partial' screening.

Within 1 and 3 kilometres of the site 'Intermittent/Partial screening' remains the slightly dominant category alongside some areas of 'Little/No Screening'. There are also a small number of areas of 'Full Screening' , along the roads in and around the villages of Ballyduff and Lixnaw, shown in Plate 13-12 and Plate 13-13 below, where the built environment provides 'Full Screening' from views towards the optimised turbines. There are also some longer stretches of 'Full Screening' on the local road adjacent to the site along the north-western boundary. The R551 regional road running parallel north-west of the site is a mosaic of screening types including 'Intermittent/Partial Screening' and 'Little/No Screening', with stretches of 'Full Screening' as it moves further north towards Ballyduff. The R557 which approaches Lixnaw from the south of the proposed development site is mostly 'Little/No Screening' with patches of 'Intermittent/Partial Screening' and 'Full Screening' closer to the village of Lixnaw.

Plate 13-12 View towards the proposed development site from an elevated position at the northern end of Ballyduff, this is an example of 'Intermittent/Partial' screening in the village.

Plate 13-13 Example of the first open view toward the proposed development site when travelling west out of Lixnaw, the last buildings of which can be seen in the middle-ground

Plate 13-14 View from Ferry Bridge towards the proposed development site

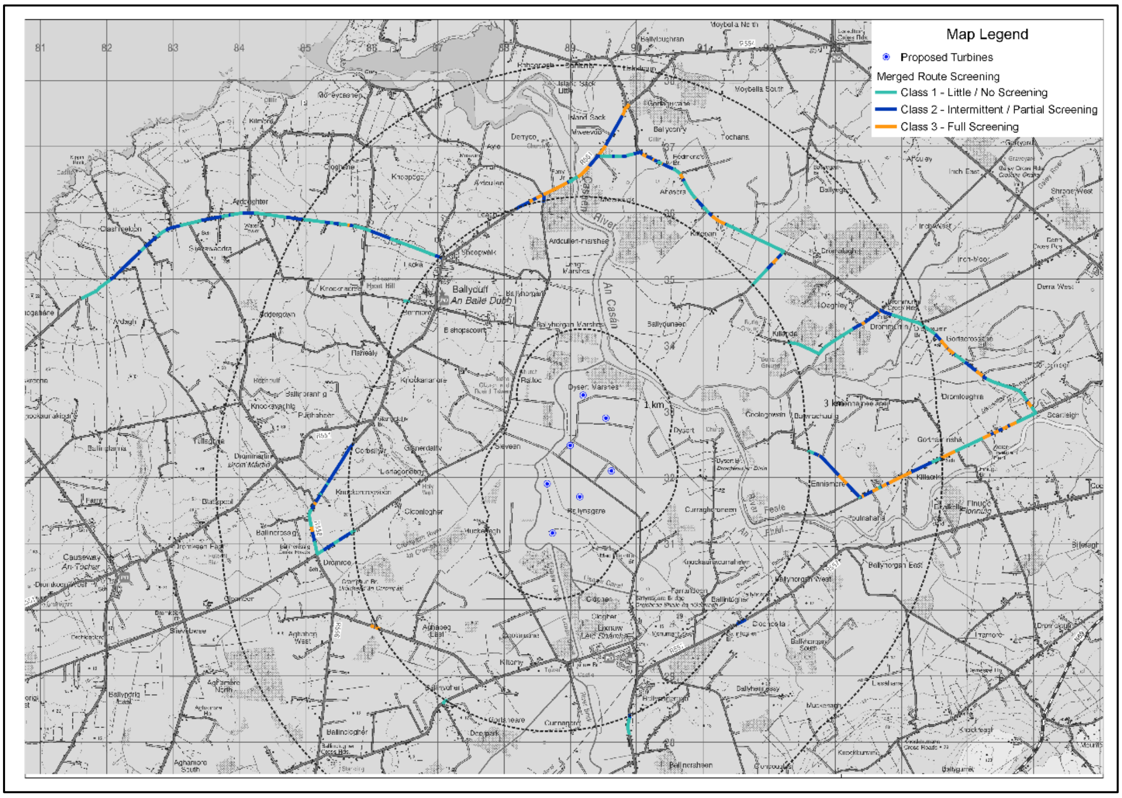


Figure 13- 4: Route Screening Analysis – Outer Perimeter Route

Outer Perimeter Roads

The outer perimeter roads that were assessed between 3km and 5km are classed as high due to their designations in the Kerry County Development Plan and where visual receptors may have some susceptibility to change as a result of the proposed development. The outer perimeter roads that were assessed in the Route Screening Analysis include those at the Scenic Route 1 at Ferry Bridge, and northwest of the village of Ballyduff along the Wild Atlantic Way along Scenic Route 9.

The dominant category for the outer perimeter route is 'Intermittent/Partial Screening'. The local roads to the north and east of the optimised turbines contain a mosaic of all screening types with larger stretches of 'Little/No Screening' further to the east. The stretch of the R556 regional road to the south of Ballyduff beyond 3km is mostly 'Intermittent/Partial Screening' with small sections of 'Little/No Screening'. Plate 13-88 above demonstrates the 'Intermittent/Partial Screening' from this section of the R556 near Knockercreeveen.

It is worth noting that the sections of the Wild Atlantic Way Tourist Route within the study area, which makes up of sections of the North Road, the Coast Road, and the R551 north of Ballyduff, includes a mosaic of screening types. With the sections of the Route located west of Ballyduff comprising an even mix of 'Little/No Screening' and 'Intermittent/Partial Screening', which changes to predominantly 'Full Screening' and 'Intermittent/Partial Screening' to the east of Ballyduff. Plate 13-14 above shows the view from Ferry Bridge, located along this Route to the north-east of Ballyduff. While this is an example of 'Little/No Screening', the coniferous plantation forestry seen in the right middle and background of the view introduces a manmade element in the view and reduces its aesthetic value. This coniferous forestry will partially screen visibility of the proposed development site in the midground of the view.

13.5 Landscape Baseline

This part of the LVIA focusses on identifying the key landscape receptors that should form part of the assessment. As the LVIA study area includes County Kerry as well as a small area of County Clare, landscape policy for both counties were referenced in this section.

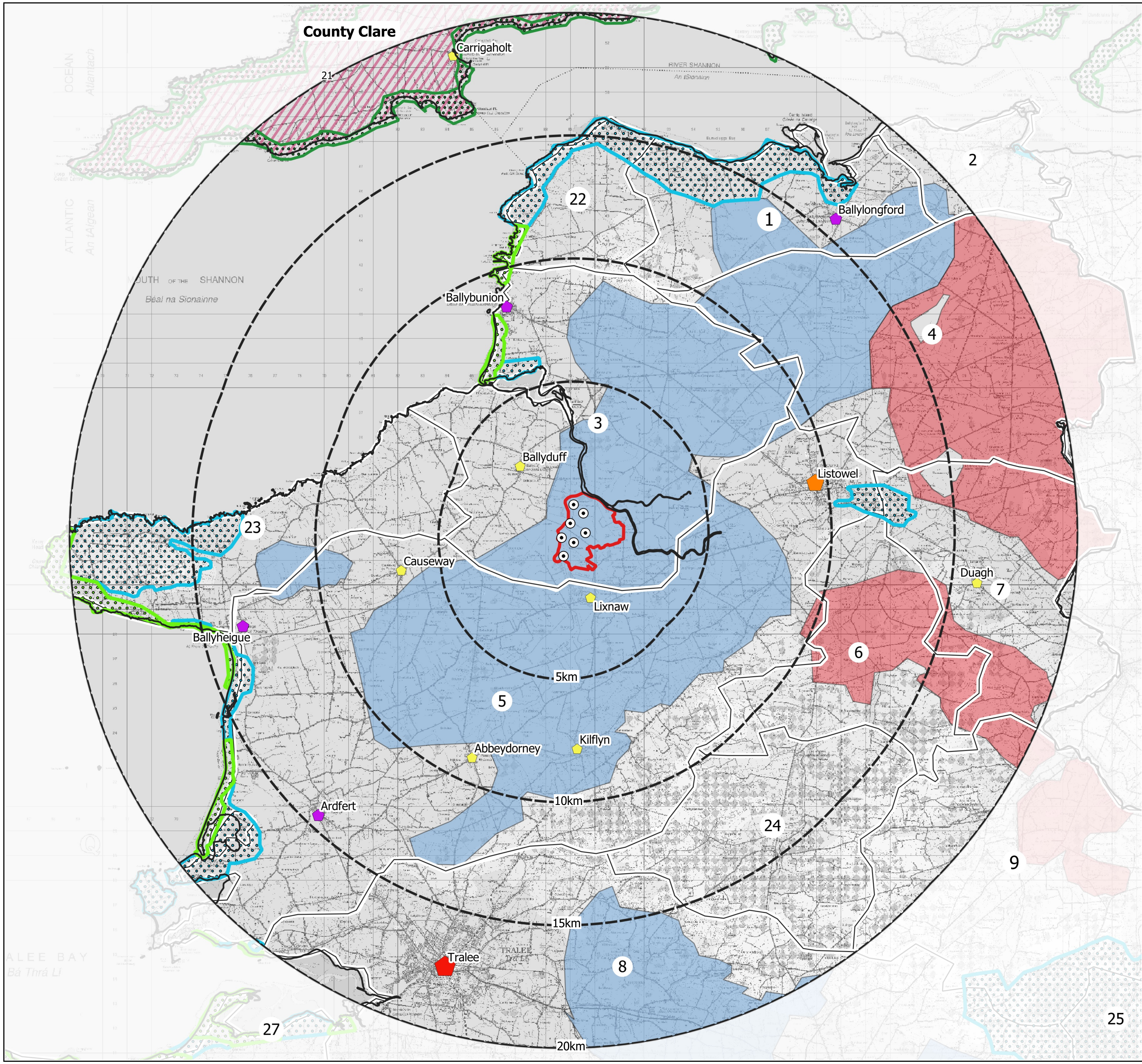
Baseline Landscape Receptors:

- **Landscape Designations** based on:
  - The Kerry County Development Plan 2015-2021 (Kerry County Council, 2015).
  - Draft Renewable Energy Strategy 2012 (Kerry County Council, 2012).
  - Landscape Character Assessment prepared for the Renewable Energy Strategy 2012 & Adopted / Proposed Archaeological Landscapes (Kerry County Council, 2012).
  - The Clare County Development Plan 2017-2023 (As Varied)
  - Clare County Development Plan 2017-2023 Volume 5- Clare Wind Energy Strategy
- **Landscape Character of the proposed development site** and its immediate environment based on:
  - Landscape Type identified using Draft Revised Wind Energy Development Guidelines (Department of Housing, Planning and Local Government, 2019)
  - Site Visits.
- **Landscape Character of the Study Area** based on:
  - The Kerry County Development Plan 2015-2021 (Kerry County Council, 2015).
  - Draft Renewable Energy Strategy 2012 (Kerry County Council, 2012).
  - Landscape Character Assessment prepared for the Renewable Energy Strategy 2012 & Adopted / Proposed Archaeological Landscapes (Kerry County Council, 2012).

13.5.1 Landscape Designations and Policy

The Development Plans of County Kerry and County Clare were consulted to identify landscape designations and policy.

The list of views and scenic routes within 20 km of the proposed turbines, mapped in Figure 13- 8 are set out under the Visual Baseline, as they are in their nature a visual designation, and assessed and form part of the basis of viewpoint selection.



Map Legend

- Site Boundary
- Proposed Ballynagare Turbines
- County Boundary
- Co. Kerry Landscape Character Areas
- Co. Kerry Primary Special AmenityArea
- Co. Kerry Secondary Special Amenity Area
- Co. Clare Heritage Landscapes
- Wind Deployment Zone-Open to Consideration
- Wind Deployment Zone-Strategic Site Search
- Co. Clare WES- Not Normally Permissible

Co. Kerry Settlement Hierarchy

- Hub Town
- Regional Town
- District Town
- Village

Co. Clare Settlement Hierarchy

- Large Village

N

Drawing Title Landscape Baseline	
Project Title Ballynagare Wind Farm	
Drawn By AW	Checked By TB
Project No. 200512	Drawing No. Figure 13-5
Scale 1:150000	Date 2021.05.31

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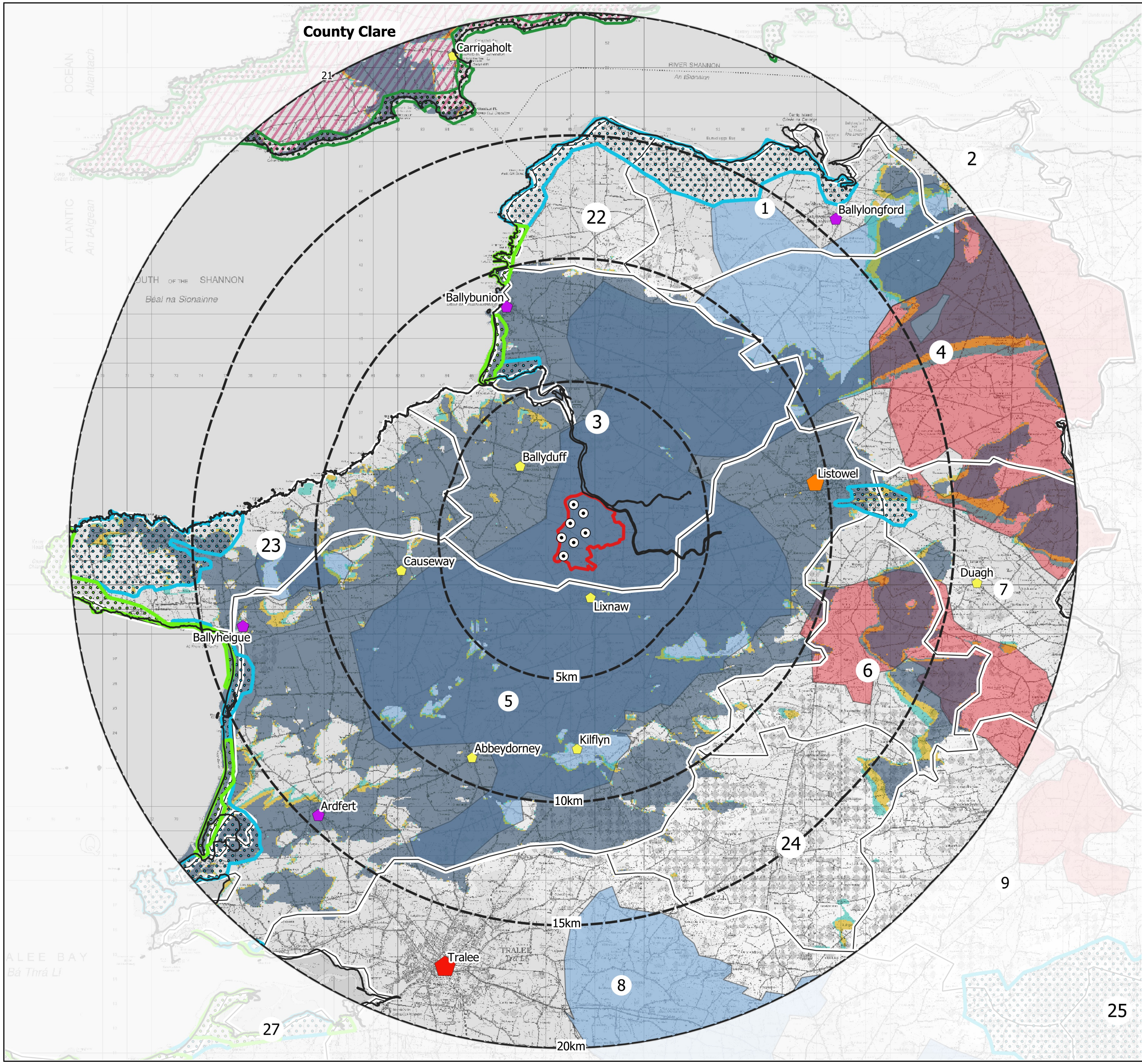

Map Legend

- Site Boundary
- Proposed Ballynagare Turbines
- County Boundary
- Co. Kerry Landscape Character Areas
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- Co. Clare Heritage Landscapes
- Wind Deployment Zone-Open to Consideration
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Co. Kerry Settlement Hierarchy

- Hub Town
- Regional Town
- District Town
- Village

Co. Clare Settlement Hierarchy

- Large Village

Half Blade ZTV

- 1-2 Turbines
- 3-5 Turbines
- 6-7 Turbines

N

Drawing Title
Half Blade ZTV and Landscape Baseline

Project Title
Ballynagare Wind Farm

Drawn By	Checked By
AW	TB
Project No. 200512	Drawing No. Figure 13-6
Scale 1:150000	Date 2021.05.31

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13.5.2 County Kerry

The Kerry County Development Plan 2015-2021 (hereafter referred to as the KCDP) came into effect on the 15th of March 2015. The Plan includes policies and objectives pertaining to wind energy development, landscape and amenity designations which are referred to in the following sections:

- General Landscape Policy
- Landscape Character Assessment
- Landscape Zoning
- Scenic Amenity, Views and Prospects
- Wind Energy Policy

General Landscape Policy

The Kerry County Development Plan (KCDP) sets out the overall strategy for the proper planning and sustainable development of the county. The policies and objectives of the plan have been developed in recognition of the unique characteristics of the county and in consideration of government policy. Sections 12.1 to 12.3 of the KCDP detail the objectives and policies of Kerry County Council in relation to landscape and development. Regarding landscape protection, the plan sets out the following objective:

> ***Objective ZL 1:*** *Protect the landscape of the county as a major economic asset as well as for its invaluable amenity which contributes to the quality of people's lives.*

The plan states that a Landscape Character Assessment is required for the county, which would have three distinct elements:

- Identification and Classification of Landscape Types.
- Landscape Character Areas.
- Landscape Value and Sensitivity to Development.

Landscape Character Assessment

Kerry County Council has to date not completed its landscape character assessment, but states as an objective in the KCPD:

> ***Objective ZL-2****: Prepare a Landscape Character Assessment of the County following the publication of the proposed National Landscape Strategy. This assessment will include capacity studies for different forms of development and will involve consultation with adjoining local authorities.*

However, within the Renewable Energy Strategy prepared by Kerry County Council in 2012, forty-six Landscape Character Areas (LCAs) were identified. All of the proposed turbines are located within LCA 3 - Cashen River.

In the 2012 Renewable Energy Strategy for County Kerry (hereafter referred to as RESCK) LCA 3 – Cashen River is categorised as a 'Hilly and Flat Farmland, Coastal' Landscape Character Type. Its overall capacity for wind farm development is as follows:

"Capacity in the area, constraints include visual impact on this open landscape and proximity to Natura 2000 site. Flooding may be an issue."

Volume 2 of the RESCK details the landscape character of LCA-3 Cashen River from two viewpoint locations within the LCA. The viewpoint at Knockercreeveen is in closest proximity to the proposed development site and the description and assessment best represents the landscape character of the proposed development site and the immediate surrounding area. The development capacity for the

'Knockercreeveen' area within the Cashen River LCA local to the proposed development is reported below:

"There is a high density of population in parts of the area. An area has been identified as having some capacity for wind development. This area includes lands on either side of the Crompaun River, River Brick, Cashen River and Galey River. The reason this area is considered to have capacity for wind development is that it would have less population than the remainder of the area, and the land is also marginal. The view from the Ferry Bridge is protected in the Kerry County Development Plan 2009-2015, which should be considered as a constraint rather than a barrier to wind development. Given the flat and open nature of the landscape turbine heights in excess of 50-75m would be overly dominant and have an adverse impact on the amenity of the local population. There is the possibility of flooding in the area, which may act as a constraint to wind development. It is therefore zoned as being Open to Consideration."

No explicit landscape value or sensitivity ratings are detailed in the RESCK for this area of the LCA, however, no amenity areas, scenic areas or dominant features were identified within the landscape, and the area is not regarded as a landscape of national importance.

Landscape Zoning

The KCDP recognises that the sensitivity of a landscape is a measure of its ability to accommodate change or intervention without suffering unacceptable effects to its character. On this basis, the KCDP sets out the following policy in regard to zoning of lands in rural areas:

> ***Objective: ZL-3*** *Determine the zoning of lands in rural areas having regard to the sensitivity of the landscape as well as its capacity to absorb further development.*

There are three categories of rural area zoning designations; Rural Prime Special Amenity, Rural Secondary Special Amenity and Rural General, as indicated in Maps *12.1 (a)* to *12.1 (u)* of the KCDP (Volume 3). A description of the two most sensitive zoning types as defined by the KCDP and their capacity for accommodating new development in consideration of landscape sensitivity and value are reported below:

> ***Rural Prime Special Amenity:*** *"are those landscapes which are very sensitive and have little or no capacity to accommodate development. In these areas all development will be prohibited, other than normally exempted development in accordance with Section 4, Planning and Development Act 2000-14, Schedule 2 of the Planning & Development Regulations 2001-2013 and Chapter 3.3.2, which will be open to consideration, subject to satisfactory integration into the landscape and compliance with the proper planning and sustainable development in the area."*

> ***Rural Secondary Special Amenity:*** *"The landscape of areas in this designation is sensitive to development. Accordingly, development in these areas must be designed so as to minimise the effect on the landscape. Proposed developments should, in their designs, take account of the topography, vegetation, existing boundaries and features of the area, as set out in the Building a House in Rural Kerry Design Guidelines (Kerry County Council 2009). Permission will not be granted for development which cannot be integrated into its surroundings. Development will only be permitted where it is in accordance with the provisions of Chapter 3.3.2."*

As shown in *Figure 13- 5* (above), the proposed development is not located in an area of Rural Primary Special Amenity or Rural Secondary Special Amenity. Within the LVIA study area (within 15km of the proposed development site for landscape) there are three areas designated as Rural Special Amenity, these are listed below and shown above in *Figure 13- 5*.

Rural Prime Special Amenity within the LVIA Study Area:

- Two closely located strips 6 km north-west of the nearest turbine at its closest point immediately north and south of Ballybunion town. The landscape designation incorporates the coastal cliffs immediately north of Ballybunion and the dune complex to the south. This area (119 Hectares) of Rural Prime Special Amenity only extends 700 metres inland and 4.5km along the coastline. Any landscape effects on this sensitive landscape area attributed to the proposed development will be significantly mitigated by distance.
- A small parallel strip 14 km southwest of the nearest turbine at its closest point immediately south of Ballyheige. The area only extends 163 metres inland and 2.6km along the coastline. Any landscape effects on this sensitive landscape area attributed to the proposed development will be significantly mitigated by distance.

Rural Secondary Special Amenity within the LVIA Study Area:

- Land around the River Feale as it enters the town of Listowel from the east, this area (290 hectares) of Rural Secondary Amenity is approximately 9.5km east of the nearest turbine at its closest point.
- A small area south of Ballybunion town overlooking Cashen Bay on the River Feale estuary, this area (97 hectares) of Rural Secondary Amenity is approximately 5.6 km north-west of the nearest turbine at its closest point.
- An area located 11.4 km north of the nearest turbine on the coast of the Shannon Estuary and west of Ballylongford. Approximately 1290 Hectares of the designated area is within the LVIA study area for landscape. Any landscape effects on this designated area attributed to the proposed development will be significantly mitigated by distance.
- Two closely located strips 13.5 km south-west of the nearest turbine at its closest point immediately west of Ballyheige town. These areas together are approximately 177 Hectares of Rural Secondary Special Amenity and only extend 800 metres inland and 3.1km along the coastline. Any landscape effects on these sensitive landscape areas attributed to the proposed development will be significantly mitigated by distance.
- Land around the Maulin Mountain and along the Shannon coast, this area is approximately 290 hectares of Rural Secondary Amenity and approximately 13km west of the nearest turbine at its closest point. Any landscape effects on this sensitive landscape area attributed to the proposed development will be significantly mitigated by distance.

Scenic Amenity, Views and Prospects

The policy of Kerry County Council regarding scenic views and prospects is presented in Section 12.4 of the KCDP. The plan states:

> *"County Kerry contains areas of outstanding natural beauty which are recognised internationally. There is a need to protect and conserve views and prospects adjoining public roads throughout the county. These views and prospects are important to the amenity of the County and to its tourist industry.... In assessing views and prospects it is not proposed that this should give rise to the prohibition of development along these routes, but development, where permitted, should not seriously hinder or obstruct these views and should be designed and located to minimise their impact."*

The following objectives of the KCDP relates to views and prospects:

> ***Objective ZL-5:*** *Preserve the views and prospects as defined on Map No's 12.1, 12.1a– 12.1u*

> ***Objective ZL-6:*** *Facilitate the sustainable development of existing viewing points as identified by Fáilte Ireland along the route of the Wild Atlantic Way, while ensuring the protection of environmental attributes in the area through the implementation of environmental protection objectives, standards and guidelines of this Plan.*

Map 12.1 (a,b,c,e,f,) of the KCDP was consulted to identify a total of 22 County Kerry designated scenic views/prospects within the LVIA study area. Viewing points designated by Fáilte Ireland along the route of the Wild Atlantic Way have also been considered when identifying prominent visual receptors for assessment in this LVIA. Designated views/prospects within 20 km of the proposed turbines, mapped in Figure 13- 8 are set out under the Visual Baseline (Section 13.6), as they are in their nature a visual designation, and assessed and form part of the basis of viewpoint selection.

Wind Energy Policy

The policy of Kerry County Council regarding renewable wind energy is presented in Section 7.6.3 of the KCDP. The plan states that it is an objective of the council to:

> *"**EP-11:** Implement the Renewable Energy Strategy for County Kerry (KCC 2012)".*

The RESCK was consulted to identify landscape designations and policy in the context of wind energy strategy for County Kerry. The RESCK divides the land of County Kerry into three categories called Wind Deployment Zones, each zone has a differing capacity to accommodate wind energy developments. The three Wind Deployment Zones are listed below:

- Strategic Site Search Areas
- Open to Consideration
- Unsuitable

Utilising Map 7.6 of the RESCK as guidance, Figure 13-5 (above) illustrates the position of 'Strategic Site Search Areas' and 'Open to Consideration' Wind Development Zones located within the LVIA study area. The proposed development is identified in an area designated as 'Open to Consideration', a description of this Wind Development Zone as reported by the RESCK is described below:

Open to Consideration: *"Site searches within these areas will identify sites with wind energy capacity and the environmental and infrastructural capacity to support wind development. They differ from Strategic Areas in that there are fewer suitable sites. It is recommended that during the site search process developers consult with the planning authority. Again the capacity of these areas has limits and the cumulative impact of in these areas will be monitored."*

In consideration of this designation, all efforts were made to consult with local planning authority and consider cumulative impacts when selecting the proposed development site.

13.5.3 County Clare

The Clare County Development Plan 2017-2023 (hereafter referred to as the CCDP) came into effect on the 19th of December 2016. The Plan includes policies and objectives pertaining to wind energy development, landscape and amenity designations which are referred to in the following sections:

- General Landscape Policy
- Landscape Character Assessment
- Living Landscapes- Heritage Landscapes
- Scenic Amenity, Views and Prospects
- Wind Energy Policy

General Landscape Policy

The Clare County Development Plan (CCDP) sets out the overall strategy for the proper planning and sustainable development of the county. The policies and objectives of the plan have been developed in recognition of the unique characteristics of the county and in consideration of government policy. Sections 13.1 to 13.3 of the CCDP detail the objectives and policies of Clare County Council in relation to landscape and development.

Landscape Character Assessment

The Clare County Council has identified 21 LCAs presented in Map 13.2 in Section 13 of the CCDP. Clare County Council defines Landscape Character Areas as:

> *"Units of the landscape that are geographically specific and have their own character and sense of place. Each LCA has its own distinctive character, based upon patterns of geology, landform, land use, cultural, historical and ecological features."*

The following objective relates to Landscape Character Areas as set out in the CCDP:

> *"**Objective LCA 1**: To encourage the utilisation of the Landscape Character Assessment of County Clare and other relevant landscape policy and guidelines and to have regard to them in the management, enhancement and promotion of the landscapes of County Clare"*

There are no Landscape Character Areas located within the 15km study area for County Clare as described in Section 13.3.1 of this report. The closest LCA is LCA 21- Loop Head, approximately 16.8km northwest from the turbine at its closest point.

Living Landscapes - Heritage Landscape

Section 13.3.1 and 13.3.2 of the CCDP identifies areas within the county boundary as living landscapes. The CCDP puts great emphasis on the idea that landscapes are continuously evolving and changes to the landscape will evolve with the growing needs of the community. The Living Landscapes are therefore used to identify landscapes in County Clare which have different capacities to accommodate change.

The CCDP identifies three Living Landscape Types:

- Settled Landscapes: areas where people live and work;
- Working Landscapes: intensively settled and developed areas within Settled Landscapes or areas with a unique natural resource;
- Heritage Landscapes: areas where natural and cultural heritage are given priority and where development is not precluded but happens more slowly and carefully.

The 20km study area for the proposed site includes areas of Heritage Landscape. Heritage Landscapes are set out in the CCDP as:

> *"those areas within the County where sensitive environmental resources – scenic, ecological and historic, are located."*

Heritage Landscapes are identified in the CCDP as being the most valuable areas of the county in terms of scenic, historic and ecological significance. Therefore, careful consideration for Heritage Landscapes within 20 km of the proposed turbines, mapped in Figure 13- 5 are set out under the Landscape Baseline (Section 13.5), as they are in their nature both a landscape and visual designation, and assessed and form part of the basis of viewpoint selection.

Objectives and policies pertaining to Heritage Landscapes as set out in Section 13.3.2.3 of the CCDP include:

> ***Objective: HL 1:*** *To require that all proposed developments in Heritage Landscapes demonstrate that every effort has been made to reduce visual impact. All proposed developments in these areas will be required to demonstrate:*
>
> - *That sites have been selected to avoid visually prominent locations;*

- *That site layouts avail of existing topography and vegetation to minimise visibility from scenic routes, walking trails, public amenities and roads;*
- *That design for buildings and structures minimise height and visual contrast through careful choice of forms, finishes and colour and that any site works seek to reduce the visual impact of the development.*

Seascape Landscapes

Section 13.4 of the CCDP outlines areas within the county boundary as seascape landscapes. Seascape landscapes are defined as

> *"A Seascape Character Assessment of County Clare was carried out as part of the aforementioned Landscape Character Assessment. The Seascape Character Assessment identified 12 individual Character Areas in County Clare (Figure 13.3). Each of these areas has unique scenic, geology, history and sensitivities."*

Objectives and policies pertaining to Seascape Landscapes as set out in Section 13.6 of the CCDP include:

> ***Objective: SL A:*** *To require all proposed developments within Seascape Character Areas to demonstrate that every effort has been made to reduce the visual impact of the development. This must be demonstrated by assessing the proposal in relation to:*
> - *Views from land to sea;*
> - *Views from sea to land;*
> - *Views along the coastline.*
>
> ***Objective: SL B:*** *To ensure that appropriate standards of location, siting, design, finishing and landscaping are achieved.*

Scenic Amenity, Views and Prospects

County Clare contains a number of valuable and attractive scenic views and prospects. Many of the scenic routes and prospects are located within the settled, working and heritage landscapes. A list of the County Clare scenic routes and views are shown in Volume 2 and Map 13A of the CCDP. The Council recognises the need to protect sensitive areas from injurious developments. Developments where permitted, must not give rise or hinder the obstruction of the scenic views and must be designed and located to minimise their impact.

The following objectives of the CCDP relates to views and prospects:

> ***Objective SV-A:*** *To protect sensitive areas from inappropriate development while providing for development and change that will benefit the rural community;*
>
> ***Objective SV-B:*** *To ensure that proposed developments take into consideration their effects on views from the public road towards scenic features or areas and are designed and located to minimise their impact;*
>
> ***Objective SV-C:*** *To ensure that appropriate standards of location, siting, design, finishing and landscaping are achieved.*

Sections 13.5, 9.3.5 and 17.4.4 of the CCDP identifies a series of Discovery Points and Signature Discovery Points encompassing the most scenic and high-amenity areas along The Wild Atlantic Way. Viewing points designated by Fáilte Ireland along the route of The Wild Atlantic Way have also been considered when identifying prominent visual receptors for assessment in this LVIA. Designated views/prospects within 20 km of the proposed turbines, mapped in Figure 13- 8 are set out under the

Visual Baseline (Section 13.6), as they are in their nature a visual designation, and assessed and form part of the basis of viewpoint selection.

Wind Energy Policy

The objectives of Clare County Council regarding renewable wind energy is presented in Volume 5 of the CCDP – Clare Wind Energy Strategy ("WES"). Objective 1 of the WES states that it is an objective of the council to:

> *"support, in principle and in appropriate scales and locations, the development of wind energy resources in County Clare."*

Figure D of the County Clare WES identifies areas within the Clare County boundary suitable for wind energy development. Figure D divides the land of County Clare into four categories called Strategic Windfarm Deployment Areas, each area has a differing capacity to accommodate wind energy developments. The four Strategic Windfarm Deployment Areas are listed below:

- Strategic Areas
- Acceptable in Principle
- Not Normally Permissible
- Open to Consideration

The 20km study area for the proposed development within County Clare is located within an area of Not Normally Permissible for wind energy development, as shown in Figure 13- 5.

13.5.3.2 Summary of Potential Landscape Receptors – Landscape Designations

Landscape Designations within the LVIA for Counties Kerry and Clare within the study area are shown in Figure 13- 5 and have been listed in Table 13-1, below.

Table 13- 1: Landscape Receptors – Landscape Designations

Description	County	Landscape Designation	Theoretical Visibility (ZTV)	Actual Visibility
5 to 10 km				
Two closely located strips immediately north and south of Ballybunion town.	Kerry	Rural Primary Special Amenity	Partial to None	Partial to No Visibility Anticipated.
A small area south of Ballybunion town overlooking Cashen Bay on the River Feale estuary	Kerry	Rural Secondary Special Amenity	Full Theoretical Visibility	Full to Partial Visibility Anticipated.
Land around the River Feale as it enters the town of Listowel from the east	Kerry	Rural Secondary Special Amenity	Partial to None	No visibility is Anticipated.

Description	County	Landscape Designation	Theoretical Visibility (ZTV)	Actual Visibility
5 to 10 km				
10 to 15 km				
A small coastal strip southwest of Ballyheige town	Kerry	Rural Primary Special Amenity	No Theoretical Visibility	No visibility is Anticipated.
A large area located on the coast of the Shannon Estuary and northwest of Ballylongford	Kerry	Rural Secondary Special Amenity	No Theoretical Visibility	No visibility is Anticipated.
Two closely located strips west of Ballyheige town	Kerry	Rural Secondary Special Amenity	Full to partial Theoretical Visibility	No visibility is Anticipated.
Land around the Maulin Mountain and along the Shannon coast	Kerry	Rural Secondary Special Amenity	Partial to None	No visibility is Anticipated.
Small area of Heritage Landscape around Rinevella Bay	Clare	Heritage Landscape Area	Partial to None	Partial to No Visibility Anticipated.

The ZTV map overlaid the identified landscape receptors (Figure 13- 6 above) was used to conduct a preliminary assessment to discern if there was theoretical visibility of the proposed turbines from each landscape receptor in Table 13-1.

Knowledge attained from site visits and desk-based analysis was used to assess if there is likely to be any actual visibility of the proposed development and the nature of this visibility from the designated landscape receptors.

As exhibited in Table 13-1, the small Area of Secondary Special Amenity on the northern bank of the River Feale estuary is the only designated landscape receptor likely to have any actual visibility of the proposed development. However actual visibility here is limited by residential screening and distance as this area is over 10 km from the proposed site.

13.5.4 Landscape Character of the Proposed Development Site

13.5.4.1 DoHPLG- 'Draft Revised Wind Energy Development Guidelines' (2019)

These guidelines offer guidance for the siting and design of wind energy developments in various landscape contexts by defining six landscape character types that represent most situations where wind turbines may be proposed. The guidance is intended to be indicative and general and notes that it, represents the 'best fit' solutions to likely situations.

The six landscape character types include 'Mountain Moorland', 'Hilly and Flat Farmland', 'Flat Peatland', Transitional Marginal Land', 'Urban/industrial' and 'Coastal' landscape character types. The guidelines note that where a wind energy development is located in one landscape character type but is visible from another, it will be necessary to decide which might more strongly influence the approach adopted for the assessment.

The proposed development site, the areas surrounding as well as many other areas within the study area can be described as 'hilly and flat farmland', however, there are also areas of flat peatland within the study boundary. Although in some cases the turbines will be viewed from other landscape types, it is considered that in terms of the siting and design the 'hilly and flat farmland' landscape type most strongly influences the siting and design of the proposed development. Further details of this landscape character type are provided below.

13.5.4.1.1 Hilly and Flat Farmland

The key characteristics of the Hilly and Flat Farmland type are:

- Intensively managed farmland, whether flat, undulating or hilly;
- A patchwork of fields delineated by hedgerows varying in size;
- Farmsteads and houses are scattered throughout, as well as occasional villages and towns;
- Roads, and telegraph and power lines and poles are significant components; and
- A working and inhabited landscape type.

Plate 13-15 View from southern access road into site, showing hilly and flat farmland on the proposed development site.

The siting and design guidance given for 'Hilly and Flat Farmland' in the DoHPLG guidelines is set out below:

Location

Location on ridges and plateaux is preferred, not only to maximise exposure, but also to ensure a reasonable distance from dwellings. Sufficient distance should be maintained from farmsteads, houses and centres of population in order to ensure that wind energy developments do not visually dominate them. Elevated locations are also more likely to achieve optimum aesthetic effect. Turbines perceived as being in close proximity to, or overlapping other landscape elements, such as buildings, roads and power or telegraph poles and lines may result in visual clutter and confusion. While in practice this can be tolerated, in highly sensitive landscapes every attempt should be made to avoid it.

Spatial Extent

This can be expected to be quite limited in response to the scale of fields and such topographic features as hills and knolls. Sufficient distance from buildings, most likely to be critical at lower elevations, must be established in order to avoid dominance by the wind energy development.

Spacing

The optimum spacing pattern is likely to be regular, responding to the underlying field pattern. The fields comprising the site might provide the structure for spacing of turbines. However, this may not always be the case and a balance will have to be struck between adequate spacing to achieve operability and a correspondence to field pattern.

Layout

The optimum layout is linear, and staggered linear on ridges (which are elongated) and hilltops (which are peaked), but a clustered layout would also be appropriate on a hilltop. Where a wind energy development is functionally possible on a flat landscape a grid layout would be aesthetically acceptable.

Height

Turbines should relate in terms of scale to landscape elements and will therefore tend not to be tall. However, an exception to this would be where they are on a high ridge or hilltop of relatively large scale. The more undulating the topography the greater the acceptability of an uneven profile, provided it does not result in significant visual confusion and conflict.

Cumulative Effect

It is important that wind energy development is never perceived to visually dominate. However, given that these landscapes comprise hedgerows and often hills, and that views across the landscape will likely be intermittent and partially obscured, visibility of two or more wind energy developments is usually acceptable.

Conclusion for the assessment of the proposed development

The proposed development is in accordance with the above guidance in terms of location (turbines are not located in a sensitive landscape) spatial extent (moderate scale of the wind energy development) spacing (regular), layout (clustered grid) height (in keeping with the landscape scale and on an even profile) and cumulative effect (there are no wind farms in the immediate vicinity of the proposed development).

13.5.4.2 Site Visit Findings

Topography and Landform

The topography of the proposed development site is primarily flat, rising to a small peak in the centre of the site of 12 metres O.D. Towards the north-western boundary of the site, the elevation of the land gently rises from 20 to 60 metres O.D. around the Village of Ballyduff. The lands surrounding the site to the north, east and southwest are of a similar topography and elevation to those of the proposed development site, with most of these lands forming part of the Cashen River and Listowel Plains Landscape Character Area. Changes in topography occur to the north and northeast of the site where the elevation in the lands rise steadily towards Knockanore Mountain. A variation in topography also occurs to the south of the proposed development site, where the elevation of the land begins to rise steadily towards the Stack's Mountains to the south and the Glanaruddery Mountains to the southeast.

The site is located towards the southern fringe of a large, flat coastal plain, which extends from the Stacks Mountains in the south, north to Listowel and west towards Ballybunnion and Ballheige on the Atlantic coast. The flat coastal plain is clearly visible in the Topographical Map shown in Figure 13- 2 above.

Although the landscape and geographical characteristics that give rise to the coastal plain are clearly visible on a map, an observer or person standing, living or driving in the local landscape anywhere around the Ballynagare site has no sense of a coastal plain. The majority of views around the site are very limited in extent and create no sense of attachment to the coast. Even at the higher elevations on the foothills of the Stacks Mountains to the south, the views of the northwest Kerry coastline to the west are not distinguishable.

Plate 13-16 Image indicating the topography of the proposed development site looking south.

Drainage

The protection of the watercourses within and surrounding the site, and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the site of the proposed development. The proposed development's drainage design has therefore been proposed specifically with the intention of having no negative impact on the water quality of the site and nearby or adjacent rivers and watercourses, and consequently no impact on downstream catchments and ecological ecosystems. No routes of any natural drainage features will be altered as part of the proposed development and only seven natural watercourse crossings are proposed as part of the proposed development. Turbine locations and associated roadways were originally selected to avoid natural watercourses, and existing roads are to be used wherever possible. There will be no direct discharges to any natural watercourses, with all drainage waters being dispersed as overland flows. All discharges from the proposed works areas will be made over vegetation filters at a minimum of 50 metres distance from natural watercourses. Buffer zones around the existing natural drainage features have informed, wherever possible, the layout of the proposed development. Where there is infrastructure proposed within 50 metres of a natural watercourse, stringent drainage measures will be put in place to ensure the protection of the water quality of the natural watercourse.

Further details regarding site drainage are set out in Chapter 9 of this EIAR: *Hydrology and Hydrogeology.*

Landcover

Landcover is the term used to describe the combinations of vegetation and land-use that cover the land surface. It comprises the more detailed constituent parts of the landscape and encompasses both natural and man-made features.

The proposed development site is predominantly used for peat-cutting and consists of cut-over raised bog surrounded by farmland. In addition to peat-cutting, other land-uses in the surrounding area include agriculture, small-scale commercial forestry, and low to medium-density residential areas. There is an existing 220kV and 110 kV transmission grid infrastructure in the region, however, the proposed site is relatively remote from existing substations. The closest substation to the development site is the Clahane 110kV substation located approximately 8.4 km southeast of the site.

Plate 13-17 Cutover raised peatbog within the proposed development site where Stack's Mountain can be seen along the skyline.

Plate 13-18 Agricultural grassland and small shrubs within the proposed development site.

Plate 13-19 Agricultural grassland bordered by drainage ditch and hedgerows within the proposed development site.

Land Use

Current land-use on the site comprises mainly of cutover bog and some areas of agricultural grassland. The character of the wider landscape is that of a settled working rural landscape. Within the wider landscape, agriculture is also common, with occasional pockets of cutover peat, whilst the frequency of woodland increases toward Listowel. The proposed development site is traversed by a local road and a number of farm, forestry and turf-cutting access tracks, which contributes to activity on the site. One-off residential bungalows and farmhouses are a common landscape feature dotted throughout much of the study area.

Plate 13-20 Cutover peat bog on site.

The site is located within a large, flat coastal plain, which extends from the Stacks Mountains in the south, north to Listowel and west towards Ballybunnion and Ballheige on the Atlantic coast. The topographical map seen above in Figure 13-2 shows the flat coastal plain in which the site is located.

Plate 13-21 Foot tracks found along the northern site boundary.

During the site visit walkover, it was observed that there was a local foot path throughout the site, as shown in Plate 13-21 above. The foot track found within the proposed development site is accessed via the local road and extends towards the northeast and north along the Cashel River. It is assumed that the foot path is used for recreational purposes by locals in the nearby area and is located within and around the peatbog. Foot paths similar to the one shown above, are common in flat farmland landscape character types and evidence of local recreational footpaths can successfully co-exist with wind farms throughout Ireland.

Although the landscape and geographical characteristics that give rise to the coastal plain are clearly visible on a map, an observer or person standing, living or driving in the local landscape anywhere around the Ballynagare site has no sense of a coastal plain. The majority of views around the site are very limited in extent and create no sense of attachment to the coast. Even at the higher elevations on the foothills of the Stacks Mountains to the south, the views of the northwest Kerry coastline to the west are not distinguishable.

13.5.5 Landscape Value and Sensitivity of the Proposed Development Site

To determine the landscape sensitivity and value of the proposed development site the landscape issues pertaining to the site have been summarised in Table 13-2 below. These in turn were then summed up in a landscape value and landscape sensitivity classification of Low, Moderate or High for the proposed development site.

Table 13- 2: Indicators of Landscape Value

Indicator	Description
Landscape Designations	The proposed development site is **not** located in an area of County Kerry Prime or Secondary Special Amenity, its designation is therefore Rural General, which is of **Low** Landscape Sensitivity.
Landscape Quality/Condition	Due to its flat nature, the landscape does not have any outstanding landscape properties. The condition of the landscape is partially degraded due to intensive agricultural drainage and peat harvesting operations.
Wildness/naturalness	The proposed development site is in a highly managed rural landscape. The anthropological influences of agriculture, peat harvesting, and roads are very visible within and around the proposed development site, any sense of naturalness or wildness has been greatly diminished.
Recreation Value	The proposed development site has no classified recreational value. The footpath found within the site boundary is of local recreational use and is not of wider county importance.

In consideration of the factors summarised in Table 13- 2, the landscape value of the proposed development site is deemed Low and the landscape sensitivity is deemed Low.

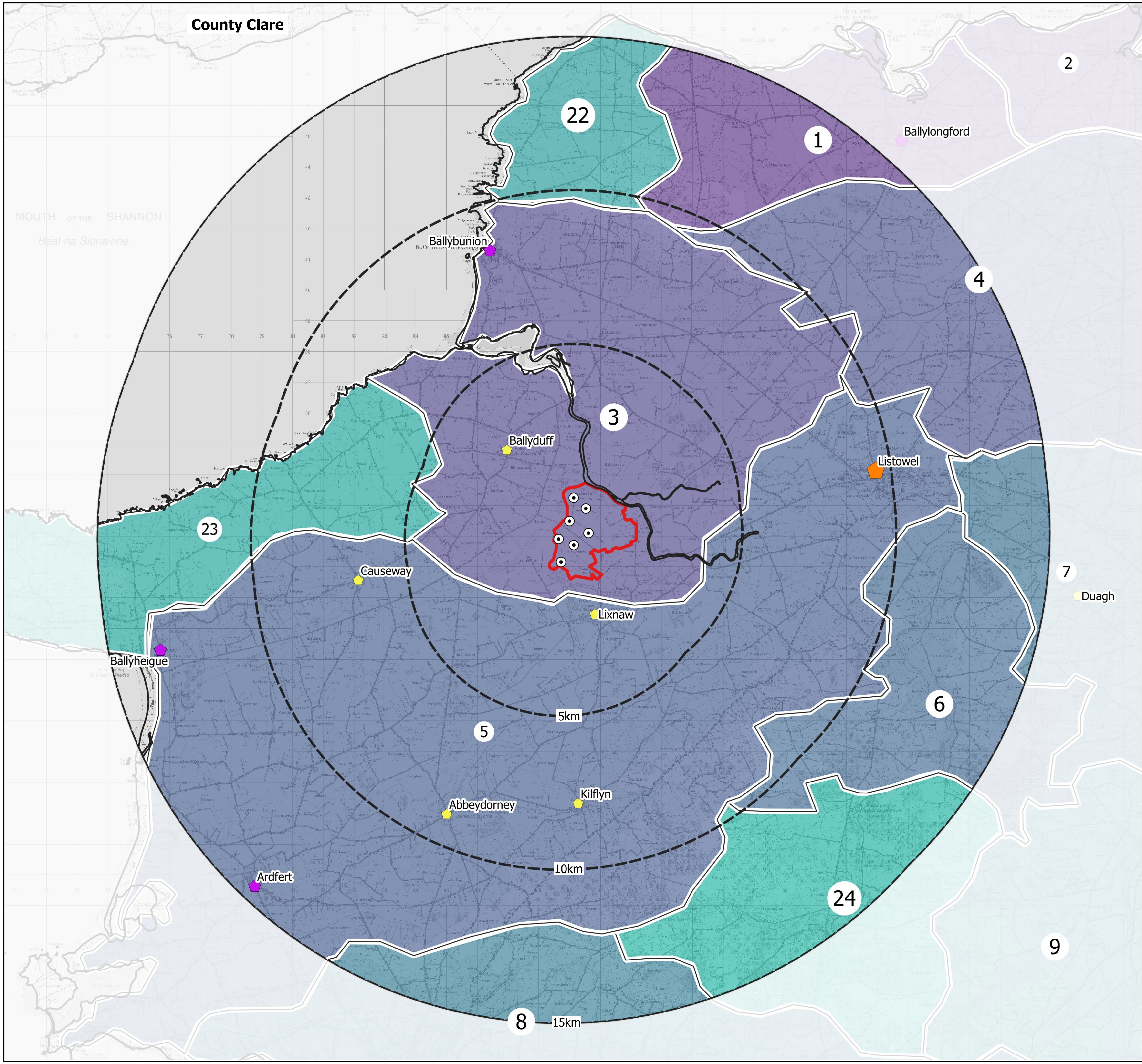
13.5.6 Landscape Character of the Study Area

Landscape character refers to the distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and how people perceive this. It reflects particular combinations of geology, landform, soils, vegetation, land use and human settlement, and creates the particular sense of place found in different areas.

13.5.6.1 Landscape Character Areas

Utilising Volume 2 of the RESCK, Landscape Character Areas (LCAs) located within the LVIA study area are demonstrated in Figure 13- 7 (below). Ten LCAs were identified and are located within 15km of the proposed development and are listed below:

- LCA-1 Ballylongford Creek
- LCA-3 Cashen River
- LCA-4 Inner River Plain
- LCA-5 Listowel Plain
- LCA-6 Smearlagh River Valley
- LCA-7 River Feale Valley
- LCA-8 Tralee and Castleisland Valley
- LCA-22 Beale Hill
- LCA-23 Kerry Head and Causeway Coast
- LCA 24 Stack's Mountain Plateau and Smearlagh River Valley



Map Legend

- Site Boundary
- Proposed Ballynagare Turbines

Co. Kerry Landscape Character Areas
- 1- Ballylongford Creek
- 3- Cashen River
- 4- Inner River Plain
- 5- Listowel Plain
- 6- Smearlagh River Valley
- 7- River Feale Valley
- 8- Tralee and Castle Island Valley
- 22- Beale Hill
- 23- Kerry Head and Causeway Coast
- 24- Stack's Mountain Plateau and Smearlagh River Valley

Co. Kerry Settlement Hierarchy
- Hub Town
- Regional Town
- District Town
- Village

Co. Clare Settlement Hierarchy
- Large Village

N

Drawing Title: Landscape Character Areas

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
AW	TB
Project No. 200512	Drawing No. Figure 13-7
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13.5.6.2 Landscape Sensitivity

County Kerry does not explicitly assign a landscape sensitivity rating to each designated LCA. For the purposes of this LVIA, the sensitivity of each LCA has been determined from relevant excerpts and statements made in the development capacity summaries for each LCA in the RESCK. Sensitivity ratings also account for landscape Zoning and Wind Energy Development Zoning designations within each LCA. The landscape sensitivity categories were divided into four classes as set out in Appendix 13-2:

- Very High
- High
- Moderate
- Low

Using the ZTV mapping shown in Figure 13- 6, the following sections assess the theoretical visibility of the proposed development from within each LCA in the LVIA study area, scoping out any LCAs with no significant visibility. Appendix 13-2 details the key characteristics for each LCA that screened in for further assessment. Using the methodology outlined above, a sensitivity classification is assigned to each LCA in Appendix 13-2.

13.5.6.3 Summary of Potential Landscape Receptors – Landscape Character Areas

The LCAs falling within the LVIA Study Area have been shown in Figure 13- 6 and listed in Table 13- 4 below, where theoretical visibility obtained from ZTV mapping as well as actual visibility observed on site are also shown.

Table 13- 3: Landscape Receptors – Landscape Character Areas

LCA	Theoretical Visibility (ZTV)	Actual Visibility
up to 5 km		
LCA 3 – Cashen River	Full theoretical visibility with patches of no theoretical visibility	Anticipated
LCA 5 - Listowel Plain	Full theoretical visibility with patches of no theoretical visibility	Anticipated
LCA 23 - Kerry Head and Causeway Coast	Partial visibility with patches of no theoretical visibility	Limited
5 to 10 km		
LCA 4 – Inner River Plain	Some patches of full theoretical visibility with large areas of no visibility	Limited
LCA 6 – Smearlagh River Valley	Small patches of full theoretical visibility with large areas of no visibility	Limited
LCA 1 -Ballylongford Creek	No visibility	None

LCA	Theoretical Visibility (ZTV)	Actual Visibility
LCA 8 – Tralee and Castleisland Valley	No visibility	None
LCA 22 - Beale Hill	No visibility	None
LCA 24 - Stack's Mountain Plateau and Smearlagh River Valley	Very small patch of partial visibility in the north and west	None
10 to 15 km		
LCA 7 – River Feale Valley	Small areas of full to partial theoretical visibility	Limited

13.5.7 Landscape Receptor Preliminary Assessment

After identifying the landscape receptors in the study area based on landscape designations and Landscape Character Areas (LCAs) derived from the KCDP and RESCK, a preliminary assessment will be carried out to screen out landscape receptors that will not or only very marginally be impacted by the proposed development.

Using the Zone of Theoretical Visibility mapping shown on Figure 13-1 the landscape receptors that will have no theoretical visibility are screened out as shown in Figure 13- 6 below. For the remaining landscape receptors, potential visibility was assessed on site. In the case of the landscape receptors included in Table 13- 1, views towards the turbines were either entirely screened or substantially screened. This along with, in some cases, distance to the proposed development site precluded these locations being selected as viewpoints.

Table 13- 4: Landscape Receptors Screened Out -No visibility indicated by ZTV map or No visibility found on site

Landscape Receptor Category	Landscape Receptor with no visibility shown on ZTV
Rural Prime Special Amenity	A small coastal strip southwest of Ballyheige town
Rural Secondary Special Amenity	A large coastal area of the Shannon Estuary west of Ballylongford town
Landscape Character Areas	LCA 1 -Ballylongford Creek
	LCA 8 – Tralee and Castleisland Valley
	LCA 22 - Beale Hill
	LCA 24 - Stack's Mountain Plateau and Smearlagh River Valley

Following the pre-assessment exercise the landscape receptors shown in Table 13- 5 below have been selected for assessment due to their significance within the study area and the potential landscape effects they may experience due to the proposed wind energy development.

Table 13- 5: Landscape receptors screened in for full assessment

Landscape Receptor Category	Landscape Receptor
Rural Primary Special Amenity	Two closely located strips north and south of Ballybunion town.
Rural Secondary Special Amenity	A small area south of Ballybunion town overlooking Cashen Bay on the River Feale estuary
	Land around the River Feale as it enters the town of Listowel from the east
	Two closely located strips southwest of Ballyheige town
	Land around the Maulin Mountain and along the Shannon coast
Landscape of proposed development Site	Landscape of proposed development Site
	LCA 3 – Cashen River
	LCA 4 – Inner River Plain
	LCA 5 - Listowel Plain
	LCA 6 – Smearlagh River Valley
	LCA 7 – River Feale Valley
	LCA 23 - Kerry Head and Causeway Coast

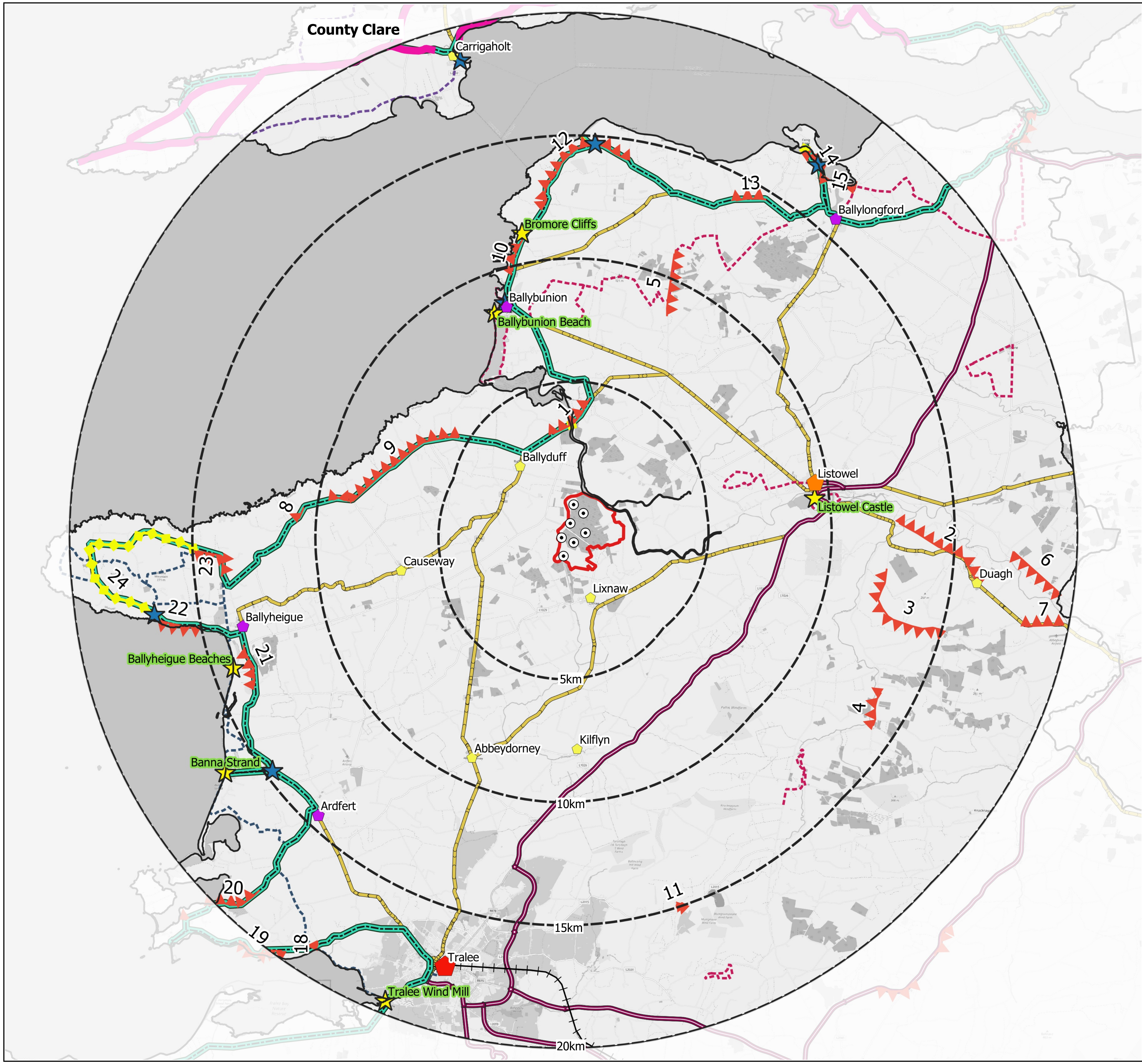
13.6 Visual Baseline

13.6.1 Visual Receptors

The main purpose of establishing the visual baseline is to identify the key visual receptors that should be considered for viewpoint selection. To this end the following have been identified:

- Designated Scenic Routes and Scenic Views
- Settlements
- Recreational Routes and Tourist Destinations
- Transport Routes

All visual receptors are shown below in Figure 13- 8. These visual receptors are listed in tables in the following sections along with theoretical visibility at those locations indicated by the ZTV map in Figure 13- 9.



Map Legend

- Site Boundary
- Proposed Ballynagare Turbines
- County Boundary
- National Road (N69)
- Regional Roads
- Tourism Designations
- WAW Points
- The Wild Atlantic Way - Tourist Route
- Co. Clare Scenic Routes
- Co. Clare - Loop Head Heritage Trail
- Co. Kerry Scenic Routes - 2 way
- Co. Kerry Scenic Routes- 1 way
- Co. Kerry Walking Trails
- North Kerry Way

Co Kerry Settlement Hierarchy

- Hub Town
- Regional Town
- District Town
- Village

Co. Clare Settlement Hieararchy

- Large Village

N

Drawing Title	
Visual Baseline	
Project Title	
Ballynagare Wind Farm	
Drawn By: AW	Checked By: TB
Project No.: 200512	Drawing No.: Figure 13-8
Scale: 1:150000	Date: 2021.05.31

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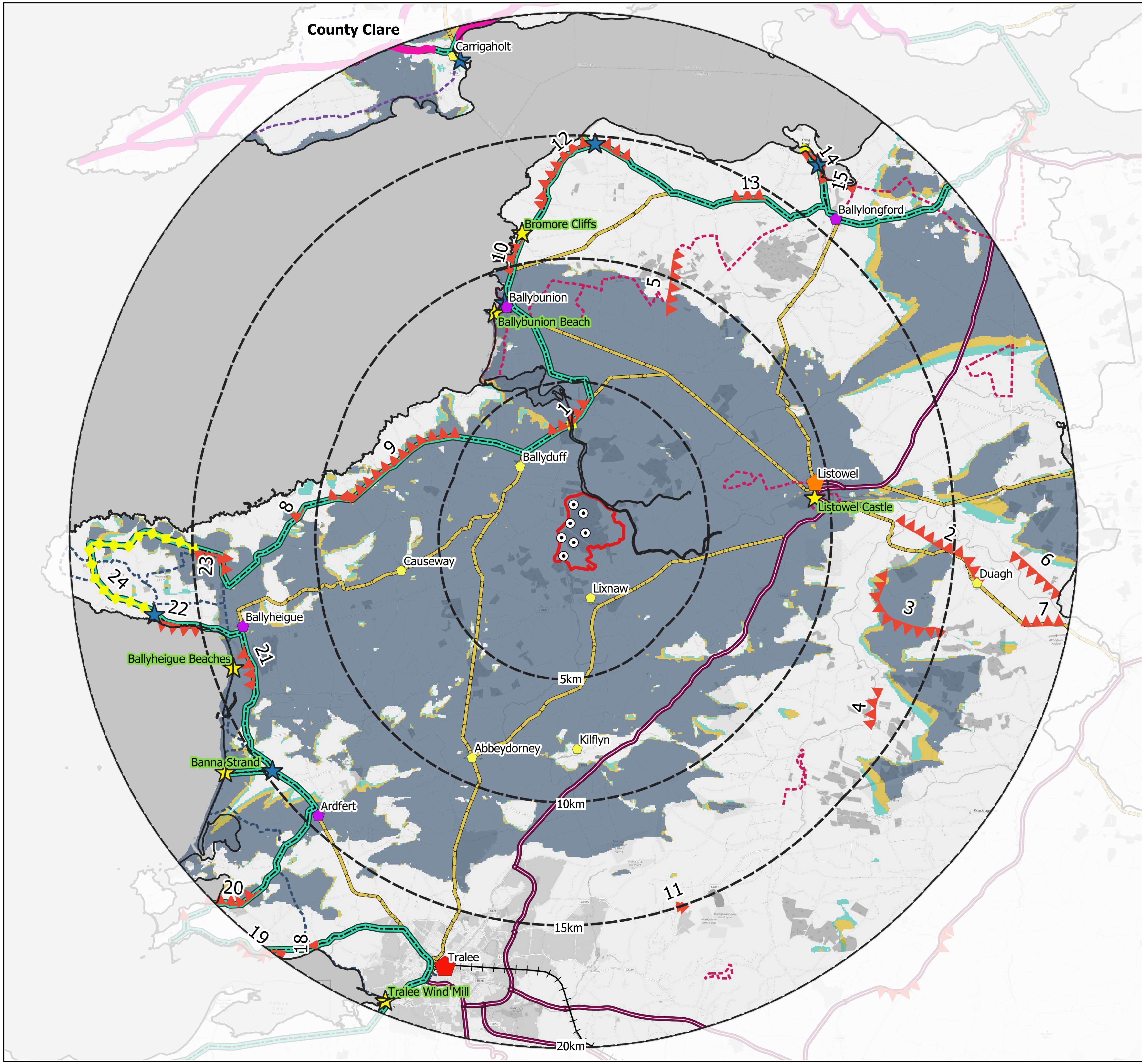

Map Legend

- Site Boundary
- Proposed Ballynagare Turbines
- County Boundary
- National Road (N69)
- Regional Roads
- Tourism Designations
- WAW Points
- The Wild Atlantic Way - Tourist Route
- Co. Clare Scenic Routes
- Co. Clare - Loop Head Heritage Trail
- Co. Kerry Scenic Routes - 2 way
- Co. Kerry Scenic Routes- 1 way
- Co. Kerry Walking Trails
- North Kerry Way

Co Kerry Settlement Hierarchy

- Hub Town
- Regional Town
- District Town
- Village

Co. Clare Settlement Hiearachy

- Large Village

ZTV

- 1-2 Turbines
- 3-5 Turbines
- 6-7 Turbines

N

Drawing Title: Half Blade ZTV and Visual Baseline	
Project Title: Ballynagare Wind Farm	
Drawn By: AW	Checked By: TB
Project No.: 200512	Drawing No.: Figure 13-9
Scale: 1:150000	Date: 2021.05.31

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13.6.1.1 Designated Scenic Views and Prospects

As outlined in Section 13.3.1 of this report, the 20km study area of the proposed development site includes Counties Kerry and Clare and will be assessed in this section for their visual receptors. County Kerry designated scenic views/prospects are identified along roads or routes in the Map 12.1 (a,b,c,e,f,) of the KCDP. As illustrated in Figure 13- 8, 21 County Kerry designated scenic views/prospects are identified within the LVIA study area and are reported in Table 13- 6 below. In addition to theoretical visibility, whether the focus of the scenic route or view is directed towards the proposed turbines is also reported in the table. Only 1 no. scenic route has been identified within the study boundary for County Clare (SR 17- R487 from outside Carrigaholt to Loop Head) and is outlined below in Table 13- 6.

The County Kerry designated scenic views and prospects are not explicitly identified with descriptions or labels in the KCDP, only the geographical location and the direction of each route/view is reported via Map 12.1. For the purposes of this LVIA, each designated scenic route within the LVIA has been given a label to enable reference throughout the assessment in the rest of this Chapter. All scenic views/route labels in the following tables correspond to the map in Figure 13- 8 above.

Table 13- 6: County Kerry and Clare Protected Views and Scenic Amenity Routes within 20 km of the proposed development.

Scenic View/Prospect No.	Distance & Direction from the Nearest Turbine.	County	Direction of Views	Directed to Site?	Theoretical Visibility
Up to 5km					
SVP 1	3 km north	Kerry	Predominantly to the west, views to the east only designated on the 'Ferry Bridge' as it crosses the River Feale.	Partially	Full
5 km to 10 km					
SVP 5	8.3 km north-east	Kerry	Directed to the east	No	Partial to None
SVP 9	5.4 km north-west	Kerry	Directed to the west	No	Full to Partial
SVP 10	9.8 km north-west	Kerry	Directed to the west	No	Partial to None
10 km to 15 km					
SVP 2	12.1 km east	Kerry	Directed to the north-east	No	Partial to None
SVP 3	11.7 km east	Kerry	Directed to the south, west and north-west	Yes	Full to Partial
SVP 4	13 km south-east	Kerry	Directed to the west	Yes	None
SVP 8	10.5 km west	Kerry	Directed to the west	No	None

SVP 11	14.8 km south-east	Kerry	Directed to the south	No	None
SVP 12	12.1 km north-west	Kerry	Directed to the north-west	No	None
SVP 13	13.6 km north-east	Kerry	Directed to the north	No	None
SVP 21	13.5 km south-west	Kerry	Directed to the south	No	Full
SVP 23	13.7 km west	Kerry	Directed to the east and south	Yes	Full
15 km to 20 km					
SVP 6	16.7 km east	Kerry	Directed to the south-west	Partial	None
SVP 7	17.6 km south-east	Kerry	Directed to the north	No	None
SVP 14	16.3 km north-east	Kerry	Directed to the east	No	None
SVP 18	18.7 km south-west	Kerry	Directed to the west	No	None
SVP 19	19.8 km south-west	Kerry	Directed to the west	No	None
SVP 20	18.5km south-west	Kerry	Directed to the north-west	No	Partial to None
SVP 22	15.3 km west	Kerry	Directed to the south	No	None
SVP 24	16.8 km west	Kerry	Directed to the north and south	Partially	Partial to None
SR 17	19.3 km north-west	Clare	Directed to the north, south and west	Partially	Partial to None

All designated scenic views/prospects that are not directed towards the proposed development or have no theoretical visibility will be scoped out of further assessment. As demonstrated in Table 13- 6, only three of the designated scenic views/prospects (SVP 1, SVP 3 and SVP 23) have views directed towards the proposed development site and have full to partial theoretical visibility, these three scenic views/prospects will be screened in for further assessment in Section 13.6.2, *Visual Receptor Preliminary Assessment.*

13.6.1.2 Settlements

In order to identify which settlements within the study area should be considered for viewpoint selection, the KCDP and CCDP were consulted to identify the settlement strategy and hierarchy for counties Kerry and Clare.

The settlement hierarchy for Kerry as exhibited in Table 3.1 of the KCDP is as follows:

- Hub Towns
- Regional Towns
- District Towns
- Villages
- Small Villages

The settlement hierarchy for County Clare is shown in Table 2.1 of the CCDP and is as follows:

- County Town Hub
- Linked Gateway
- Service Towns
- Small Towns
- Large Villages
- Small Villages
- Clusters
- Countryside

Table 13-7 below lists the settlements identified from the KCDP and CCDP within the LVIA study area also noting their status within the settlement strategy and whether there is theoretical visibility indicated by the ZTV. Settlements smaller in population of *District Town* for County Kerry outside the 10km site study boundary are deemed to have a visual receptor sensitivity which is too low with no potential for significant effects on these receptors.

Table 13- 7: Significant Settlements within the Study Area

Settlement	Settlement Hierarchy	County	Theoretical Visibility
up to 5 km			
Ballyduff	Village	Kerry	Full
Lixnaw	Village	Kerry	Full
5 to 10 km			
Abbeydorney	Village	Kerry	Full
Listowel	Regional Town	Kerry	Full
Ballybunion	District Town	Kerry	Full to Partial
Causeway	Village	Kerry	Full
Kilflyn	Village	Kerry	None
10 to 15 km			
Ballyheige	District Town	Kerry	Full to Partial
Ardfert	District Town	Kerry	Full
15 to 20 km			
Duagh	Village	Kerry	None

Settlement	Settlement Hierarchy	County	Theoretical Visibility
Ballylongford	District Town	Kerry	None
Carrigaholt	Large Village	Clare	None
Tralee	Hub Town	Kerry	None

All settlements identified in Table 13- 7 with full or partial visibility of the proposed development are taken forward for preliminary assessment in Section 13.6.2. All other settlements in Table 13- 7 are screened out from further assessment as the ZTV mapping indicated no theoretical visibility of the proposed development.

13.6.1.3 Recreational and Tourist Destinations

The tourism strategy outlined in the KCDP and CCDP and the Kerry County Tourism Action Plan 2016 – 2022 (Kerry County Council, 2015) were consulted to identify and address prominent outdoor recreational and tourist destinations in the LVIA study area. Popular destinations listed by failteireland.ie, sportireland.ie, wildatlanticway.com and Tripadvisor.ie were also used to inform the destinations listed in Table 13- 8 below. The Wild Atlantic Way tourist route and The North Kerry walking trail are popular routes located in the LVIA study area and have also been included in Table 13- 8. The locations of these destinations and routes are illustrated in Figure 13- 8 above.

Table 13- 8: Recreational and Tourist Destinations within 20km of the Proposed Development Site

Destination	Description	Theoretical Visibility
Up to 5 km		
The Wild Atlantic Way	Tourist Route/Destinations: An extremely popular route for tourists exploring the west coast of Ireland, many popular destinations are situated on this route.	Full to Partial
5 to 10 km		
Listowel Castle	12th-century castle Tourist Destination.	Full
Ballybunion Beach	Recreational Destination: Nuns Beach, Ballybunion Beach & Nuns Rock. An Taisce (2019) designated Blue Flag Beach with bathing waters of Good Quality Status.	Largely no theoretical visibility along the coast, some theoretical visibility 500m from coast.
Ballybunion Cliff Walks	Cliff walk between the north and south beaches of Ballybunion.	Full to Partial
Listowel River Walks	A combined 14km walk that follows along the River Feale and through the town of Listowel, looping around a small bog west of Listowel.	Full
Shannon Way and Lahardane Hill Walk	A combined 42km walk from Ballybunion to Tarbert Ferry Port with extensive views from Knockanore Mountain.	Largely no theoretical visibility, some larger pockets of full visibility.

Destination	Description	Theoretical Visibility
Shannon Estuary Way	Scenic Drive looping along the Shannon River just off the Wild Atlantic Way.	Largely no theoretical visibility, some larger pockets of full visibility.
10 to 15 km		
Bromore Cliffs	Tourist Destination: Scenic cliff walk with visitor centre.	None
Ballyheigue Beach	Recreational Destination: An Taisce (2019) designated Blue Flag Beach with bathing waters of Good Quality Status.	Full
Lyracrumpane River Walk	Smearlagh River Walk loop, with views of waterfalls and green fields.	None
15 to 20 km		
Banna Strand	Recreational Destination: An Taisce (2019) designated Blue Flag Beach with bathing waters of Good Quality Status.	Full
Tralee Windmill	Historic Trallee Windmill and Visitor Centre.	None
The North Kerry Way	Recreational Route: A way marked walking trail extending along the west coast from Tralee to Kerry head.	Largely no theoretical visibility, small pockets of full visibility, views focussed on the coastal landscape.
Clare Loop Head Heritage Trail	Recreational Route: A cycling/driving route following the coastline of the Loop Head Peninsula, with several scenic viewpoints throughout.	Largely no theoretical visibility with a small pocket of visibility around Rinevella Bay.
Moyvane Village Walks	Small loop walk south of Moyvane with views over flat landscapes.	None
Glenageenty Loop	Forest trail running along a riverbank with extensive scenic views over higher elevations.	None

All destinations identified in Table 13-10 with partial or full theoretical visibility of the proposed development are taken forward for preliminary assessment in Section 13.6.2, all others are screened out from further assessment as the ZTV mapping indicated no theoretical visibility of the proposed development.

13.6.1.4 Major Transport Routes

Major transport routes are prominent visual receptors as busy routes equate to a large quantity of road users who will experience landscape views upon the route. As illustrated in Figure 13- 8 above, the only major transport route with any theoretical visibility of the proposed development within the LVIA study area is the N69 Secondary Road from Limerick to Tralee. It will therefore be taken forward for assessment of visual effects later in this chapter. The N21 and N22 National Secondary Roads in the south and south-west of the LVIA study area will have no theoretical visibility. Visual effects will also be assessed from smaller Regional Roads such as the R551, R552, R553, R556 and R557 which have full theoretical visibility of the proposed turbines and are located in close proximity to the proposed development site.

13.6.2 Visual Receptor Preliminary Assessment

After identifying the visual receptors in the study area based on designated views/prospects, settlements, recreational and tourist destinations, and prominent transport routes a preliminary assessment was carried out to screen out visual receptors that will not be impacted by the proposed development.

Using the Zone of Theoretical Visibility mapping shown on Figure 13- 9 the visual receptors that will have no theoretical visibility or do not have views focussed towards the proposed development are screened out as shown in Table 13- 9 below.

Table 13- 9: Visual Receptors Screened Out of Further Assessment

Visual Receptor Category	Visual Receptor with no visibility shown on ZTV
Kerry County Council Designated Views/Routes	SVP No: 4, 6, 7, 8, 10, 11, 12, 13, 14, 15, 18, 19, 22.
Clare County Council Designated Views/Routes	SR17- Loop Head Scenic Route
Settlements	Ballylongford; Duagh; Tralee; Carrigaholt.
Recreational and Tourist Destinations	Trallee Windmill; Bromore Cliffs; Lyracrumpane River Walk; Moyvane Village Walks; Glenageenty Loop.
Major Transport Routes	R552, N22 and N21 National Secondary Roads.

For the remaining visual receptors visibility was assessed on site. In the case of the visual receptors shown in Table 13- 10 below, views towards the turbines were either entirely screened or substantially screened. In some cases, the factor of distance to the proposed development site was included in screening assessment and was a contributing factor precluding these locations being selected as viewpoints.

Table 13- 10: Visual Receptors Screened Out - no visibility found on site

Visual Receptor Category	Visual Receptor with no significant visibility found on site
Kerry County Council Designated Views/Routes	SVP 9 (Vegetation Screening); SVP 20 (Distance > 18.5km); SVP 21 (Vegetation Screening and Distance >13.5km).
Settlements	Lixnaw; Ballyheige; Ardfert; Abbeydorney; Causeway
Recreational and Tourist Destinations	North Kerry Way (at Maulin Mountain); Listowel Castle; Banna Strand; Ballyheigue Beach; Ballybunion Beach; Bromore Cliffs.

Following the pre-assessment exercise, the visual receptors shown in Table 13- 11 (below) have been selected as viewpoints due to their significance within the study area and the potential visual effects they may experience due to the proposed development.

Table 13- 11: Visual Receptors Screened IN for Further Assessment

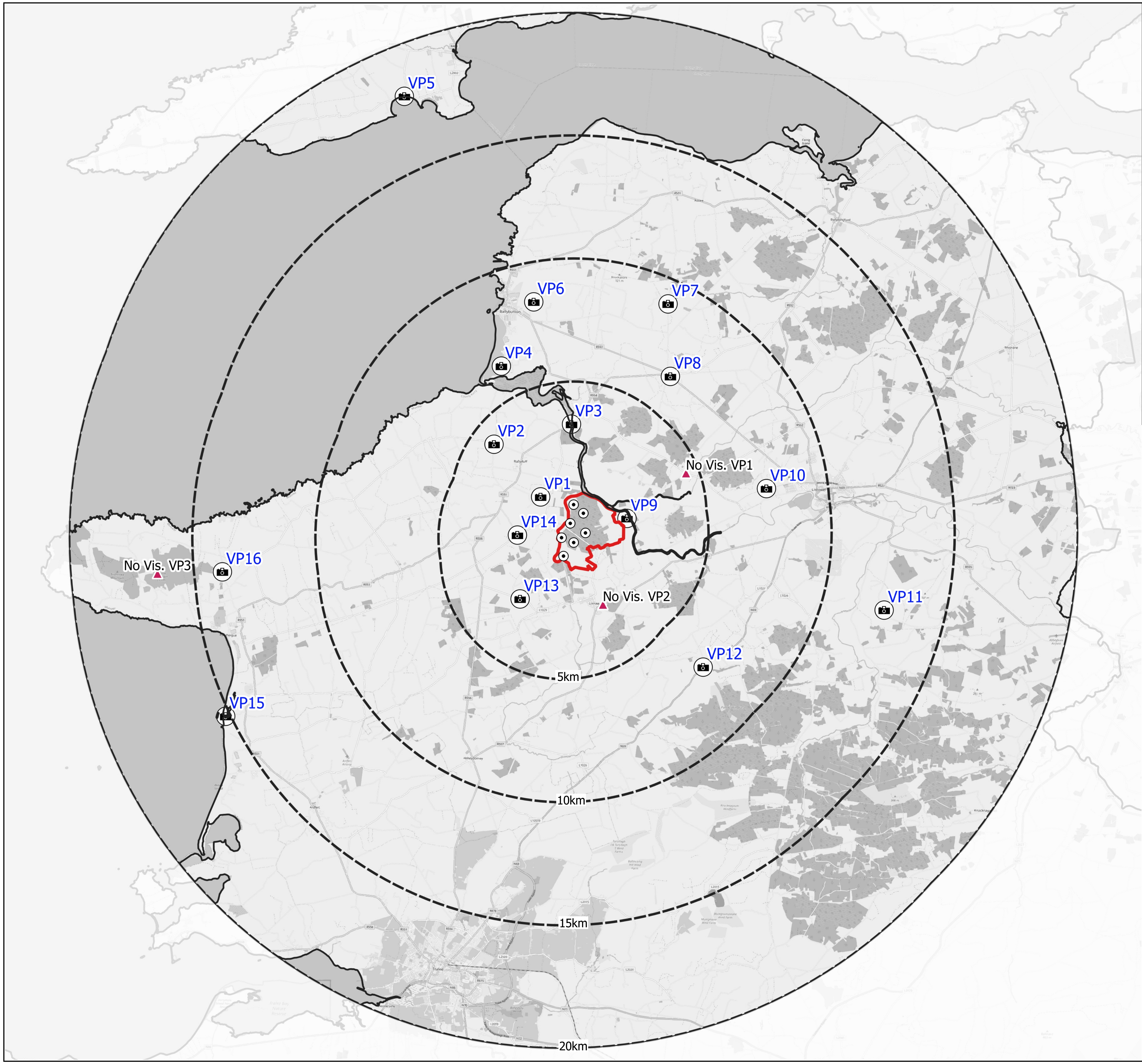
Visual Receptor Category	Description	Photomontage Viewpoint
Kerry County Council Designated Views/Routes	SVP1	VP3
	SVP3	VP11
	SVP23	VP16
Settlements	Ballybunion	VP6
	Ballyduff	VP2, VP01
	Listowel	VP10
Recreational and Tourist Destinations	Ballybunion Beach Walks	VP4
	The Wild Atlantic Way	VP2, VP16, VP3
	North Kerry Way	VP15, VP16
	Loop Head Heritage Trail	VP5
	Shannon Way	VP6, VP7
	Listowel Village Walks- Sive Walk	VP10
Transport Routes	N69 National Secondary Road	VP12
	R553	VP8

Furthermore, in addition to the viewpoints listed above, which were selected according to the key visual receptors identified in the visual baseline, additional viewpoints were selected within 2 km of the development site boundary to assess the visual effects on local residents living in close proximity to the proposed development (Viewpoints VP1; VP9; VP13; VP14).

13.6.3 Photomontage Viewpoint Locations

The locations of sixteen photomontage viewpoints are illustrated in Figure 13- 10 below. Photos taken from each photomontage viewpoint will be used to assess the significance of visual effects arising from the proposed development from each viewpoint location. The viewpoint locations are representative and in some instances, photos were not taken directly next to a visual receptor but in another location in close proximity where there may be superior line of sight towards the proposed development (e.g. higher elevation or less screening). A detailed description of the viewpoint selection process and photomontage assessment methodology is provided in Appendix 13-1.

The likely or significant visual effects of the proposed Ballynagare development arising from each viewpoint location are reported in Section 13.8 of this Chapter. The assessment process is extensively detailed in the photomontage assessment tables in Appendix 13-3.



Map Legend

- Site Boundary
- Ballynagare Turbine Locations
- Photomontage Viewpoint Locations
- No Visibility Viewpoint Locations

N

Drawing Title	
Photomontage Viewpoint Locations	
Project Title	
Ballynagare Wind Farm	
Drawn By: AW	Checked By: TB
Project No.: 200512	Drawing No.: Figure 13-10
Scale: 1:150000	Date: 2021.05.31

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13.7 Cumulative Baseline

In terms of cumulative landscape and visual effects, only other wind energy projects have been considered, as only these would be described as very tall vertical elements in the landscape and therefore have the potential to give rise to significant cumulative effects. Other wind energy developments, within 20km of the proposed development, were identified by searching past planning applications lodged through the various planning authorities (Kerry County Council, Clare County Council and An Bord Pleanála) online planning portals. The information identified in the initial planning search was then used to verify, by means of a desk-based study and ground-truthing, whether the permitted wind energy developments had been constructed. There are no existing or permitted turbines within the 5km study area or areas of County Clare within the study boundary. The list of existing and permitted wind turbines present within the study area are listed in Table 13- 12 below:

Table 13- 12: Cumulative Baseline: Other Wind Farms within 20km of the Proposed Ballynagare Wind Farm

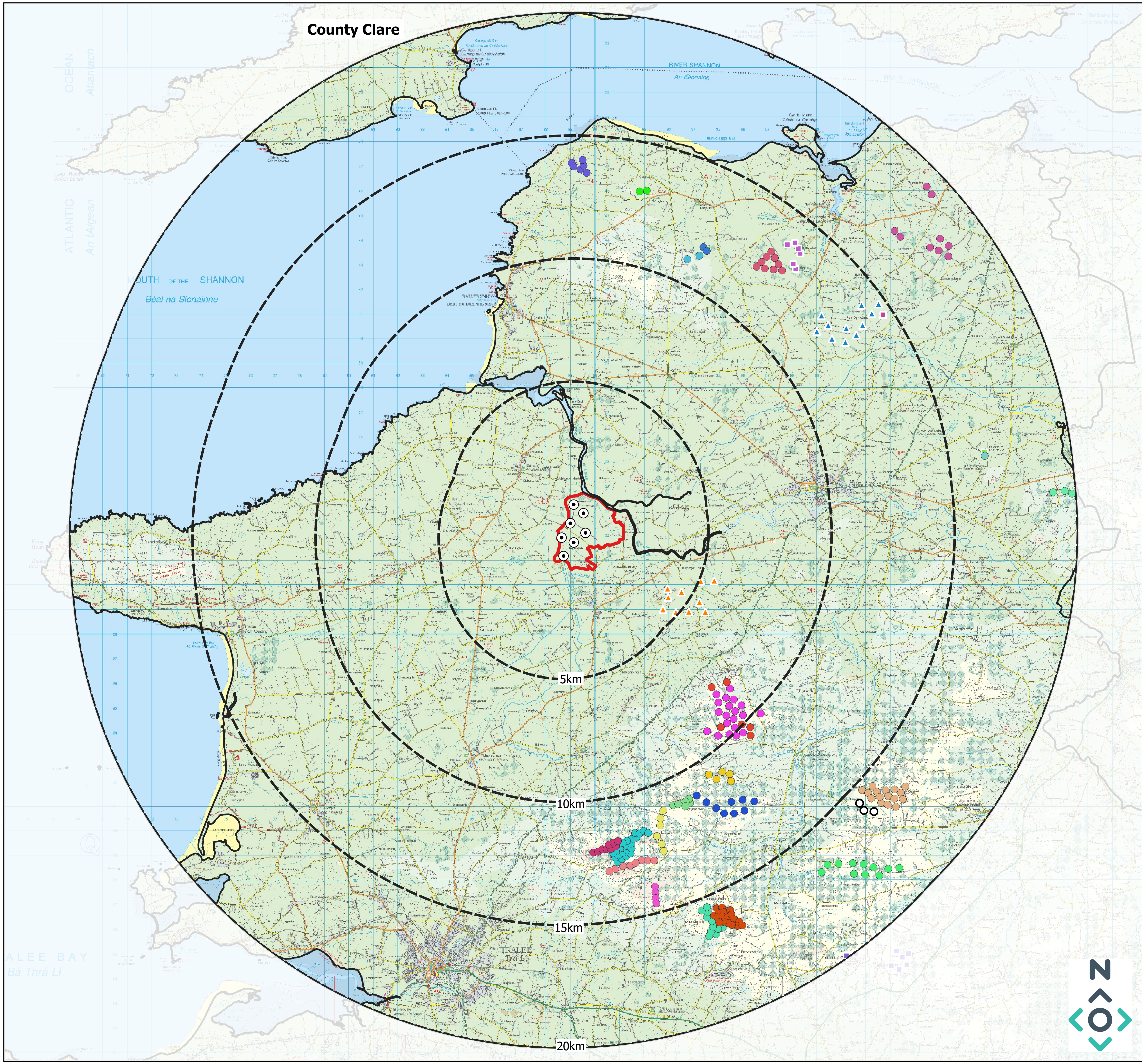
Wind Farm	County	Status	No. of Turbines	Hub and Blade Dimensions
Up to 5km				
Ballyhorgan	Kerry	Proposed	10	Tip Height, 156.5m
5 to 10km				
Pallas - Clahane	Kerry	Existing	20	67m Hub height, 71m Blade Diameter
Pallas – Clahane Extension	Kerry	Existing	6	67m Hub height, 71m Blade Diameter
10 to 15 km				
Ballincollig Hill	Kerry	Existing	8	Tip Height, 76m
Cloghaneleskirt	Kerry	Permitted	5	Tip Height, 123m
Beale Hill	Kerry	Existing	6	Tip Height, 81m
Ballylongford	Kerry	Permitted	6	Tip Height, 125m
Beenageeha	Kerry	Existing	6	Rotor Diameter 47m
Cloghboola	Kerry	Existing	16	84m Hub Height, 82m Blade Diameter.
Knocknagoum	Kerry	Existing	9	80m Hub Height, Blade Diameter 90m

Wind Farm	County	Status	No. of Turbines	Hub and Blade Dimensions
Tursillagh I	Kerry	Existing	22	Blade Diameter 47m
Tursillagh II	Kerry	Existing	9	Blade Diameter 52m
Tylagh	Kerry	Existing	4	55.6 m Hub height, 48m Blade Diameter, 79.6m Blade Tip Height
Tullahennel South	Kerry	Existing	9	80m Tower Height, 90m Blade Diameter
Tullahennel North	Kerry	Existing	2	85m Tower Height, 71m Blade Diameter
Larha	Kerry	Existing	2	79m Tower Height, 82m Blade Diameter
Curraghderrig	Kerry	Existing	2	64m Tower Height, 71m Blade Diameter
Maghanknockane	Kerry	Existing	6	Hub Height, 80m
Stacks Mountain	Kerry	Existing	4	Hub Height, 49m
Shronowen	Kerry	Proposed	11	Tip Height, 150m
15 to 20 km				
Dromadda Beg	Kerry	Under Construction	3	94.5m Hub Height, 101m Blade Diameter
Dromadda More	Kerry	Existing	11	151m Blade Tip Height
Glashantooreen	Kerry	Permitted	8	100m Blade Tip Height
Carhooearagh / Moyvane	Kerry	1 No Permitted, 1 No Existing	2	45m Hub Height

Wind Farm	County	Status	No. of Turbines	Hub and Blade Dimensions
Muingnaminnan	Kerry	Existing	18	Blade Tip Height, 77m
Leanamore	Kerry	Existing	9	74.5m Hub Height, 101m Blade Diameter
Muingnatee	Kerry	Existing	11	67m Hub Height, 52m Blade Diameter
Kilathmoy - Beenanaspuck	Kerry	Existing	3	Tip Height, 129.9m
Aghanamore North	Kerry	Permitted	1	Tip Height, 92.5m

There are 30 No. existing and permitted wind farms within a 20 kilometres radius of the proposed development. The locations of the 30 wind farms can be identified on the Cumulative Baseline map Figure 13- 11, shown below. There are no wind farms located in the County Clare boundary within the study area.

The proposed Ballynagare turbines will be assessed alongside the above turbines to separately determine the cumulative landscape and visual effects.



Map Legend

- Site Boundary
- County Boundary
- Proposed Ballynagare Turbines

Wind Farms in the study area

- Aghanamore North- Permitted
- Ballincollig Hill- Existing
- Ballyhorgan- Proposed
- Ballylongford- Permitted
- Beale Hill- Existing
- Beenageeha- Existing
- Carhooearagh / Moyvane- Existing
- Carhooearagh / Moyvane- Permitted
- Cloghaneleskirt- Existing
- Cloghboola- Existing
- Curraghderrig- Existing
- Dromadda Beg- Under Construction
- Dromadda More- Existing
- Glashantooreen- Permitted
- Kilathmoy - Beenanaspuck- Existing
- Knocknagoum- Existing
- Larha- Existing
- Leanamore- Existing
- Maghanknockane- Existing
- Muingnaminnan- Existing
- Muingnatee- Existing
- Pallas / Clahane- Existing
- Pallas / Clahane Extension- Existing
- Sharonowen- Proposed
- Stack's Mountain- Existing
- Tullahennell- South- Existing
- Tullahennell-North- Existing
- Tursillagh 1- Existing
- Tursillagh 2- Existing
- Tylagh- Existing

Drawing Title: Cumulative Baseline	
Project Title: Ballynagare Wind Farm	
Drawn By: AW	Checked By: TB
Project No.: 200512	Drawing No.: Figure 13-11
Scale: 1:150000	Date: 2021.05.31

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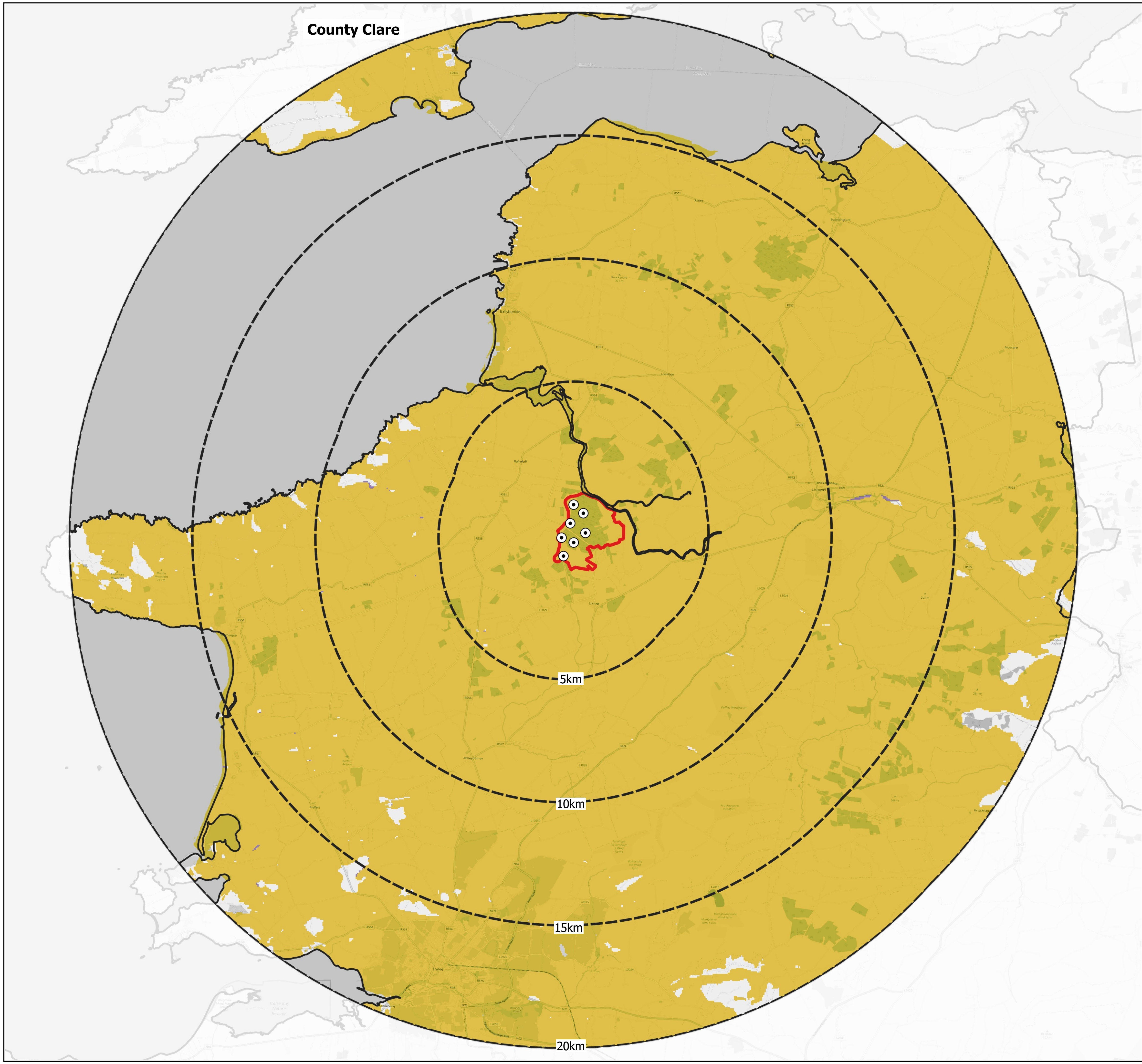
13.7.1 Comparative Cumulative Visibility to half-blade

Figure 13-12 below compares the cumulative visibility of all existing, permitted and proposed wind farms (represented in yellow) with any additional visibility of the proposed development represented in purple. Two very small areas of purple are evident in Figure 13-12 these areas are located east of the site (approximately 10.3km). Another small area, approximately 7.8km west of the site also shows visibility with the addition of the proposed Ballynagare wind farm. No prominent visual receptors are located in the three areas where cumulative visibility is increased as a result of the proposed wind farm development. The very small proportion of purple in the map clearly shows that due to the high proportion of existing, permitted and proposed turbines within 20 kilometers, and the insignificant visibility of the proposed development from surrounding areas, the addition of the proposed turbines is a minor addition to the extent and pattern of visibility.



Map Legend

- Site Boundary
- Proposed Ballynagare Turbines

Comparative ZTV

- Additional Ballynagare Turbines
- All turbines in study area

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Drawing Title: Comparative Cumulative ZTV	
Project Title: Ballynagare Wind Farm	
Drawn By: AW	Checked By: TB
Project No.: 200512	Drawing No.: Figure 13-12
Scale: 1:150000	Date: 2021.05.31

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13.8 Likely or Significant Landscape and Visual Effects

13.8.1 'Do-Nothing' Scenario

In the Do-Nothing scenario, the proposed development would not take place. The opportunity to capture an even greater part of County Kerry's valuable renewable energy resource would be lost. The existing uses of the site for agriculture and turbary would continue. Therefore, there would be no landscape or visual effects in the 'do-nothing' scenario.

13.8.2 Construction Phase Effects

It is estimated that the construction phase of the proposed development will last approximately 18 months. The construction phase can be broken down into three main phases, 1) civil engineering works - 9 months, 2) electrical works - 6 months, and 3) turbine erection and commissioning - 6 months. The main task items under each of the three phases are outlined in Chapter 4 of this report.

13.8.2.1 Landscape Effects

It is considered that this is a Short-term, Imperceptible, Negative effect in terms of landscape effects during the construction phase. The construction phase effects of the proposed development are intended to be short term and for a short duration and will not result in the loss of key landscape elements.

13.8.2.2 Visual Effects

During the construction phase, the ancillary project elements will give rise to a long-term Slight, Negative visual effect.

For more details on the visual effects of the ancillary project elements see 'Ancillary Project Elements' in the following section, *Operational Phase Effects.*

13.8.3 Operational Phase Effects

13.8.3.1 Landscape Effects

13.8.3.1.1 *Landscape Designations*

The only landscape designation brought forward as a landscape receptor likely to experience landscape effects is the zone of Rural Secondary Special Amenity north of Cashen Bay, River Feale estuary and Banna Strand. Here the ZTV mapping shows widespread full theoretical visibility. Assessment of landscape effects attributed to the proposed development are determined to be insignificant. The proposed development will be located a significant distance from this landscape designation and turbines will not obstruct or intrude upon views of the landscape as a resource, this is clearly evident in Photomontage VP4 and VP15 (see Volume 2 and Appendix 13-3) which are located in very close proximity to these landscape receptors. Heritage landscapes were also observed within County Clare from across the Shannon River towards the proposed site boundary, as evident in VP5, almost no visibility of the proposed development from this location was found due to the distance of over 18km.

No significant visibility of the proposed development site was found at any other Kerry County Council landscape designations of Rural Primary Special Amenity within the LVIA study area.

13.8.3.1.2 Landscape Character of the Proposed Development Site

The landscape character of the proposed development site will undergo a change in character by the introduction of vertical structures in the landscape. There will also be a minor localised change around the ancillary project infrastructure. The Landscape Character Assessment ("LCA") carried out in support of the Renewable Energy Strategy which has been adopted within the Kerry County Development Plan, has identified the site of the current proposal as being "Open to Consideration", for the provision of wind farm development due to the *'area having less population than the remainder of the area and the land is also marginal. The view from Ferry Bridge, however, is a designated Scenic View and is therefore a constraint to wind farm development'*. The LCA has evaluated the characteristics of the entire county and has identified 46 different landscape character areas informed by carrying out viewpoint assessments as well as carrying out public meetings, Habitats Directive Assessment and Strategic Environmental Assessment.

The landscape within which the proposed development is located has not been identified as being an important scenic area on a County or National basis. Scenic Route/Scenic View 1 at Ferry Bridge R551 is identified as having scenic quality in this LCA and is described in more detail in Section 13.8.3.2.2 below.

13.8.3.1.3 Landscape Character Areas

An assessment of the effects on landscape character was undertaken for the six LCAs within the study area that were identified as having potential visibility in the Landscape Receptor Preliminary Assessment above and listed in Table 13- 5 of the same section. The individual assessments for each LCA are summarised in Table 13- 13 below and included in detail in Appendix 13-2 Landscape Character Assessment Tables.

Table 13- 13: Landscape Character Effects of LCAs within the LVIA Study Area.

Landscape Character Type (LCT)	LCT Sensitivity to Wind Farm Development	Magnitude of Change	Significance of Landscape Character Effect
LCA 3 – Cashen River	Medium	Slight	Slight
LCA 4 – Inner River Plain	Low	Negligible	Imperceptible
LCA 5 - Listowel Plain	Low	Moderate	Slight
LCA 6 – Smearlagh River Valley	Low	Slight	Not Significant
LCA 7 – River Feale Valley	Low	Slight	Not Significant
LCA 23 - Kerry Head and Causeway Coast	High	Negligible	Slight

As demonstrated by Table 13-13, no significant landscape effects are likely to occur on the landscape in the LVIA study area. The proposed development is located in the southern portion of LCA-3 Cashen River and it is located in close proximity to LCA-5 Listowel Plain. Both LCAs are likely to have 'Slight' landscape character effects as a result of the proposed development. LCA-23 Kerry Head and Causeway Coast also recorded 'Slight' Landscape effects. This can be attributed to its highly sensitive landscape receptors located on the coast. Likely landscape effects are significantly mitigated by topographical screening and distance from the proposed development.

LCA-3 Cashen River is an LCA of moderate sensitivity due to scenic landscape elements located on the west coast and surrounding the River Feale and Cashen Bay. While there is relatively no visibility of the proposed development at the coast, views of the proposed wind farm surrounding the River Feale and Cashen bay are significantly mitigated by screening from the steep sided banks of the river and the abundance of forestry and heavily vegetated marshlands lining the riverbanks. Inland areas of LCA 3 closer to the proposed development comprise of a flat landscape of a wide and expansive nature, enabling the proposed development to be absorbed effectively within the landscape as the perceived scale of the proposed turbines will reduce significantly with distance.

LCA-5 Listowel Plain is likely to have Slight landscape effects on landscape character as the moderate change that the proposed development will bring to the landscape is in an area of the LCA that is both of low sensitivity and 'Open to Consideration' for wind energy development. Landscape effects are only limited to areas of the LCA in relatively close proximity to the proposed development. Factors such as topographical screening and distance (>15 km) significantly mitigates likely landscape effects occurring in the high sensitivity landscape receptors located on the west coast of this LCA.

The assessments determined that the proposed development is only likely to induce 'Not Significant' or 'Imperceptible' effects on the landscapes of the other LCAs assessed within the LVIA study area.

13.8.3.1.4 *Cumulative Landscape Effects*

After identifying the cumulative baseline and cumulative status for each LCA it was assessed to what extent the addition of the proposed development changes the status of the individual LCAs. It was found that only in the LCA within which the proposed development is located does the cumulative landscape status change.

Although, it was found that the proposed development adds to the cumulative landscape status, it would not change the character of the individual LCAs in terms of wind energy and therefore the cumulative landscape effects are considered Low.

13.8.3.2 Visual Effects

13.8.3.2.1 *Summary of Viewpoint Assessment*

An assessment of the visual effects of the proposed turbines was undertaken from the 16 viewpoint locations identified in Section 13.6.3 above using the assessment methodology described in Appendix 13-1. The locations of these viewpoints are shown in Figure 13- 10 above. The individual assessments from the 16 viewpoints are presented in Appendix 13-3 and summarised in Table 13- 14 below. Appendix 13-3 and Table 13- 14 should be read in conjunction with the photomontage booklet forming Volume 2 of the EIAR.

In general, Hilly and Flat Farmland windfarm sites tend to be capable of absorbing suitably designed wind farm projects of similar scale to the proposed Ballynagare development. Key reasons enabling the proposed wind energy development to be effectively absorbed by the landscape of the site and surrounding area are outlined below and will be evident in the photomontages:

> ***Flat Topography of the site and Listowel Plain to the north, west and south-west.***
> *The low-lying elevation and relatively flat topography of the Ballynagare site and surrounding Listowel Plain, contributes to the landscape's capacity to accommodate a wind farm. This is shown in the photomontages created from Viewpoints 1, 2, 5 and 11. The low-level terrain in which the proposed development is sited results in an even overall height of all the wind turbines, this means that visual confusion caused by turbines at various heights does not arise. For Ballynagare, most visual receptors to the north, west and south-west are also of similar elevation to the base level of the proposed turbines i.e. the*

turbines are not situated on elevated lands and so the potential for clear and open views of the project from receptors at lower elevations does not arise. This topographic feature of the Ballynagare site and surrounds mitigates the potential for overbearing or domineering effects provided sufficient setback from receptors is designed into the project. It also means that separation distances between receptors and turbines becomes important as the turbines appear smaller in scale quickly when viewed in this planar view.

Highly Vegetated Nature of the Landscape
The landscape surrounding this site is often seen as a patchwork of agricultural fields bordered by lines of trees, hedgerows and pockets of woodland shrub. In close proximity to the site, mature hedgerows and mature treelines reduce the potential for clear and open views and any associated potential domineering effects. As demonstrated by the route screening analysis, these vegetation types are evident alongside most of the roads surrounding the proposed development. Located between visual receptors and the proposed turbines, these vegetational elements of the landscape provide screening, obscuring large numbers of turbines or making those views of the turbines intermittent in nature. The ZTV does not take into account this screening and hence ZTV mapping can only be considered accurate where no visibility is indicated. In areas where theoretical visibility is indicated, actual visibility on the ground is diminished by screening factors, as was evident in the results of the route screening analysis.

A Highly Managed and Settled Working Landscape
The site of the proposed Ballynagare development and the wider study area is considered a rural area, however, a significant human influence is evident within the landscape. This can be attributed to relatively intensive agricultural and residential developments throughout North Kerry. This is reflected in the landscape designations which have been attributed to the landscape.

The visual effect of the proposed wind turbines was assessed from each viewpoint in terms of the sensitivity of the visual receptors, along with the magnitude of change, as recommended in the GLVIA (2013) guidelines. This, in conjunction with a detailed review of the photomontages themselves and the ZTV maps, informed the visual effects assessment.

Visualisations such as photomontages are tools that can represent the likely effect of a development and are used to inform the reader's prediction of how that development will appear in the landscape. In terms of the predicted visual quality of the proposed turbines however, i.e. whether a visual effect is deemed to be positive, negative or neutral, this involves a degree of subjectivity. What appears to be a positive effect to one viewer could be deemed to be a negative effect by another viewer. All predicted visual effects of the viewpoints below are Long Term and Direct effects.

Table 13- 14: Viewpoint Assessment Summary

VP No	Description	Grid Ref.	Approx. distance & direction to nearest turbine	Visual Sensitivity of Receptor(s) (at viewpoint)	Magnitude of Change	Residual Significance of Visual Effect
1	View taken from the Rattoo Church and Round Tower in the townland of Clooneagh.	E 487,776, N 633,611	1.3 km NE	**Very High**	**Moderate**	**Moderate**
2	View from the L-1032 just off the Wild Atlantic Way in the townland of Cloghane.	E 548,637, N 755,343	4 km SW	**High**	**Slight**	**Slight**
3	View from R551 and Wild Atlantic Way in the townland of Derryco. Designated as Scenic Route 1 (Ferry Bridge).	E 489,030, N 636,566	3.2 km N	**Very High**	**High**	**Moderate**
4	View from local road in the townland of Ballyeagh, which is also located in an area of Secondary Special Amenity.	E 486,181, N 638,925	6.3 km NW	**High**	**Slight**	**Slight**
5	View from L-2002 in the townland of Cloonconeen. Located within a designated Co. Clare Heritage Landscape.	E 482,240, N 649,884	17.9 km NW	**Medium**	**Negligible**	**Imperceptible**
6	View from the local road and Shannon Way in the townland of Dromin.	E 487,497, N 641,534	8.4 km NW	**Medium**	**Slight**	**Not Significant**
7	View from local road off the R553 in the townland of Farranastack. Designated as Scenic Route 5.	E 492,953, N 641,450	8.7 km NE	**High**	**Slight**	**Slight**
8	View from R553 in the townland of Ballydonohough.	E 493,047, N 638,507	6.5 km NE	**Low**	**Slight**	**Imperceptible**
9	View from local road off the R557 in the townland of Dysert.	E 491,284, N 632,737	1.3 km E	**Medium**	**Moderate**	**Slight**

VP No	Description	Grid Ref.	Approx. distance & direction to nearest turbine	Visual Sensitivity of Receptor(s) (at viewpoint)	Magnitude of Change	Residual Significance of Visual Effect
10	View from the Great Southern Trail in the townland of Listowel Rural.	E 496,949, N 633,949	7.5 km E	**Medium**	**Slight**	**Not Significant**
11	View from local road just off the R555 in the townland of Rathea. Designated as Scenic Route 3.	E 501,731, N 629,013	12.5 km W	**High**	**Negligible**	**Imperceptible**
12	View from the N69 in the townland of Pallas.	E 494,378, N 626,696	7.3 km SE	**Low**	**Slight**	**Imperceptible**
13	View from local road off R554 in the townland of Glanerdalliv.	E 486,833, N 632,061	1.8 km E	**Medium**	**Moderate**	**Moderate**
14	View from the Ballyduff local road in the townland of Aghabeg East.	E 486,942, N 629,466	2.6 km SW	**Low**	**Moderate**	**Not Significant**
15	View from Banna Strand in the townland of Ballinprior. Located in an Area of Secondary Special Amenity and is located along the North Kerry Way.	E 474,982, N 624,700	15.3 km NW	**Medium**	**Negligible**	**Imperceptible**
16	View from local road just off the R551, which is also part of the Wild Atlantic Way and North Kerry Way. Designated as Scenic Route 23.	E 474,849, N 630,566	13.8 km W	**High**	**Slight**	**Slight**

The assessment of visual effects determined the residual significance of the visual effects to range from 'imperceptible' to 'moderate', with the number of findings at each level of significance listed in Table 13- 15 below.

Table 13- 15: Summary of Viewpoint Impact Assessment Results

Significance of Residual Visual Effect	Description	No. of Viewpoints
Profound	An effect which obliterates sensitive characteristics	0
Very significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment	0
Significant	An effect, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment	0
Moderate	An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends	3
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities	5
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences	6
Imperceptible	An effect capable of measurement but without significant consequences	2

The significance of the residual visual effect was not considered to be "Profound" "Very Significant" or "Significant" at any of the 16 viewpoint locations. A residual effect of "Moderate" was deemed to arise at viewpoint locations 1, 3 and 13 due to the intervening distance of <5km from the site and the location of VP 3 along Scenic Route 1 at Ferry Bridge and Wild Atlantic Way and VP1 at the Rattoo Church and Round Tower cultural centre. A residual visual effect of "Slight" was deemed to arise at five of the 16 viewpoint locations. All other viewpoints were assessed as resulting in Not Significant (6) and Imperceptible (2) residual visual effects.

The viewpoint assessment results will be discussed in more detail in the following sections.

13.8.3.2.2 Visual Effects in the overall LVIA study area

Generally overall visual effects are strongly guided by ZTV mapping (based purely on topography, in this case 10-meter contour data) as an indication of areas that will have no visibility of proposed turbines and areas that will have theoretical visibility. The level of certainty for areas where no visibility is indicated by ZTV is very high. On the contrary, in areas where the ZTV mapping shows theoretical visibility this will not have taken account of local variations in ground levels not represented by the 10 metre contour data and more importantly vertical objects such as vegetation, buildings and other structures that will block views of the proposed turbines.

A combination of ZTV mapping, photomontage assessment and on-site visual assessments has determined that visibility of the site and likely visual effects are primarily constrained to the flat coastal plain surrounding the proposed site from the north, east and west (at a distance of approximately 10km). Topographical landform significantly mitigates likely visual effects occurring in the majority of the landscape to the south, east and north beyond 10km of the site. Areas to the west and south-west where visibility of the site could potentially occur will be restricted to remote, elevated locations where there is a notable absence of sensitive visual receptors and visibility is significantly mitigated by distance, therefore, resulting visual effects in these areas will be insignificant.

The visual baseline reports that visual receptors of highest sensitivity in the LVIA study area are located to the west at Ballybunion and Kerry Head and north-west around the town of Ballyheigue. Topographical screening and the factor of distance renders visibility of the proposed Ballynagare development to be highly unlikely from these receptors, resulting in insignificant visual effects.

Designated Scenic Routes

Map 12.1 (a,b,c,e,f,) of the KCDP was consulted to identify a total of 22 designated scenic views/prospects for County Kerry within the LVIA study area. Viewing points designated by Fáilte Ireland along the route of the Wild Atlantic Way have also been considered when identifying prominent visual receptors for assessment in this LVIA. 18 of the 22 Designated Scenic Routes for County Kerry and SR17 in County Clare within the study area, were screened out for further assessment in Section 13.6.2 as the ZTV indicates there is no visibility and visibility during the site visit was hard to establish due to screening by vegetation and changes in local topography.

No Effect was deemed to arise from Viewpoints 16 (Scenic Route 23) and Viewpoint 11 (Scenic Route 3) due to distance and screening by vegetation and topography, which significantly reduces visibility of the proposed turbines. From the perspective of Viewpoint 11, the undulating landform ensures that the proposed development does not obstruct or intrude upon views of other landscape elements.

Viewpoint 3 along Scenic Route 1 and Ferry Bridge will have a residual effect of 'Moderate' given the designation in the CDP and the close proximity to the site. From this location, the man-made coniferous forestry plantation in the foreground mitigates visibility of the turbines and reduces the overall aesthetic quality of the view.

Settlements

Of the 13 settlements identified in the study area, 10 were screened out in the 'Visual Receptor Preliminary Assessment', as no visibility of the proposed development could be established on site. Hence, viewpoints were selected for the remaining three settlements Listowel, Ballybunion and Ballyduff.

During the site visit, a viewpoint was taken from the R557 on the southern outskirts of the village of Lixnaw. As shown in Plate 13-22 below, visibility was hard to establish, as vegetation screening along the R557 significantly reduces visibility of the proposed development. Therefore, the village of Lixnaw was screened out for further assessment during viewpoint selection as visibility on site was hard to establish.

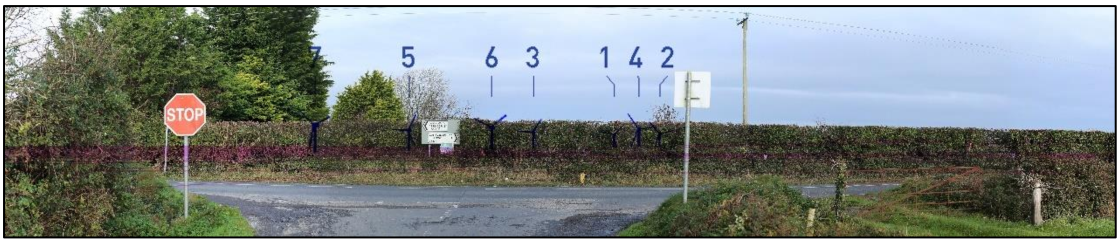


Plate 13-22 View taken from R557 on the southern outskirts of the village of Lixnaw, showing very limited visibility of the proposed Ballynagare turbines (No Visibility VP2).

Viewpoint 2 was taken on the northern outskirts of the village of Ballyduff <5km from the proposed development. No views of the site could be found within the village of Ballyduff. From this slightly elevated viewpoint location of VP2, extensive vegetation screening found along this road significantly reduces visibility of the proposed turbines.

Listowel is the largest settlement in the LVIA study area with full theoretical visibility, hence particular attention was given to establishing whether residents would have views of the proposed turbines. During the site visit, no visibility of the proposed development could be found within the village of Listowel. Hence, VP10 was chosen as a 'worst case' scenario as it is located on the southern outskirts of Listowel and is representative of views from the Sive Walkway. Mature vegetation screening and the flat topography of the landscape significantly reduces visibility of the proposed turbines.

Recreational Routes and Tourist Designations

Viewpoints 6 and 7 were selected to assess, amongst other visual receptors, the visual effects on the Shannon Way from the heightened elevated lands of Knockanore Mountain looking south. While the ZTV mapping had shown predominantly full theoretical visibility for this recreation route, it was found that screening by roadside vegetation blocked views for a large part of the route. The residual visual effects from Viewpoint 7 are deemed 'Slight' as the elevated position of this viewpoint allows for distant views over the flat Listowel plain towards Stack's Mountain and VP7 is located along Scenic Route 5. As outlined in the KCDP, Scenic Route 5 is directed east and not in the direction of the proposed development (south). Key landscape features of field boundaries outlined by hedgerows in the lower Listowel plain and Stacks Mountain in the skyline ensures that the proposed development does not obstruct or screen the overall aesthetics of these key landscape features. A residual effect of 'Not Significant' was deemed at VP6 as man-made elements of electrical powerlines and over vegetated hedge banks significantly reduce visibility of the turbines.

Viewpoints 15 and 16 were chosen as they are located along or in close proximity to the North Kerry Way. No Effect in visibility was deemed from Viewpoint 15 and from Viewpoint 16 the proposed wind farm development is significantly screened from view by an intervening distance of over 10km and distance across a flat landscape. As the photomontage demonstrates there will be no effect as a result of the proposed development.

During the site visit in the Fall of 2020, the highest point on The North Kerry Way at 217 O.D. was walked and visibility was observed. Although the ZTV shows partial visibility from this heightened location, visibility on site was difficult to establish, as the proposed turbines will be screened entirely as shown in Plate 13-23 below.

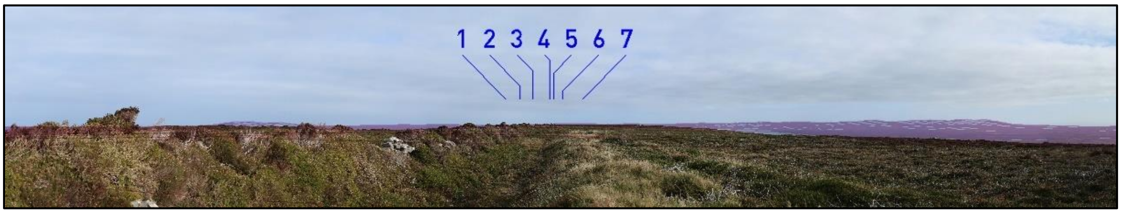


Plate 13-23 View from highest point along the North Kerry Way (No Visibility Viewpoint 3).

Viewpoint 5 was taken from the Loop Head Walkway in County Clare. As the photomontage demonstrates, the proposed wind farm will be indiscernible due to an intervening distance of over 18km and therefore, no effect in the view will arise as a result of the proposed Ballynagare development.

Major Transport Routes

The N69 is the major transport route within the study boundary and runs south of the site. Viewpoint 12 was selected as it is located along the N69. Road users along the N69 will be travelling at speeds close to 100km/h. and the focus of views is likely to be directed on traffic and the road rather than being directed towards the turbines of the proposed development. This photomontage is not truly representative of the roadside screening from dense hedgerows and trees which is evident along the road in either direction from this viewpoint location, such screening therefore has a capacity to significantly mitigate visual effects in the surrounding area. A residual effect of 'Not Significant' was deemed to arise at VP12.

Viewpoint 8 was taken along the R335. From Viewpoint 8, the proposed wind farm development can be seen across the flat landscape in the distance. The intervening distance of 6km and screening by vegetation further mitigates views of the proposed turbines. This viewpoint was taken on a sparsely populated road and the road users will not be traveling in the direction of the proposed turbines, therefore, residual visual effects are considered 'Not Significant' from this viewpoint location.

Settlements (within 5km of the Site)

Lixnaw: The well-established streetscape in the village of Lixnaw will largely prevent any views from the village in the direction of the proposed Ballynagare wind farm. This was the finding of the visual screening assessment detailed in Section 13.4.4.

Ballyduff: The village of Ballyduff, and particularly the areas in all directions from the crossroads in the centre of the village does not have clear views towards the Ballynagare site from the public realm. The extent and type of screening is detailed in the Route Screening Analysis, as shown in Plate 13-24 below.

Plate 13-24 View of Ballyduff streetscape which will prevent any views towards Ballynagare

13.8.3.2.3 Visual Effects Within Five Kilometres of the Site

Likely visual effects arising within areas 5 km from the proposed Ballynagare development will be significantly mitigated by the highly vegetated nature of the flat settled working landscape in which the site is located. This was clearly demonstrated by the Route Screening Analysis in Section 13.4.3 above. Six of the selected photomontage viewpoints fall within five kilometres of the proposed turbines (VP1, VP2, VP3, VP5 VP13 and VP14).

Wind farm visibility less than 3km: Three viewpoint locations (VP1, VP9 and VP13) were chosen to demonstrate visibility of the proposed turbines at a close distance of less than 3km. In most cases the sensitivity of the viewpoints were rated as either high or moderate giving consideration to the close proximity of residential receptors to the proposed development. Likely residual visual effects occurring at VP1 was scored as 'Moderate' and a residual effect of 'Slight' was scored at VP9 and VP13 respectfully. Due to the close proximity to the site from these locations, the turbines will appear large. Screening by vegetation and local changes in topography reduces visibility of the turbines from these locations.

Wind farm visibility between 2 and 5 kilometres: Three photomontages (VP2, VP3 and VP14) were prepared from a distance of between two and five kilometres from the closest turbine, but they importantly show the difference in visibility from the two types of landscape setting around the Ballynagare site; the flat coastal plain and the elevated foothills of Stack's Mountains.

Even at this short additional separation distance from the proposed wind farm site, viewpoints VP2, VP3 and VP14 show that other landscape features come into the views of the proposed turbines, thereby reducing their dominance. At this slightly further setback distance, the tight spatial arrangement of the ten proposed turbines begins to take on the appearance of a cluster, whereas at distances of less than two kilometres, given the proximity of the turbines, the cluster was more difficult to discern. VP3 and VP14 show that there will be very little screening in the foreground of the views and the landscape between the photo location and proposed turbines is open and expansive. From VP3, the man-made coniferous forestry plantation will mitigate domineering effects of the turbines, however, the likely residual effect is considered 'Moderate' due to the distance from the nearest turbine and the viewpoint taken from Ferry Bridge along Scenic Route 1 (designated southern direction towards proposed site). VP14 was taken from a local road showing open and expansive views of the proposed Ballynagare turbines across a flat agricultural field. There are very few visual receptors along the local road where VP14 was taken and the flat and expansive views allows the turbines to be absorbed, thus the residual effect is considered 'Not Significant' from this location.

13.8.3.2.4 *Ancillary Project Elements including Grid Connection*

For the purposes of this LVIA, a number of individual elements of the proposed development, ancillary to the proposed wind turbines, have been grouped together for the assessment of effects, given the similar nature of the works required. These operational project elements include the proposed roads and turbine hardstand areas, anemometry masts and the electricity substation compound (and ancillary elements thereto) may all give rise to potentially similar landscape and visual effects.

Due to the topography of the proposed development site and surrounding areas the lower ancillary project elements will be visible in their immediate surroundings, hence, any visual effects will be localised and predominantly confined to within the proposed development site.

Visual effects arising from the proposed ancillary project elements will be slight, localised and long-term where seen, but will remain largely unseen from within and outside the site.

13.8.3.3 Cumulative Visual Effects

As outlined in the methodology in Appendix 13-1 the cumulative visual effects assessed were visual separation from other wind farms and visual disparity caused by other turbines of a different scale and design being seen alongside the proposed turbines. Cumulative visual effects were assessed as part of the Photomontage Viewpoint Assessment Tables found in Appendix 13-3.

There are 31 other existing, permitted and proposed wind farms located within 20km of the proposed Ballynagare development with the majority of these located at significant distances from the site. Turbines from the proposed Ballyhorgan and existing Pallas-Clahane wind farm are in closest proximity to the proposed development and are most likely to induce cumulative visual effects. The proposed turbines are isolated from nearby wind farms (Ballyhorgan and Pallas-Clahane) by factors of distance and elevation. Cumulative visual effects are significantly mitigated by distance as the difference in scale of other existing wind farms will contrast adversely to that of the proposed development. The low elevation of the proposed development on the flat coastal plain visually separates it from other nearby wind farms located on the high ridges of the Stack's Mountains to the south-east.

A comparative ZTV (Figure 13-12 above) shows that the cumulative visibility over that of the existing and permitted turbines within the LVIA study area only increased in a small number of tiny pockets due to the addition of the Proposed Development, and therefore it is considered that the proposed development will not have a significant impact on the extent of cumulative visibility within the LVIA study area.

The landscape character is one of a large scale which contains open, expansive views, and these assist in allowing the landscape to accommodate a large number of turbines. Overall, it is considered that the cumulative impact can be described as Long-term, Slight Cumulative Impact, given the amount of wind farm development that has already occurred and the limited numbers of additional turbines that will come into view as a result of the proposed development.

13.8.4 Operational Phase

The proposed wind farm development is expected to have a lifespan of approximately 30 years. During this period, on a day-to-day basis the wind turbines will operate automatically, responding by means of anemometry equipment and control systems to changes in wind speed and direction.

The proposed grid connection from the site to the national grid is underground, thereby eliminating landscape or visual effects during the operational phase.

The wind turbines will be connected together and data relayed from the wind turbines to an off-site control centre. Each turbine will also be monitored off-site by the wind turbine supplier. The monitoring of turbine output, performance, wind speeds, and responses to any key alarms will be monitored at an off-site control centre 24-hours per day.

A description of the operational phase effects is outlined further in Chapter 4 of this report.

13.8.5 Decommissioning Phase Effects

The wind turbines proposed as part of the proposed development are expected to have a lifespan of approximately 30 years. Following the end of their useful life, the wind turbines may be replaced with a new set of machines, subject to planning permission being obtained, or the site may be decommissioned fully, with the exception of the electricity substation.

Upon decommissioning of the proposed wind farm, the wind turbines would be disassembled in reverse order to how they were erected. All above ground turbine components would be separated and removed off-site for recycling. Turbine foundations would remain in place underground and would be covered with earth and reseeded as appropriate. Leaving the turbine foundations in-situ is considered a more environmentally prudent option, as to remove that volume of reinforced concrete from the ground could result in significant environment nuisances such as noise, dust and/or vibration. Site roadways could be in use for purposes other than the operation of the wind farm by the time the decommissioning of the project is to be considered, and therefore it may be more appropriate to leave the site roads in situ for future use. If it were to be confirmed that the roads were not required in the future for any other useful purpose, they could be removed.

A description of the decommissioning phase effects is outlined further in Chapter 4 of this report.

13.9 Ballynagare Alternative Turbine Range

For this assessment, an alternative turbine tip height was examined to determine if there is a difference in increased visual effect from the 170m turbine tip height in comparison to lowering the tip height to 169.5m. To determine the visual effect, a wireframe was produced from one of the viewpoints outlined in this report as shown in Figure 13-13 below, where green indicates the 169.5m tip height option and blue indicates the 170m tip height option. The dimensions for the alternative 169.5m tip height option include 95m for the hub height and 149m for the rotor diameter. When comparing the 170m tip height option to the 169.5m tip height option, there is an imperceptible difference in the increased visual effect for the turbines, even at a close range as shown in Figure 13-13 below. Therefore, it is evident that lowering the tip height by 0.5m as shown in Figure 13-13 below does not change the residual impact assessment carried out within this EIAR.

Figure 13- 13: Turbine envelope comparison, where green indicates a 169.5m tip height option and blue indicates a 170m tip height option.

13.10 Conclusion

The sensitive visual and landscape receptors with visibility of the proposed development were assessed based on site visits and using the photomontage methodology that follows best practice guidance for LVIA. Other tools such as ZTV mapping and Route Screening Assessment have also been employed to determine the likely potential and actual visibility of the proposal. Residual Visual Effects were recorded as Moderate, Slight, Not Significant and Imperceptible for these sensitive visual receptors. No significant visual effects were recorded for any of the photomontages as a result of the proposed Ballynagare development.

In terms of landscape character, only County Kerry's Landscape Character Area *3 Cashen River*, in which the turbines of the proposed development are located, experiences direct effects on landscape character as a result of the project. Any other effects on other LCAs are indirect, as the proposed development will be visible from within these LCAs but located outside of them. The site is not located within or close to any designated County Kerry zones of special landscape amenity and has not had any significant effect on these areas. In some LCAs the proposed development will add to the cumulative landscape status, although it would not change the character of the individual LCAs in terms of wind energy and therefore the cumulative landscape effects are considered Low.

The visual assessment concluded that residual visual effects of "Moderate" significance was deemed to arise at three of the sixteen viewpoint locations. All other viewpoints were assessed as resulting in Slight (5), Not Significant or Imperceptible residual visual effects.

Visual receptor sensitivity from Viewpoints 1 and 3 were deemed High due to designations in the KCDP, they're both located within or along recreational and tourist designations and their intervening distance is less than 5km from the nearest turbine. The Rattoo Church and Round Tower at Viewpoint 1 is not listed as a common tourist destination and the local road of the Rattoo Church is in poor condition with very few residential receptors, therefore is unlikely to be travelled often. Viewpoint 3 located at the Ferry Bridge, Scenic Route 1 and Wild Atlantic Way will have direct views of the turbines over Cashen River, however, the coniferous forestry plantation in the foreground significantly reduces the aesthetic quality of landscape views. Additionally, the key views of the Cashen River and Stacks Mountain are not impacted with the addition of the proposed development and the turbines are readily absorbed into what is a predominantly working and man-made landscape.

Furthermore, it was shown that the potential for actual visibility is greatly restricted by the flat nature of the surrounding topography and actual visibility is likely to be further restricted by the effects of localised screening in the highly vegetated working landscape surrounding the site. As demonstrated in the Photomontage booklet and photomontage assessment tables (Appendix 13-3), the turbine locations spacing and heights have been appropriately selected for the Ballynagare site. The strategic siting ensures the wind farm will be viewed as a spatially coherent development, with minimal occurrence of visual confusion and overlapping, significantly mitigating the impact of likely visual effects. Overall, landscape and visual effects arising from the proposed development will be minimal and no significant effects are foreseen.

14. MATERIAL ASSETS

Material Assets are defined in the '*Advice Notes for Preparing Environmental Impact Statements'* (EPA, Draft 2015) as "*resources that are valued and that are intrinsic to specific places"* and in the 'Guidelines on the Information to be contained in Environmental Impact Assessment Reports' (EPA, Draft 2017) ''as "*built services and infrastructure. Traffic is included because in effect traffic consumes roads infrastructure.*' They may be either of human or natural origin. The cultural assets of Archaeology and Cultural Heritage are addressed in Chapter 12 of this Environmental Impact Assessment Report (EIAR). Economic assets of natural heritage include non-renewable resources such as minerals or soils, and renewable resources such as wind and water. These assets are addressed in Chapter 8: Land, Soils and Geology, Chapter 9: Hydrology and Hydrogeology, and Chapter 10: Air and Climate. Tourism and amenity resources, which are also considered material assets, are addressed in Chapter 5: Population and Human Health.

This chapter of the EIAR addresses the likely significant effects of the proposed development on transportation infrastructure (Section 14.1 Traffic and Transport) and on Telecommunications and Aviation (Section 14.2), which are economic assets of human origin. This chapter of the EIAR has been prepared in accordance with the requirements of the EIA legislation and guidance outlined in Chapter 1: Introduction.

14.1 Traffic and Transport

14.1.1 Introduction

14.1.1.1 Background and Objectives

The purpose of this section is to assess the effects, on roads and traffic, of the additional traffic movements that will be generated during the construction, operational and decommissioning phases of the proposed Ballynagare Wind Farm Development, located in the townlands of the townlands of Ballynagare, Dysert Marshes, Dysert, Curraghcroneen, Farrandeen, Monument, and adjacent townlands in County Kerry.

For developments of this nature, the construction phase is the critical period with respect to the traffic effects experienced on the surrounding road network in terms of both the additional traffic volumes that will be generated on the road network, and the geometric requirements of the abnormally large loads associated with the wind turbine plant. The requirements of the additional traffic and abnormal sized loads generated during the construction stage are assessed on both the external highway network and at the proposed junctions that will provide access to the site.

It should be noted that abnormal weight loads are not a feature of the turbine delivery vehicles, they are abnormal in size only. All construction and delivery vehicles for the proposed development will be subject to the standard axle weight requirements set out under Road Traffic Regulations and therefore the loadings from construction traffic will not exceed the relevant standards. Notwithstanding the need to use some specialist vehicles to facilitate turbine delivery, it should be noted that the number of load-bearing axles for any specialist vehicles carrying large loads are designed to ensure that the load on any one axle does not exceed acceptable load bearing statutory limits.

The magnitude of the increase in traffic volumes experienced on the surrounding network is identified during the various construction stages of the proposed development. Preliminary traffic management measures are also provided in Section 14.1.11.6 aimed at minimising the traffic impact on the local highway network.

14.1.1.2 Statement of Authority

This section of the EIAR has been prepared by Alan Lipscombe of Alan Lipscombe Traffic and Transport Consultants Ltd. Alan is a competent expert in traffic and transport assessments. In 2007 Alan set up a traffic and transportation consultancy providing advice for a range of clients in the private and public sectors. Prior to this Alan was a founding member of Colin Buchanan's Galway office having moved there as the senior transportation engineer for the Galway Land Use and Transportation Study. Since the completion of that study in 1999, Alan has worked throughout the West of Ireland on a range of projects including: major development schemes, the Galway City Outer Bypass, Limerick Planning Land-Use and Transportation Study, Limerick Southern Ring Road Phase II, cost benefit analyses (COBA) and various studies for the NUI Galway. Before moving to Galway in 1997, Alan was involved in a wide variety of traffic and transport studies for CBP throughout the UK, Malta and Indonesia. He has particular expertise in the assessment of development related traffic, including many wind farm developments including the following; Ardderoo, Derryadd, Knocknamork, Shehy More, Cloncreen, Derrykillew, Coole, Cahermurphy, Lettergull, Barnadivane, Cleanrath and Knocknalough.

Alan has a BEng (hons) Degree in Transportation Engineering (Napier University, Edinburgh, 1989), is a member of Engineers Ireland and of the Institute of Highways and Transportation and is a TII accredited Road Safety Audit Team Member.

14.1.1.3 Guidance and Legislation

This section of the EIAR has been completed in accordance with the guidance set out in Chapter 1. The assessment uses standard terminology to describe the likely significant effects associated with the proposed development. Further information on the classification of effects used in this assessment is presented in Section 1.7 of this EIAR.

14.1.1.4 Scoping and Consultation

The scope for this assessment has been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties as outlined in Section 2.6 of Chapter 2 of this EIAR, and summarised below.

Transport Infrastructure Ireland

Transport Infrastructure Ireland (TII) responded to Scoping on the 4th January 2021 in which it provided a list of recommendations to be followed when preparing the EIAR. All relevant TII guidelines and policies have been taken into account in the preparation of this assessment, including the following;

- PE-PDV-02045, Transport Assessment Guidelines, Transport Infrastructure Ireland, May 2014
- PE-PAG-02017, Project Appraisal Guidelines, Unit 5.3, Travel Demand Projections, Transport Infrastructure Ireland, May 2019
- DN-GEO-03060, Geometric Design of junctions, Transport Infrastructure Ireland, April 2017
- TII Automatic Traffic Count Data, N69 between Listowel and Tralee at Knockbrack, years 2019 and 2021 (to determine impacts on traffic volumes of the Covid-19 pandemic).

With regards specific issues raised by TII the following points are noted;

- With the exception of the N69 which is on the haul route, the proposed development will not impact significantly on any other existing or proposed national road.

- An assessment of the traffic impacts on the N69 and the local road network resulting from the construction and operation of the proposed development are set out in this Section of the EIAR.
- Road Safety Audits (RSA) and a Road Safety Impact Assessments (RSIA) have not been undertaken as part of the planning stage but will be prepared as part of the detailed design stage of the project.

Kerry County Council

A pre-planning meeting was held on 2nd June 2021 with the Planning Department of Kerry County Council in relation to the proposed development prior to the submission of the planning application on this site. The meetings were attended Mr. Michael Lynch, Senior Executive Engineer with Kerry Couty Council and representatives of the Applicant and MKO.

Following the presentation, the following main planning issues were identified by the Planning Authority and discussed:

- Visual impact
- Archaeology
- Geotechnical
- Borrow pit
- Grid connection
- Ecology

14.1.1.5 Methodology and Section Structure

The traffic and transport assessment takes cognisance of guidance for such assessments set out by Transport Infrastructure Ireland (TII), in the document PE-PDV-02045 '*Traffic and Transport Assessment Guidelines',* (TII, 2014). The geometric requirements of the turbine delivery vehicles were assessed using Autocad and Autotrack.

The Traffic and Transport Section of this chapter is set out as follows:

- A review of the existing and future transport infrastructure in the vicinity of the proposed development, including an assessment of year 2021 traffic flows and traffic forecasts during an assumed construction year of 2025 (Sections 14.1.2 - Receiving Environment and 14.1.3 – Existing Traffic Volumes).
- A description of the nature of the proposed development and the traffic volumes that it will generate during the different construction stages and when it is operational (Section 14.1.4 – Proposed Development and Traffic Generation).
- A description of the abnormally sized large loads and vehicles that will require access to the site (Section 14.1.5 – Construction Traffic Design Vehicles).
- A review of the effects of development generated traffic on links and junctions during construction and when the facility is operational (Section 14.1.6 –Traffic effects during construction and during operation).
- Identification of traffic management for large deliveries during construction (Section 14.1.7 – Traffic Management for Large Deliveries).
- A geometric assessment of the route and its capacity to accommodate the abnormal-sized loads associated with the development (Section 14.1.8 – Route Assessment).
- An assessment of the provision for sustainable modes of travel (in this case primarily with respect to the transport of construction staff) (Section 14.1.9 – Provision for Sustainable Modes of Travel).

The description of likely significant effects is provided in Section 14.1.11.

14.1.2 Receiving Environment

14.1.2.1 Site Location

The proposed development, known as Ballynagare Wind Farm is shown in the context of the national and local highway networks in Figure 14.1.1.

The closest settlements to the site are Lixnaw, which is located approximately 0.5km to the west, Finuge, which is located approximately 4.5km to the east and Mountcoal, located 5 km to the southeast. The closest town is Listowel which is approximately 9kms to the north east of the site.

14.1.2.2 Proposed Abnormal Size Load Delivery Route

The proposed transport route for the large wind turbine plant will be via the entry point at the port of Foynes, east to Limerick on the N69, south to Abbeyfeale and Castleisland via the M20 and N21, to Tralee on the N21 and finally, north on the N69 towards the site where it exits the N69 at Mountcoal.

A detailed assessment of the transport route was made from where the route leaves the national road network on the N69 to join the L6055, before heading northwest for approximately 4km to the priority junction with the R557. The route then heads southwest for 2.5kms before turning right into an unnamed local road towards the site at Ballynagare. The route from the N69 is discussed in detail in Section 14.1.6 and shown in Figure 14.1.2a. A review of the implications on the wider national road network was also undertaken at junctions on the N21 and N69 bypassing Castleisland and Tralee with the locations and autotracks included as Appendix 14.1.

The extent of the route assessment discussed in this section therefore comprises of;

- Location 1 - the N69 / L6055 junction at Mountcoal,
- Location 2 - the left hand bend on the L6055 at Mountcoal,
- Location 3 - the crossroads on the L6055 with the L1027,
- Locations 4, 5 and 6 – bends on the L6055,
- Location 7 - the R557 / L6055 junction,
- Location 8 – R557 Local road junction,
- Locations 9 to 12 – Access junctions A to D providing access to the site.

The locations assessed on the wider road network and presented in Appendix 14.1 are;

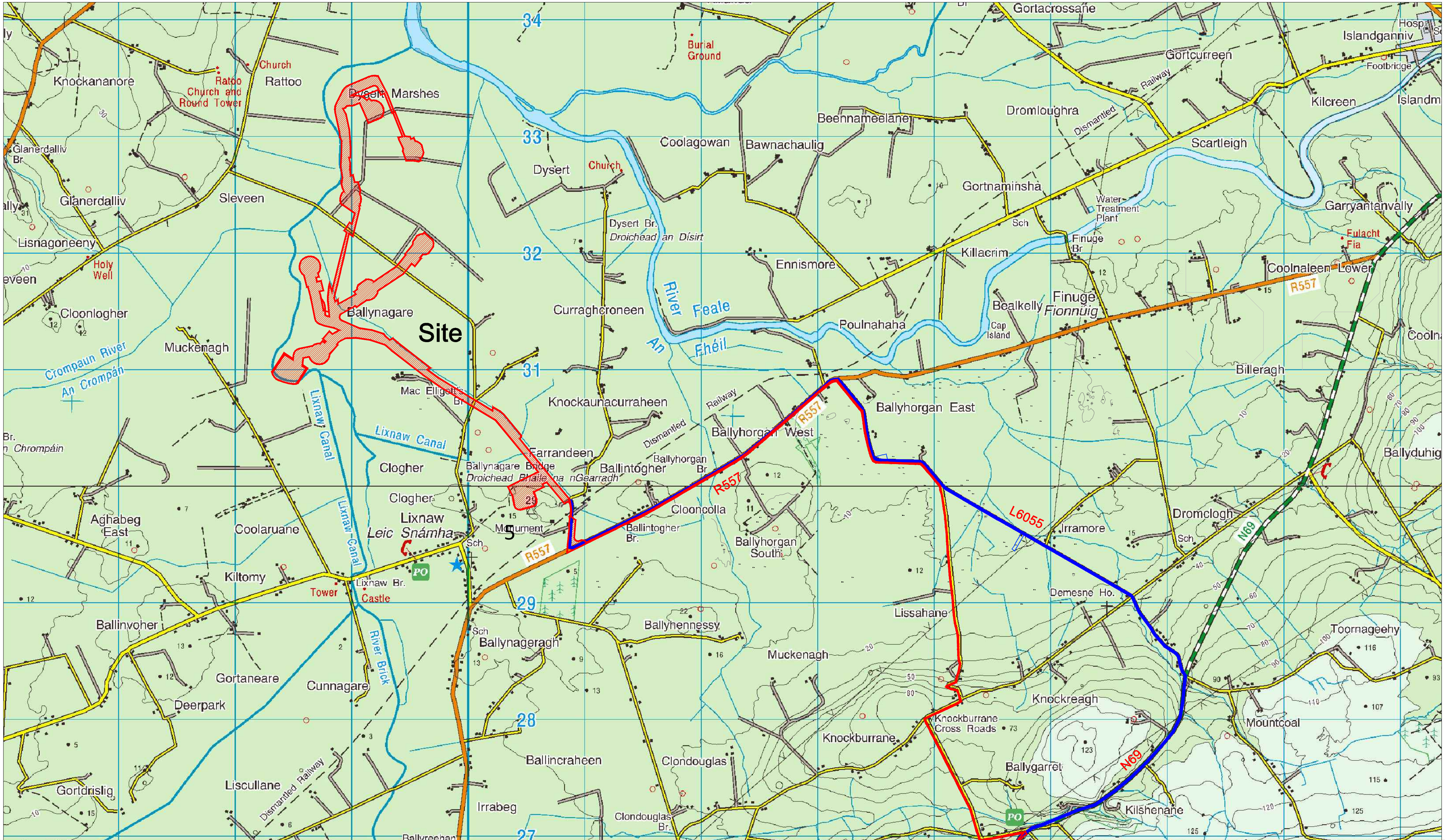
- Location A - N21 / N23 roundabout at Castleisland,
- Location B - N21 / N69 roundabout at Tralee,
- Location C - N69 / L2015 roundabout at Tralee, and,
- Location D - N69 / R878 roundabout at Tralee.

14.1.2.3 Proposed Construction Traffic Haul Route

The delivery route for general HGV construction traffic may vary depending on the location of suppliers used for stone and other materials required to construct the proposed development. Based on the location of quarries in the vicinity of the Proposed Development and the fact that deliveries of stone for the grid connection comprise a large element of deliveries to and from the site, the assessment presented in this EIAR is based on all construction traffic approaching the site on the same route as specified for the abnormal loads. While this may vary in practice this assesses the worst case scenario with all development generated traffic concentrated on one route.

14.1.2.4 Site Entrances

Access for all deliveries into the site will be via 4 access junctions at locations 9 to 12 as indicated in Figure 14.1.2a. These junctions are discussed further in Section 14.1.8.



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-1 Site location and delivery route

PROJECT:	Ballynagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	NTS
PROJECT NO: 8890	DATE: 23.08.21	DRAWN BY:	AL

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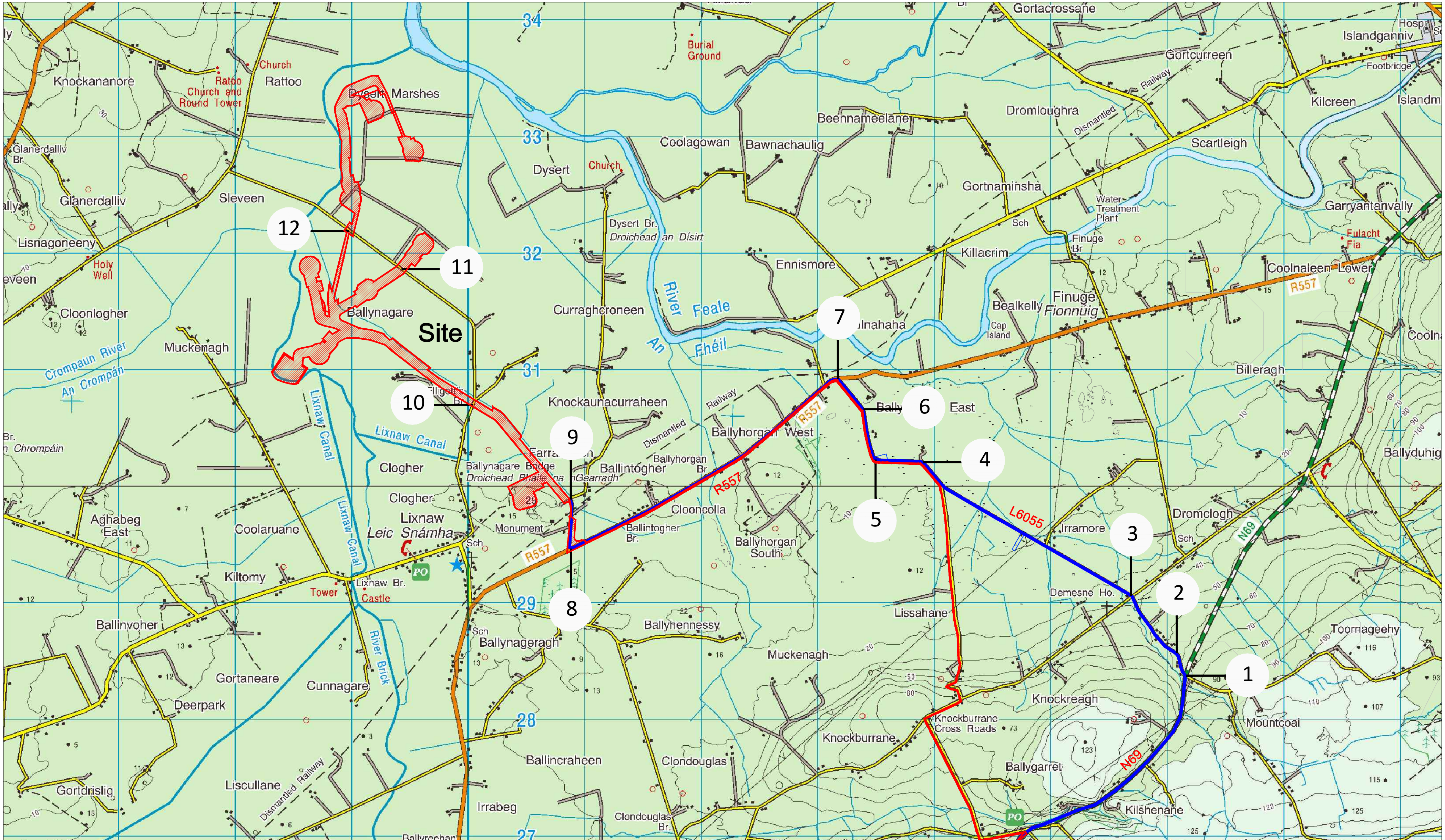

NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-2a Route assessment location map

PROJECT:	Ballynagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	NTS
PROJECT NO: 8890	DATE: 23.08.21	DRAWN BY:	AL

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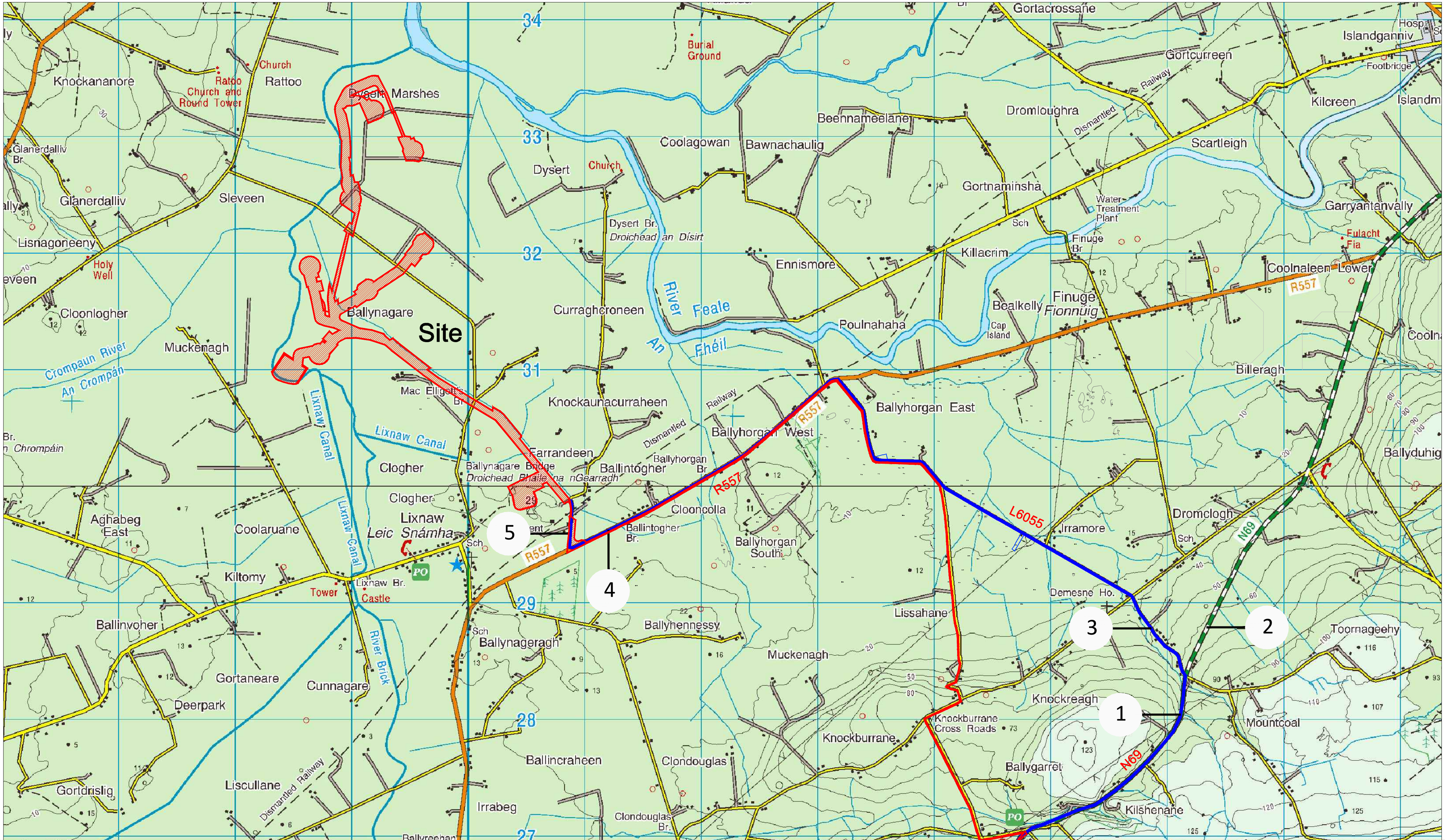

NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-2b Link count locations

PROJECT:	Ballynagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	NTS
PROJECT NO: 8890	DATE: 23.08.21	DRAWN BY:	AL

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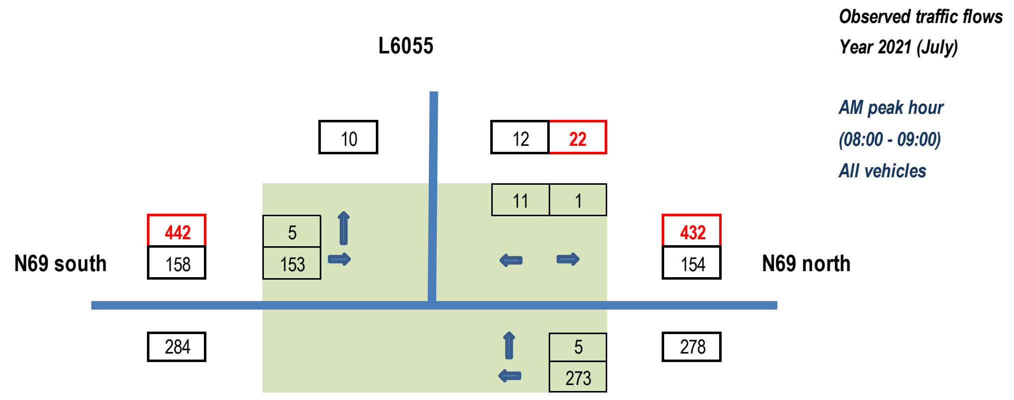

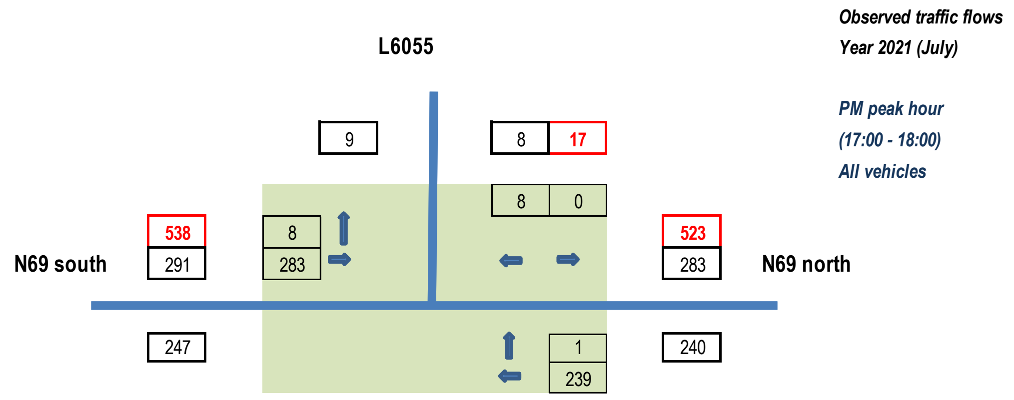

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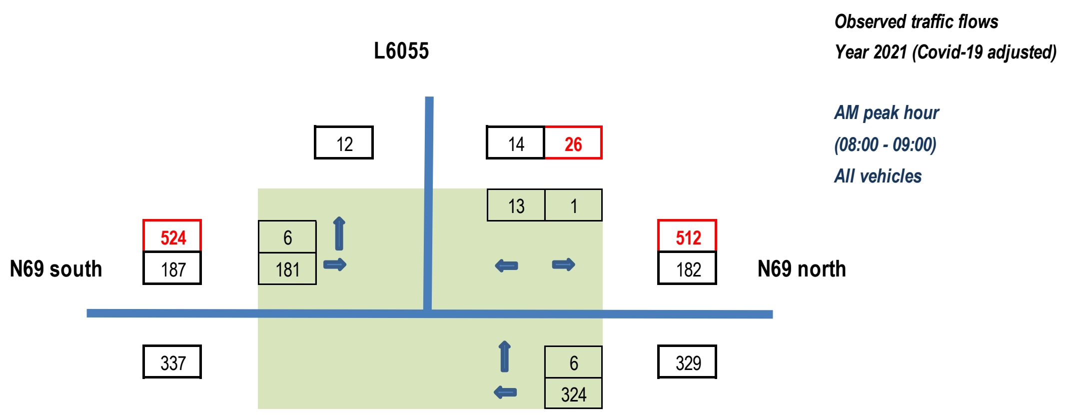
Figure 14-1-3a Observed traffic flows, AM & PM peak hours, N69 / L6055 junction, Year 2021 - All vehicles



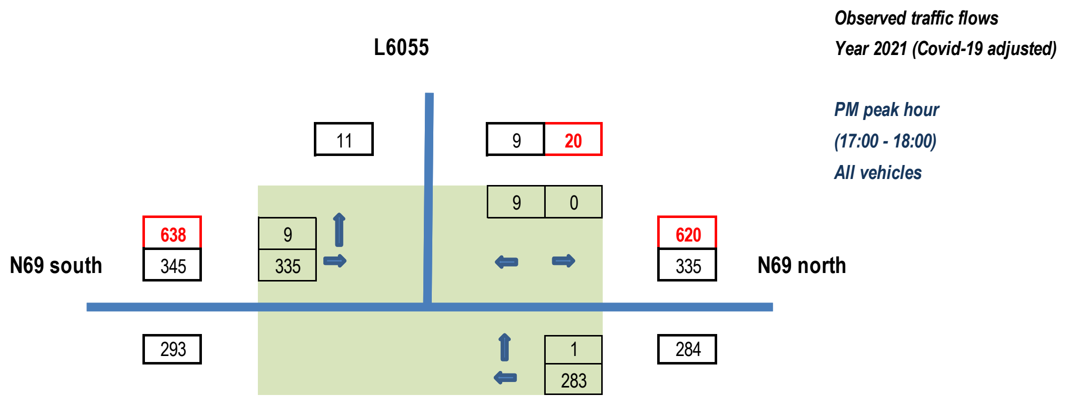
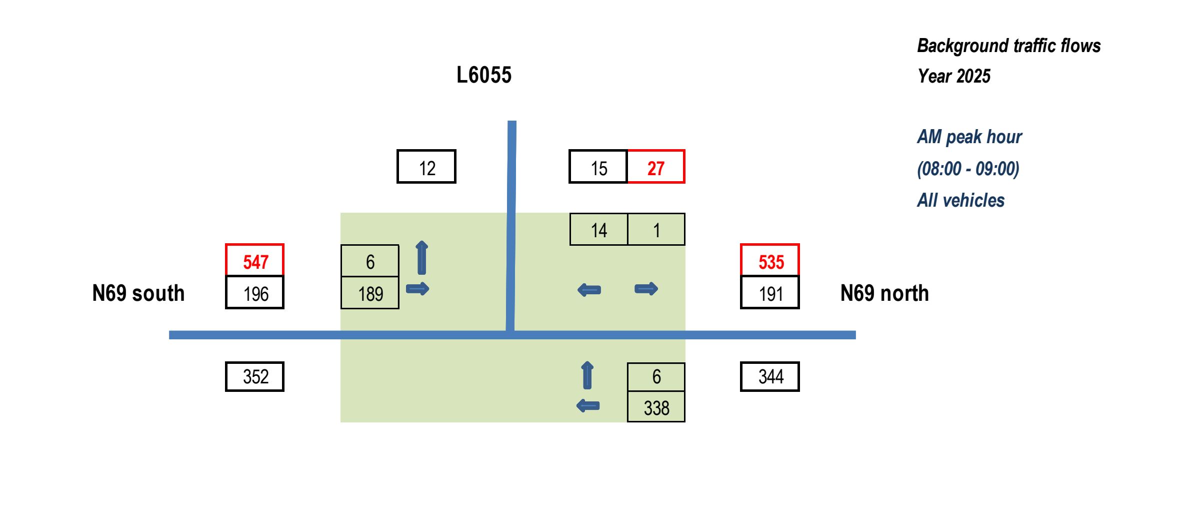


Figure 14-1-3b Observed traffic flows, AM & PM peak hours,
N69 / L6055 junction, Year 2021 - All vehicles, Covid-19 adjusted



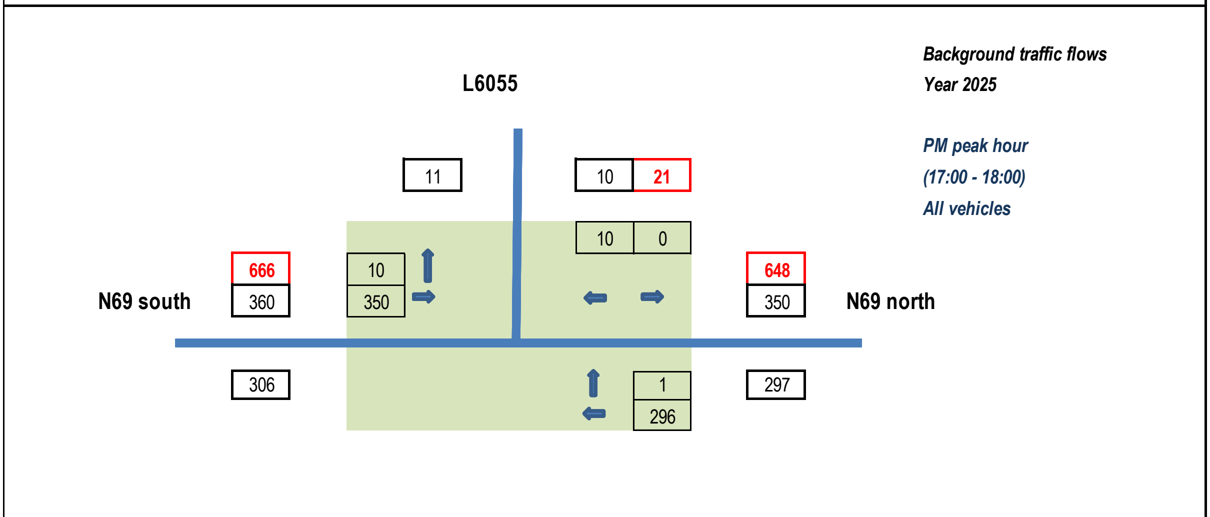


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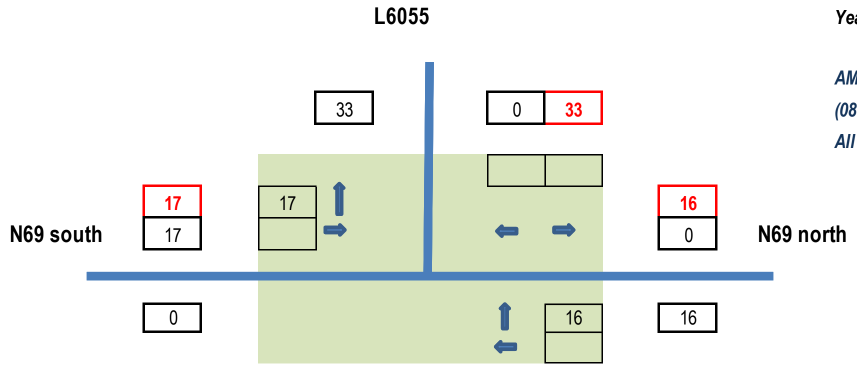
Figure 14-1-3c Forecast traffic flows, AM & PM peak hours,
N69 / L6055 junction, Year 2025 - All vehicles

Construction traffic
Year 2025

AM peak hour
(08:00 - 09:00)
All vehicles



Construction traffic
Year 2025

PM peak hour
(17:00 - 18:00)
All vehicles

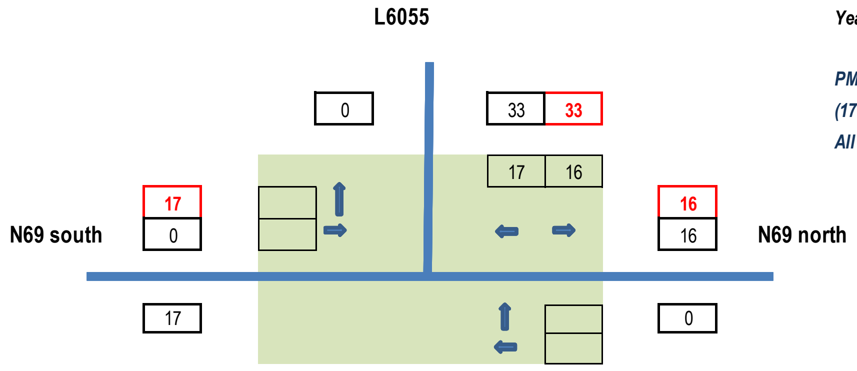


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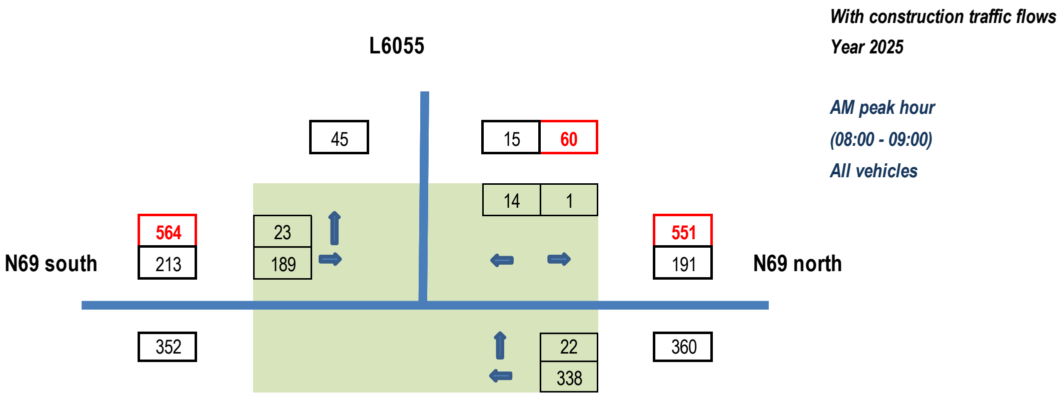
Figure 14-1-3d Construction staff generated traffic flows, AM & PM peak hours, N69 / L6055 junction, Year 2025 - All vehicles



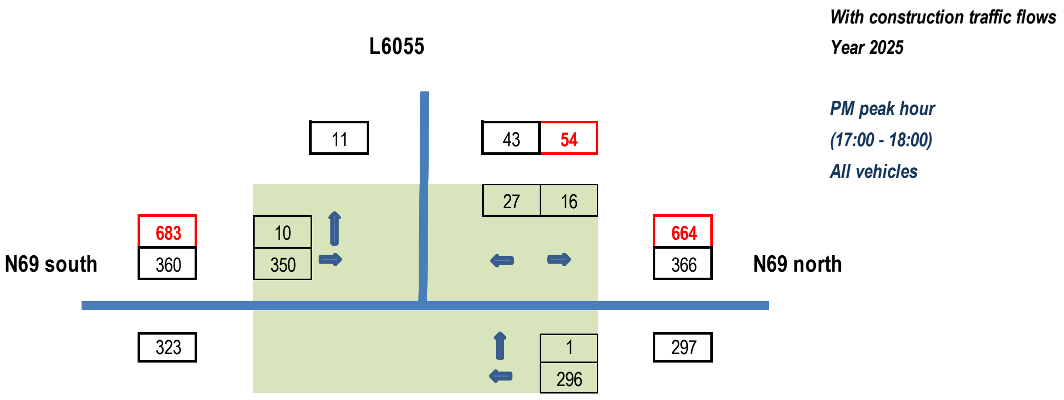


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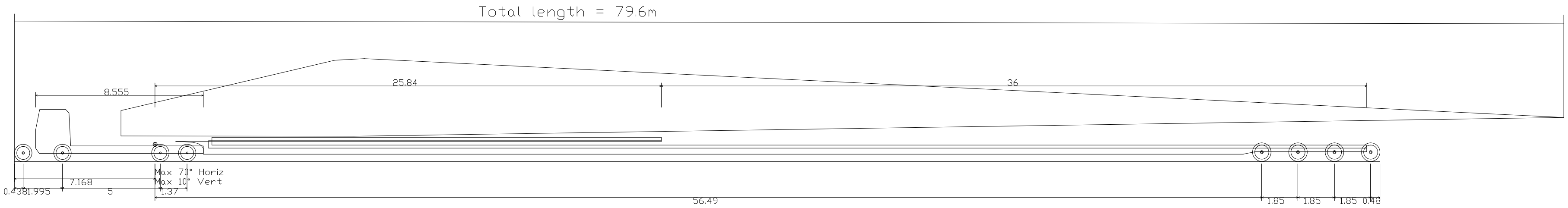
Figure 14-1-3e With construction traffic flows, AM & PM peak hours, N69 / L6055 junction, Year 2025 - All vehicles



73.65 m blade

Overall Length	69.687m
Overall Width	2.550m
Overall Body Height	2.661m
Min Body Ground Clearance	0.375m
Track Width	2.500m
Lock to Lock Time	6.00s
Wall to Wall Turning Radius	9.800m

NOTES:

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FIGURE 14-1-4 Design blade extended artic profile

PROJECT:	Ballynagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	NTS
PROJECT NO: 8890	DATE: 20.08.21	DRAWN BY:	AL

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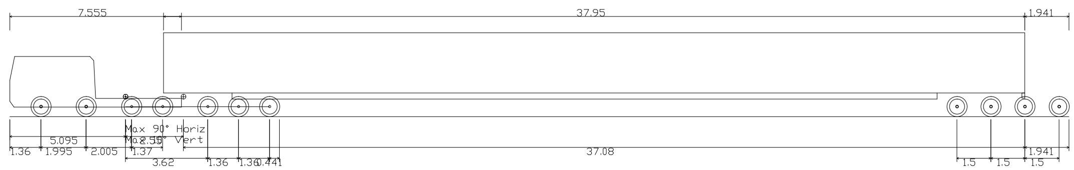

Tower	
Overall Length	46.666m
Overall Width	2.550m
Overall Body Height	3.695m
Min Body Ground Clearance	0.427m
Max Track Width	2.520m
Lock to Lock Time	6.00s
Wall to Wall Turning Radius	9.800m

NOTES:

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FIGURE 14-1-5 Design tower extended artic profile

PROJECT:	Ballynagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	NTS
PROJECT NO: 8890	DATE: 20.08.21	DRAWN BY:	AL

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14.1.3 Existing Traffic Volumes

It should be noted that traffic volumes are discussed in terms of vehicles and passenger car units, or PCUs, where each vehicle is expressed in terms of its demand on the network relative to the equivalent number of cars. For example, an articulated HGV was given a factor of 2.4 passenger car units (as per TII Project Appraisal Guidelines for National Roads Unit 5.2), while one of the extended loaders required to transport the wind turbine equipment was assigned a value of 10.

14.1.3.1 Background Traffic Flows

The link count locations included in the assessment are shown in Figure 14.1.2b.

Before discussing the traffic counts that were undertaken for the assessment of the proposed development, the impact on traffic volumes on the surrounding road network as a result of Covid -19 travel restrictions must be considered. The most appropriate source of continuous traffic data close to the site is the Automatic Traffic Count site maintained by TII on the N69 between Listowel and Tralee at Knockbrack, in County Kerry. Relevant traffic count data from the site is included in Appendix 14-1, with relevant findings as follows;

- The Average Annual Daily Traffic (AADT) volume on the N69 for the year 2019, prior to Covid-19, was observed to be 6,855, while the AADT for the year 2021, the survey year was 5,783 vehicles.
- The traffic counts observed in July 2021 were therefore factored by a Covid-19 correction factor of 1.185 (ie 6,855 / 5,783).

Observed 2-way all day traffic volumes observed in July 2021, together with covid-19 adjusted traffic flows are shown on the links on the delivery route in Table 14-1. Year 2021 traffic flows on the delivery route range from 7,277 on the N69 south of Mountcoal to 483 vehicles on the L6055, and 2,853 vehicles on the R557. A modest 483 daily traffic movements were observed on the local road leading to the site.

Table 14.1 Average all day flows by location, year 2021 (2-way vehicles)

Link	Year 2021 (observed)	Year 2021 (covid-19 adjusted)
1 N69 south of Mountcoal	6,141	7,277
2 N69 north of Mountcoal	5,893	6,983
3 L-6055 west of Mountcoal	408	483
4 R557	2,408	2,853
5 Local road	475	563

14.1.3.2 Future Background Traffic Volumes

Revised guidelines for forecasting annual growth in traffic volumes were produced by TII in May 2019, as set out by county in the Project Appraisal Guidelines (Unit 5.3). The annual growth rates for light vehicles for County Kerry, and factors for the years relevant to this study, are shown in Table 14.2 and

Table 14.3, with traffic volumes forecast to increase during the period from 2021 (the observed traffic count year) to 2025 (the assumed construction year) by 4.5%, assuming a medium growth scenario. Year 2021 and 2025 all day traffic flows on the study area network are compared in Table 14.4

It should be noted that while the assumed construction year of 2025 may vary slightly, this will not alter the forecast outcomes and effects presented in this section of the EIAR. This is due to the annual growth rate for background traffic being relatively low (1.11%) and the traffic volumes generated by the Proposed Development will remain unchanged regardless of construction year, as presented subsequently in Section 14.1.4.

Table 14.2 TII Traffic Growth Indices for County Kerry

Year	Lights – Annual Factor			Lights – Cumulative Index		
	Low	Medium	High	Low	Medium	High
2021	1.0094	1.0111	1.0144	1.0000	1.0000	1.0000
2022	1.0094	1.0111	1.0144	1.0094	1.0111	1.0144
2023	1.0094	1.0111	1.0144	1.0189	1.0223	1.0290
2024	1.0094	1.0111	1.0144	1.0285	1.0337	1.0438
2025	1.0094	1.0111	1.0144	1.0381	1.0451	1.0589

Source: TII Project Appraisal Guidelines – Unit 5.3, May 2019

Table 14.3 TII traffic growth rates by growth scenario

Period	New Factors		
	Low	Medium	High
2021 – 2025	1.038	1.045	1.059

Table 14.4 Average all day flows by location and year (2-way vehicles)

Link	Year 2021 (covid-19 adjusted)	Year 2025
1 N69 south of Mountcoal	7,277	7,605
2 N69 north of Mountcoal	6,983	7,297
3 L-6055 west of Mountcoal	483	505
4 R557	2,853	2,982
5 Local road	563	588

The traffic counts undertaken at the 2 junctions were also used to determine the existing percentage of HGVs, on the study area network. Traffic volumes forecast on the study network for the proposed construction year 2025 are shown by vehicle type in Table 14.5.

Table 14.5 All day flows, percentage HGVs and flows by vehicle type, year 2025

Link	All day flow (vehs)	% HGV's	Vehicles		PCUs		
			HGVs	Cars / lgvs	HGVs	Cars / lgvs	Total
1 N69 south of Mountcoal	7,605	6.6%	502	7,103	1,205	7,103	8,307
2 N69 north of Mountcoal	7,297	6.9%	504	6,794	1,208	6,794	8,002
3 L-6055 west of Mountcoal	505	5.9%	30	475	72	475	547
4 R557	2,982	9.8%	292	2,690	701	2,690	3,391
5 Local road	588	7.6%	45	544	107	544	651

14.1.4 Proposed Development and Traffic Generation

14.1.4.1 Development Trip Generation – During Construction

The assessment of the effects of traffic generated during the construction of the proposed development is considered in two stages.

- Stage 1 – Site preparation and groundworks, and,
- Stage 2 – Turbine component delivery.

For the purpose of the traffic impact assessment, assumptions based on typical wind farm construction projects regarding the length of the construction phases and work periods etc. must be made to inform the assessment. These assumptions allow for a worst-case scenario assessment but should not be inferred as prescriptive limitations to the construction phase. There are numerous variables which can affect a construction project programme such as weather for example. The construction phase of the proposed development will be carried out in accordance with the CEMP, which is submitted as Appendix 4-2 of this EIAR. The CEMP will be agreed with the Local Authority prior to construction commencing.

14.1.4.1.1 *Stage 1 – Site Preparation and Ground Works*

The construction phase of the proposed development is expected to last approximately 12 months (1 year). While this could increase to 18 months, 12 months was assumed for the purpose of this assessment in order to test the worst-case scenario with respect to the potential for increased traffic volumes on the surrounding road network. For assessment purposes a standard 255 working days for 12 months was adopted for the site preparation and ground works stage with the total numbers of deliveries made to the site during that period shown in Table 14.6.

During this construction phase, there will be two distinct types of days with respect to trip generation. A total of 7 days will be used to pour the 7 concrete wind turbine foundations. Foundations will likely be poured one per day, with an estimated 75 concrete loads required for each turbine foundation delivered to the site over a 12-hour period. This will result in just over 6 HGV trips to and from the site per hour. On the remaining 248 working days for this stage, other general materials will be delivered to the site.

During all of Stage 1, based on trip rates typical of wind farm projects, it is estimated that 2,851 two-way trips will be made to the site by trucks and large articulated HGVs, as set out in Table 14.6, with the daily effect on the local road network shown in Tables 14.7 and 14.8. The figures show that on the 7 days that concrete will be delivered to the site an additional 360 two-way PCUs will be added to the network (comprising 75 two-way HGV trips or 150 movements, with 2.4 PCUs per movement), as shown in Table 14.7. Similarly, on the 248 days when other materials will be delivered to the site, traffic volumes on the local network are forecast to increase by an average of 45.2 PCUs, as set out in Table 14.8.

Table 14.6 Stage 1 – Site preparation and groundworks – total movements

Material	Total no. Truck Loads	Truck type
Concrete	525	Trucks
Concrete blinding and steel	77	Large artic
Plant / fencing / compound set-up	17	Large artic
Forestry felling	18	Large artic
Rock and stone	35	Large artic
Ducting / cabling	206	Large artic
Grid cable laying (spoil & backfill)	1,804	Large artic
Cranes	11	Large artic
Substation components	79	Large artic
Refuelling / maintenance / misc	80	Large artic
Total	2,851	

Table 14.7 Stage 1 – Concrete foundation pouring – total movements and volumes per delivery day

Material	Total Truck Loads	Truck type	PCU Value	Total PCUs	PCU Movements /day*	2- way PCUs/day
Concrete	525	Truck	2.4	1,260	180.0	360.0
* Estimation based on 7 concrete pouring days						

Table 14.8 Stage 1 – Site preparation and groundworks – total movements and volumes per delivery day

Material	Total Truck Loads	Truck type	PCU Value	Total PCUs	PCU Movements /day*	2- way PCUs/day
Concrete blinding and steel	77	Truck	2.4	184	0.7	1.5
Plant / fencing / compound set-up	17	Large artic	2.4	40	0.2	0.3
Forestry felling	25	Large artic	2.4	60	0.2	0.5
Rock and stone	35	Large artic	2.4	84	0.3	0.7
Ducting / cabling (spoil & backfill)	206	Large artic	2.4	494	2.0	4.0
Grid cable laying	1,804	Large artic	2.4	4,330	17.5	34.9
Cranes	11	Large artic	2.4	26	0.1	0.2
Substation components	79	Large artic	2.4	190	0.8	1.5
Refuelling / maintenance / misc	80	Large artic	2.4	192	0.8	1.5
Total	2,333			5,600	22.6	45.2
* Estimation based on ground work period of 248 working days						

14.1.4.1.2 Stage 2 – Turbine Construction

During the turbine construction stage, including delivery and assembly, some deliveries to the site will be made by abnormally large vehicles, referred to in this section as extended artics, transporting the component parts of the turbines (nacelles, blades and towers). There will also be deliveries made by normal large HGVs, transporting cables, tools and smaller component parts. The types of load and associated numbers of trips made to the site during the turbine construction period are shown in Table 14.9, which summarises that a total of 63 trips will be made to and from the site by extended artics, with a further 21 trips made by conventional large articulated HGVs.

Table 14.9 Stage 2 – Wind turbine plant – total movements

Material	Units	Quantity per Unit	Total Quantity	Quantity per Truck	Total Truck Loads	Truck type
Nacelle	7	1	7	1	7	Extended Artic
Blades	7	3	21	1	21	Extended Artic
Towers	7	5	35	1	35	Extended Artic
Sub total					***63***	
Transformer	7	1	7	1	7	Large Artic
Drive train and blade hub	7	1	7	1	7	Large Artic
Base and other deliveries	7	1	7	1	7	Large Artic
Sub total					***21***	
Total					**84**	

For the purposes of this assessment an assumed delivery period is provided although this may be subject to change. It is assumed that the turbine delivery element will progress at the rate of 3 extended artic trips made by convoy to the site on 2 days per week, resulting in this stage taking approximately 21 days/nights spread over an assumed 11 week period. On a further two days per week, lasting for approximately 4 weeks, the remaining equipment required during this phase will be delivered to the site. The additional traffic movements for these 2 types of days are summarised in Table 14.10 and Table 14.11. In Table 14.10, a pcu equivalent value of 10 was allocated to each extended artic movement, resulting in an additional 60 PCUs on the study network on these 2 days per week, while an additional 14 PCUs are forecast to be on the network on two other days per week, as shown in Table 14.11.

Table 14.10 Stage 2 – Wind turbine plant, extended artics – total movements and volumes per delivery day

Material	Units	Truck Type	PCU Value	Total PCUs	2-way PCUs/ day
Nacelle	1	Extended Artic	10	10.0	20.0
Blades	3	Extended Artic	10	30.0	60.0
Towers	5	Extended Artic	10	50.0	100.0
Total per turbine	9			90.0	180.0
Total per delivery day	3			30.0	60.0
*Estimation based on 3 abnormal sized loads being delivered per day/night on 2 days per week (total 63 loads will take 21 nights spread over 11 weeks)					

Table 14.11 Stage 2 - Wind turbine plant, normal artic HGVs - total movements and volumes per delivery day

Material	Quantity per Unit	PCU Value	2-way PCUs / day
Transformer	1	2.4	4.8
Drive train and blade hub	1	2.4	4.8
Base & other deliveries	1	2.4	4.8
Total	3		14.4
*Estimation based on equipment for 2 turbines being moved per week spread over 2 days			

14.1.4.1.3 Construction Employee Traffic

It is estimated that a maximum of 65 staff members will be employed on the site at any one time during the site preparation and groundworks stage of construction, reducing to a maximum of 40 staff at any one time during the turbine construction stage. If a worst case is assumed that all staff will travel to / from the site by car, at an average of 2 persons per car, then a total of 65 pcu movements (each trip is two way) will be added to the network during the groundworks stage of the development, reducing to 40 pcu trips during the turbine construction stage.

14.1.4.2 Development Trip Generation – During Operation

It is assumed that the wind farm will be unmanned once operational and will be remotely monitored. Traffic associated with the operational phase of the wind farm will be from the wind farm developers, ESB personnel visiting the substation, and maintenance personnel who will visit individual turbines.

It is estimated that the traffic volumes that will be generated by the development once it is operational will be minimal. The site will generate maintenance trips, with approximately two maintenance staff travelling to site at any one time. The impact on the network of these trips during the operational stage is discussed in Section 14.1.6.

14.1.5 Construction Traffic Design Vehicles

14.1.5.1 Construction Traffic Vehicle Types

The delivery of turbine components, including blades, tower sections and nacelles, is a specialist operation due to the oversized loads involved. The blades are the longest turbine component and in the case of the Proposed Development blades 73.65m long have been considered for the purpose of this assessment. Any other blade considered for the proposed development will be shorter and therefore the autotracks present the worst case scenario.

For the purpose of the assessment set out in this EIAR, it is assumed that the blades, which are the largest turbine components, will be transported using a standard extended arctic. As this method involves transporting the blade in a horizontal position it represents the worst case in terms of the geometric requirements on the road network. It is noted, however, that during the delivery phase consideration will be given to using alternative transportation technologies, including the use of scissor lift adaptors which raise the rear of the blade over existing obstructions, and in extreme cases, the use of blade lift adaptors that can transport blades at an angle to both lift the rear of the blade and shorten the wheelbase of the transporter.

The key dimensions are as follows:

Transport of Blades – Super Wing Carrier with blade

Total length	79.50 m
Length of blade	73.65 m
Inner radius	28.00 m

Transport of Tower – Using low-bed or drop deck trailers

Total length (with load)	46.60 m
Length of load	38.00 m
Inner radius	25.00 m

The critical vehicles in terms of size and turning geometry requirements, and used in the detailed route assessment discussed in Section 14.1.8 are the blade and tower transporters. The geometry of the design vehicles are included as Figures 14.1.4 and 14.1.5.

The vehicles used to transport the nacelles will be shorter in length compared to the blade and tower transporters.

All other vehicles requiring access to the site will be standard HGVs and will be significantly smaller than the design test vehicles.

14.1.6 Traffic Effects During Construction and During Operation

14.1.6.1 Traffic Effect During Construction and During Operation

As detailed below, transportation of large turbine components will be carried out at night when traffic is at its lightest and in consultation with the relevant Roads Authority and An Garda Síochána with deliveries accompanied by Garda escort.

Effect on Link Flows – During Construction

Background traffic volumes, as established previously and set out in Table 14.4, and development generated traffic volumes for the typical construction day scenarios discussed in Section 14.1.4 are set out in Table 14.12 to 14.15, with the traffic effects summarised in Table 14.16 to 14.19. The actual figures presented in the tables will be subject to change, however they are considered to represent a robust estimation of the likely effects.

In terms of daily traffic flows the potential effects may be summarised as follows:

During Stage 1 – Concrete Pouring

For these 7 days an additional 425 PCUs will travel on the study network. On these days, the percentage increase in traffic volumes experienced on the study network will be between 5.1% on the N69 and 12.5% on the R557, to 65.3% on the local road leading to the site and 77.7% on the L6055.

During Stage 1 - Site Preparation and Groundworks

On average an additional 110 PCUs will travel on the local highway network resulting in a percentage increase in traffic volumes on the study network of between 1.3% on the N69 and 3.2% on the R557, to 16.9% on the local road leading to the site and 20.1% on the L6055.

During Stage 2 - Turbine Construction Stage – Delivery of large equipment using extended articulated vehicles

The additional 100 PCUs (made up of cars and large extended artics) will travel on the study network for 21 days / nights. On the days/nights this impact occurs, volumes will increase by between 1.2% on the N69 and 2.9% on the R557, to 15.4% on the local road leading to the site and 18.3% on the L6055.

The most significant traffic impact may be experienced during these days primarily due to the slow speeds, size and geometric requirements of these vehicles. The provision of traffic management measures, including ensuring that these deliveries are made at night (as set out in 14.1.11.6 and included in the CEMP), will be required to minimise the impact of development traffic on the study network on these days.

During Stage 2 - Turbine Construction Stage – Other deliveries using conventional articulated HGVs

For 7 days on the delivery route 55 additional PCUs (made up of cars and standard articulated HGV movements to the site and back) will travel on the study network. On these days, the percentage increase on the study network will be between 0.7% on the N69 and 1.6% on the R557, to 8.5% on the local road leading to the site and 10.1% on the L6055.

Table 14.12 Effects of development traffic during concrete pouring – all day, year 2025

Link	Background PCUs			Development PCUs			Total PCUs (Background + Development)		
	Car	HGV	Total	Car	HGV	Total	Car	HGV	Total
1 N69 south of Mountcoal	7,103	1,205	8,307	65	360	425	7,168	1,565	8,732
2 N69 north of Mountcoal	6,794	1,208	8,002	65	360	425	6,859	1,568	8,427
3 L-6055 west of Mountcoal	475	72	547	65	360	425	540	432	972
4 R557	2,690	701	3,391	65	360	425	2,755	1,061	3,816
5 Local road	544	107	651	65	360	425	609	467	1,076

Table 14.13 Development traffic during site preparation and groundworks – all day. Year 2025

Link	Background PCUs			Development PCUs			Total PCUs (Background + Development)		
	Car	HGV	Total	Car	HGV	Total	Car	HGV	Total
1 N69 south of Mountcoal	7,103	1,205	8,307	65	45	110	7,168	1,250	8,417
2 N69 north of Mountcoal	6,794	1,208	8,002	65	45	110	6,859	1,253	8,112
3 L-6055 west of Mountcoal	475	72	547	65	45	110	540	117	657
4 R557	2,690	701	3,391	65	45	110	2,755	746	3,501
5 Local road	544	107	651	65	45	110	609	152	761

Table 14.14 Development traffic during turbine construction - extended artics (large turbine components) – all day, Year 2025

Link	Background PCUs			Development PCUs			Total PCUs (Background + Development)		
	Car	HGV	Total	Car	HGV	Total	Car	HGV	Total
1 N69 south of Mountcoal	7,103	1,205	8,307	40	60	100	7,143	1,265	8,407
2 N69 north of Mountcoal	6,794	1,208	8,002	NA	NA	NA	NA	NA	NA
3 L-6055 west of Mountcoal	475	72	547	40	60	100	515	132	647

Link	Background PCUs			Development PCUs			Total PCUs (Background + Development)		
4 R557	2,690	701	3,391	40	60	100	2,730	761	3,491
5 Local road	544	107	651	40	60	100	584	167	751

Table 14.15 Effect of development traffic during turbine construction – other deliveries (small turbine components) - all day, Year 2025

Link	Background PCUs			Development PCUs			Total PCUs (Background + Development)		
	Car	HGV	Total	Car	HGV	Total	Car	HGV	Total
1 N69 south of Mountcoal	7,103	1,205	8,307	40	15	55	7,143	1,220	8,362
2 N69 north of Mountcoal	6,794	1,208	8,002	40	15	55	6,834	1,223	8,057
3 L-6055 west of Mountcoal	475	72	547	40	15	55	515	87	602
4 R557	2,690	701	3,391	40	15	55	2,730	716	3,446
5 Local road	544	107	651	40	15	55	584	122	706

Table 14.16 Summary effect of development traffic during concrete pouring - all day, Year 2025

Link	Background	Development	Total	% increase	Estimated No. of days
1 N69 south of Mountcoal	8,307	425	8,732	5.1%	7
2 N69 north of Mountcoal	8,002	425	8,427	5.3%	7
3 L-6055 west of Mountcoal	547	425	972	77.7%	7
4 R557	3,391	425	3,816	12.5%	7
5 Local road	651	425	1,076	65.3%	7

Table 14.17 Summary effect of development traffic during site preparation and ground works - all day, Year 2025

Link	Background	Development	Total	% increase	Estimated No. of days
1 N69 south of Mountcoal	8,307	110	8,417	1.3%	248
2 N69 north of Mountcoal	8,002	110	8,112	1.4%	248
3 L-6055 west of Mountcoal	547	110	657	20.1%	248
4 R557	3,391	110	3,501	3.2%	248
5 Local road	651	110	761	16.9%	248

Table 14.18 Summary effect of development traffic during turbine construction – extended artics (large turbine components) - all day, Year 2025

Link	Background	Development	Total	% increase	Estimated No. of days
1 N69 south of Mountcoal	8,307	100	8,407	1.2%	21
2 N69 north of Mountcoal	8,002	NA	NA	NA	NA
3 L-6055 west of Mountcoal	547	100	647	18.3%	21
4 R557	3,391	100	3,491	2.9%	21
5 Local road	651	100	751	15.4%	21

Table 14.19 Summary effect of development traffic during turbine construction – other deliveries (small turbine components) - all day, Year 2025

Link	Background	Development	Total	% increase	Estimated No. of days
1 N69 south of Mountcoal	8,307	55	8,362	0.7%	7
2 N69 north of Mountcoal	8,002	55	8,057	0.7%	7
3 L-6055 west of Mountcoal	547	55	602	10.1%	7
4 R557	3,391	55	3,446	1.6%	7
5 Local road	651	55	706	8.5%	7

An assessment of the impact on link capacities in the study area was undertaken for the various construction stages as set out in Table 14.20, Table 14.21, and Table 14.22. The capacity for each link in the study area is shown in 14.17. The capacities range from a daily flow of 8,600 vehicles on the N69 to 2,200 on the local road leading to the site and are based on road widths and capacities set out in the TII Standards document DN-GEO-03031 Road Link Design, Table 6/1.

Background, or do nothing traffic flows, are compared to flows forecast for the various construction delivery stages in Table 14.21 with the percentage capacity reached for each link and stage shown in Table 14.22. Based on this assessment the following points are noted;

- The N69 is forecast to operate with a link capacity at 97% for the do-nothing scenario, increasing to a maximum of 102% during the 7 days that the concrete foundations will be poured.
- The local road leading to the site is forecast to operate well within capacity for all scenarios, increasing from 30% for the do-nothing scenario to a maximum of 49% on the 7 days that the foundations will be poured.

Table 14.20 Table 14.20 Carriageway widths, link type and link capacity

Link	Width (m)	Link type	Link capacity
1 N69 south of Mountcoal	7.0	Type 2 single	8,600
2 N69 north of Mountcoal	7.0	Type 2 single	8,600
3 L-6055 west of Mountcoal	6.0	Type 3 single	5,000
4 R557	6.0	Type 3 single	5,000
5 Local road	5.0	Local	2,200

Table 14.21 Link capacity and summary of link flows by construction delivery stage

Link	Link capacity	Construction delivery stage				
		Background traffic	Concrete pour	Other site works	Turbine plant	Turbine equipment
1 N69 south of Mountcoal	8,600	8,307	8,732	8,417	8,407	8,362
2 N69 north of Mountcoal	8,600	8,002	8,427	8,112	8,102	8,057
3 L-6055 west of Mountcoal	5,000	547	972	657	647	602
4 R557	5,000	3,391	3,816	3,501	3,491	3,446
5 Local road	2,200	651	1,076	761	751	706

Table 14.22 Link capacity and % of link capacity by construction delivery stage

Link	Link capacity	Construction delivery stage				
		Background traffic	Concrete pour	Other site works	Turbine plant	Turbine equipment
1 N69 south of Mountcoal	8,600	97%	102%	98%	98%	97%
2 N69 north of Mountcoal	8,600	93%	98%	94%	94%	94%
3 L-6055 west of Mountcoal	5,000	11%	19%	13%	13%	12%
4 R557	5,000	68%	76%	70%	70%	69%
5 Local road	2,200	30%	49%	34%	34%	32%

Substation Construction

It is estimated that an additional 400 HGV trips will be generated to and from the site during the construction of the substation, associated compound and grid connection works. It is assumed that the construction of the substation will take place at the same time as the site preparation and groundworks stage, as set out in Table 14.3 and Table 14.4, with traffic effects included in the assessment for that construction period.

Effect on Link Flows – During Operation

Once the wind farm is operational it is estimated that approximately two maintenance staff will access the site at any particular time, to carry out operational maintenance, with a similar number of vehicle trips. It is considered that the traffic impact during this phase will be imperceptible.

Effect on Junctions – During Construction

The capacity of the study area junction most affected, the N69 / L6055 junction, was assessed using the industry standard junction simulation software PICADY, which permits the capacity of any junction to be assessed with respect to existing or forecast traffic movements and volumes for a given period. The capacity for each movement possible at the junction being assessed is determined from geometric data input into the program with the output used in the assessment as follows:

- Queue – This is the average queue forecast for each movement and is useful to ensure that queues will not interfere with adjacent junctions.
- Degree of Saturation or Ratio of Flow to Capacity (% Sat or RFC) – As suggested, this offers a measure of the amount of available capacity being utilised for each movement. Ideally each movement should operate at a level of no greater than 85% of capacity.
- Delay – Output in minutes, this gives an indication of the forecast average delay during the time period modelled for each movement.

Scenarios Modelled

While other junctions and links on the network will experience an increase in traffic volumes passing through them, as discussed previously and as set out in Table 14.14 to 14.18 above, the worst-case effect will be experienced during peak hours when, during peak construction periods, up to 65 workers (33 cars) will pass through it. It is noted that deliveries of materials to the site will take place during the day after the workers have arrived on site, and before they leave at the end of the day, and will therefore not occur at the same time.

N69 / L6055 junction Capacity Test Results

The AM and PM peak hour traffic flows through the N69 / L6055 junction are shown for the year 2021 in Figure 14.3a, with background traffic flows for the assumed construction year of 2025 shown in Figure 14.3b. Traffic flows generated by the proposed development during the AM and PM peak hours are shown in Figure 14.3c while the year 2025 traffic flows with development generated traffic are shown in Figure 14.3d.

The results of the capacity assessment, as set out in Table 14.23, show that additional car trips passing through the junction will have a slight effect, increasing the maximum ratio of flow to capacity (RFC) at the junction for the traffic movements impacted from 1.6% to 6.2% in the AM peak hour, and from 3.2% to 9.1% during the PM peak hour, which is within the acceptable limit of 85%.

Table 14.23 Junction capacity test results, N59 / L6055 junction, AM and PM peak hours, without and with construction staff, year 2025

Period	Location	Without construction traffic			With construction traffic		
AM		RFC	Queue (vehicles)	Delay (minutes)	RFC	Queue (vehicles)	Delay (minutes)
	Right turn from L6055	4.0%	0.04	0.16	4.1%	0.04	0.17
	Left turn from L6055	0.3%	0.00	0.15	0.3%	0.00	0.15
	Right turn from N69	1.6%	0.02	0.08	6.2%	0.10	0.08
PM		RFC	Queue (vehicles)	Delay (minutes)	RFC	Queue (vehicles)	Delay (minutes)
	Right turn from L6055	3.2%	0.03	0.18	9.1%	0.10	0.20
	Left turn from L6055	0.0%	0.00	0.00	4.2%	0.04	0.15
	Right turn from N69	0.3%	0.00	0.09	0.3%	0.00	0.09

Effect on Junctions – During Operation

As discussed in Section 14.1.6 it is forecast that once operational, the development will generate approximately 2 trips per day for maintenance purposes. It is therefore concluded that the development will not have a significant effect on the local network once constructed.

Effect on Network of Grid Connection

It is proposed to connect the Ballynagare Wind Farm to the Clahane 110kv substation via an underground cable. The underground cable connection will originate at the proposed onsite substation and will run north and east along proposed site roads to the public road in the townland of Dysert. The grid connection cabling route will continue south along the local road through the townlands of Curraghcroneen and Ballintogher before turning east onto the R557 in the townland of Monument. The grid route travels east along the R557 for 2.7km where it heads south east along the tertiary road for 1.5km. It then travels south for 2km and turns west along the L1027 road for 0.35km where it then continues south for 1.1km. It then joins the L6074 road for 0.4km to Banemore Cross where it joins the N69. It then travels 0.45km south west along the N69 to the entrance of the existing Clahane 110kV substation which is approx. 550m from the N69 road. The total length of the proposed underground grid connection route is approximately 13.8 kilometres. The grid connection route will comprise underground cabling located primarily within the public road.

The connection will be installed by 2 teams, with each team laying approximately 150 metres of cable per day, equating to a total of 300 metres per day. With a total cable length of 13.8 kms it is therefore estimated that the cable construction for the grid route take approximately 46 days to construct.

For all roads concerned it is likely that a localised closure will be required as they are not wide enough to accommodate both the construction works and one live lane of traffic. Details of all water crossings are provided in Chapter 4. It is estimated that the construction of the cable route will require 902 loads of spoil material to be removed from the site and a further 902 loads of clean materials to back fill the trench to be transported to the site. The effects of these trips on the surrounding road network are included in the trip generation figures set out in Tables 14.4 and 14.6 and the capacity assessment discussed in Section 14.1.6.

The construction methodology of providing a cable route under and along local road networks is well established and accepted nationwide. There are in excess of 270 wind farms currently operational in Ireland and the majority of these are connected to the national grid via underground cable connections predominantly along the public road networks.

14.1.7 Traffic Management of Large Deliveries

The greatest effect on the road network will likely be experienced on the approximately 21 days / nights during which the 3 large loads comprising the tower sections, the blades and the nacelles are delivered to the site.

Traffic management measures are included in Section 14.1.10.6 and include the following:

- Identification of a delivery schedule,
- Details of the alterations required to the infrastructure identified in Section 14.1.8 of this report and any other minor alteration identified (hedge rows etc),
- A dry run of the route using vehicles with similar dimensions.

The transport of large components is challenging and can only be done following extensive route selection, route proofing and consultation with An Garda Síochána and the various local authorities. Turbine components are often transported at night when traffic is lightest and this is done in consultation with the roads authorities / An Garda Síochána and special permits are generally required.

In some cases, temporary accommodation works are required along the turbine delivery route (TDR) such as hedge or tree cutting, temporary relocation of powerlines/poles, lampposts, signage and minor road verge works. Any updates to the road will be carried out in advance of turbine deliveries and following consultation and agreement with the appropriate local authorities.

It is not anticipated that any sections of the local road network will be closed, although there may be delays to local traffic at various locations if the deliveries are made during daylight hours. During these periods, it may be appropriate to operate local diversions for through traffic. The effect of this stage may be minimised by the deliveries of the abnormally sized large loads taking place during the night. It is noted that it is proposed that all deliveries of abnormally sized loads will be made during night time hours, as is the norm for such deliveries.

14.1.8 Route Assessment – Local Context

The proposed transport route in the local context is indicated in Figure 14.1.2a, with the following commentary referring to the route in the direction that vehicles accessing the site will travel. All locations along the route referred to in this section are also highlighted in Figure 14.1.2a. Detailed assessment is confined to locations considered as potentially presenting issues for the abnormal loads, as identified from site visits. For these locations preliminary road and junction alignments, based on OS mapping or site surveys, were supplied by the project team. A preliminary swept path analysis was then undertaken using Autotrack in order to establish the locations where the wind farm transporter vehicles will be accommodated, and the locations where some form of remedial measure may be required.

The locations discussed are as follows;

- Location 1 - the N69 / L6055 junction at Mountcoal,
- Location 2 - the left hand bend on the L6055 at Mountcoal,
- Location 3 - the crossroads on the L6055 with the L1027,
- Locations 4, 5 and 6 – bends on the L6055,
- Location 7 - the R557 / L6055 junction,
- Location 8 – R557 Local road junction, and,
- Locations 9 to 12 – Access junctions A to D providing access to the site.

Location 1 – N69 / L6055 junction

The swept path requirements of the wind turbine vehicles turning left from the N69 onto the L6055 are shown in Figures 14.1.6 and 14.1.7 for the blade and tower sections respectively. As shown in the figures there is a layby on the eastern side of the N69, which it is proposed will be used to facilitate the left turn for the large wind turbine vehicles. The assessment indicates that local temporary improvements / alterations will be required to be made to the lay-by and the L6055 in the proximity of the N69 junction. A dry delivery run will be required at this location, and all others identified in this section, prior to the turbine delivery stage.

Location 2 – Bend on L6055

The swept path requirements for the design vehicles negotiating this bend on the L6055 are shown in Figures 14.1.8 and 14.1.9. The figures show that the existing geometry is constrained and oversail of the blade into the eastern northern property will be required. The assessment also indicates that some minor alterations will be required to the boundary in the east side of the road to accommodate the blade vehicle.

Location 3 – Crossroads on L6055

Similar to location 2, the swept path assessment for this location, shown in Figures 14.1.10 and 14.1.11, indicates that oversail and temporary alterations will be required in order to accommodate the blade delivery vehicle at this location.

Location 4 – Bend on L6055

The swept path assessment for this location, shown in Figures 14.1.12 and 14.1.13, indicates that oversail and temporary alterations to the boundary on the east side of the road will be required at this location in order to accommodate the blade delivery vehicle at this location.

Location 5 – Bend on L6055

As shown in Figures 14.1.14 and 14.1.15 significant works will be required at this location in order to accommodate the wind turbine extended artics, including land take on the northern corner of the bend and in the field to the west of the road in order to accommodate the blade delivery vehicle at this location.

Location 6 – Bend on L6055

As shown in Figures 14.1.16 and 14.1.17 oversail of the blade into the field on the eastern side of the L6055 together with local widening will be required at this location in order to accommodate the wind turbine extended artics.

Location 7 – R557 / L6055 junction

The swept path of the wind turbine extended artics negotiating this existing priority junction is shown in Figures 14.1.18 and 14.1.19. The figures indicate that a significant area of the field on the south western corner of the junction will be required for the duration of the turbine delivery stage of the project. Localised oversail will be required on the west side of the L6055 in order to minimise land take.

Location 8 – R557 / Local road junction

Similarly, the swept path of the wind turbine extended artics negotiating this existing priority junction leading to the site is shown in Figures 14.1.20 and 14.1.21. The figures indicate the extent of the field on the north eastern corner of the junction that will be required for the duration of the turbine delivery stage of the project.

Location 9 - Site access junction A

The temporary works required to accommodate the wind farm turbine vehicles, together with the junction layouts proposed on completion, are shown for the access junction off the existing local road in Figure 14.1.22. The figure shows the proposed junction layout in accordance with TII DN-GEO-03060, and the area of land on the western side of the local road that will be required as an over-run area during the turbine delivery phase. Visibility splays (3m x 70m) that should be kept clear at all times during which the access is operational, are shown in Figure 14.1.23. The swept path analysis demonstrating that the turbine extended artic will be accommodated at this location is shown in Figures 14.1.24 and 14.1.25.

Location 10 (site access B), Location 11 (site access C) and Location 12 (site access D)

Locations 10, 11 and 12 (site access junctions B, C and D) are proposed junctions where the proposed turbine and general construction traffic route crosses existing minor local roads. For all of these locations it is proposed that the existing minor roads will retain priority with stop markings and signs provided on the delivery route approaches to these junctions. The proposed junction layouts, visibility splays and swept path analyses are shown for these 3 locations in Figures 14.1.26 to 14.1.37.

NOTES: PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES	Figure 14-1-6 Location 1 - N69 / L6055 junction, Mountcoal - blade extended artic (73.65m)			
	PROJECT: Ballnagare Wind Farm			ALAN LIPSCOMBE TRAFFIC & TRANSPORT CONSULTANTS
	CLIENT: Ballynagare Wind Farm Ltd		SCALE: 1:1000	
	PROJECT NO: 8890	DATE: 20.08.21	DRAWN BY: AL	

NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-7 Location 1 - N69 / L6055 junction, Mountcoal - tower extended artic

PROJECT: Ballnagare Wind Farm			
CLIENT: Ballynagare Wind Farm Ltd		SCALE:	1:1000
PROJECT NO: 8890	DATE: 20.08.21	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-8 Location 2 - Bend on L6055, Mountcoal - blade extended artic (73.65m)

PROJECT:	Ballnagare Wind Farm		
CLIENT:	Ballnagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 28.04.20	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

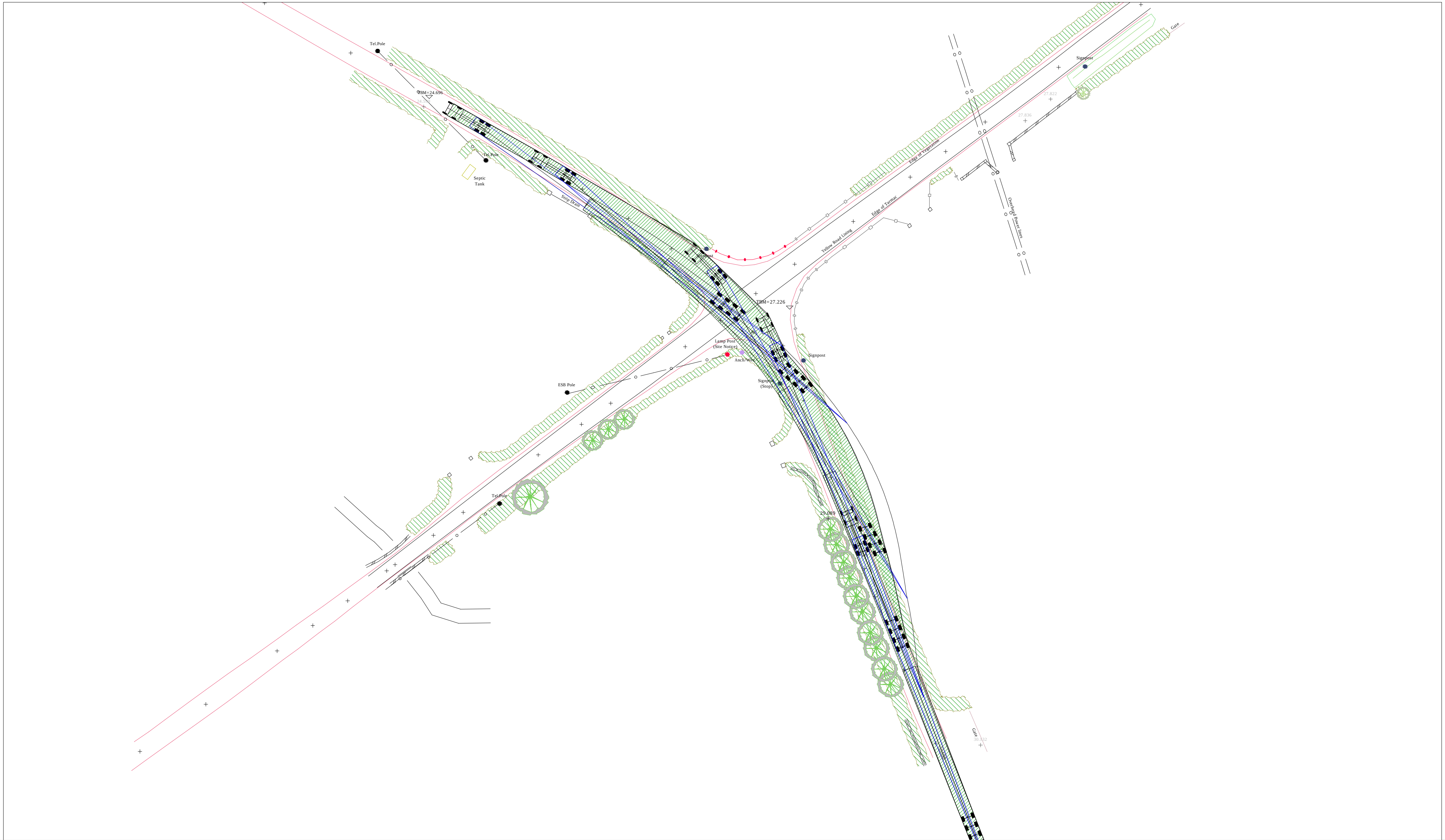
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-9 Location 2 - Bend on L6055, Mountcoal - tower extended artic

PROJECT:	Ballnagare Wind Farm		
CLIENT:	Ballnagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 28.04.20	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



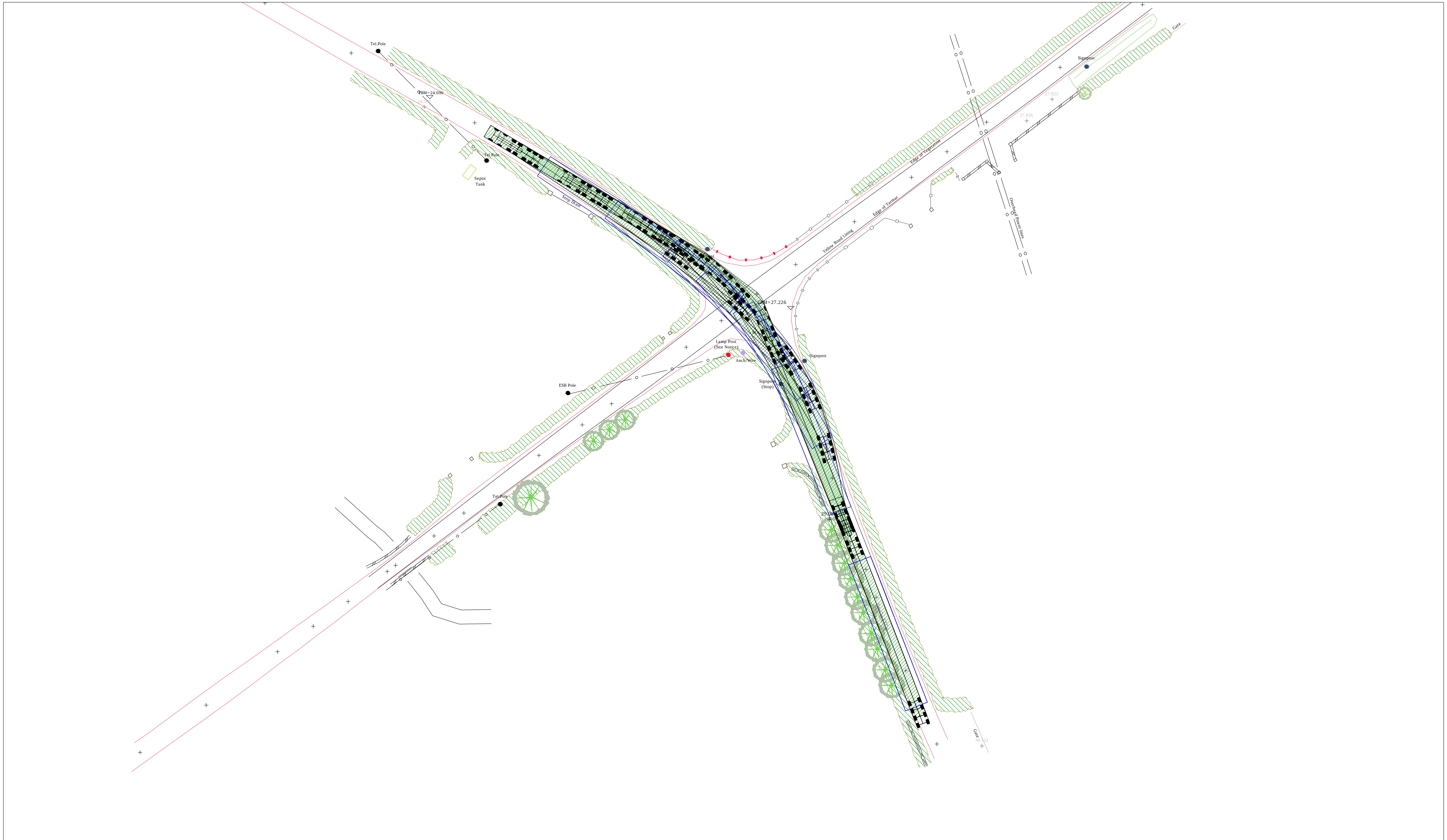
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-10 Location 3 - Crossroads on L6055 with L1027 - blade extended artic (73.65m)

PROJECT:	Ballnagare Wind Farm		
CLIENT:	Ballnagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 20.08.21	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-11 Location 3 - Crossroads on L6055 with L1027 - tower extended artic

PROJECT:	Ballnagare Wind Farm		
CLIENT:	Ballnagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 20.08.21	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

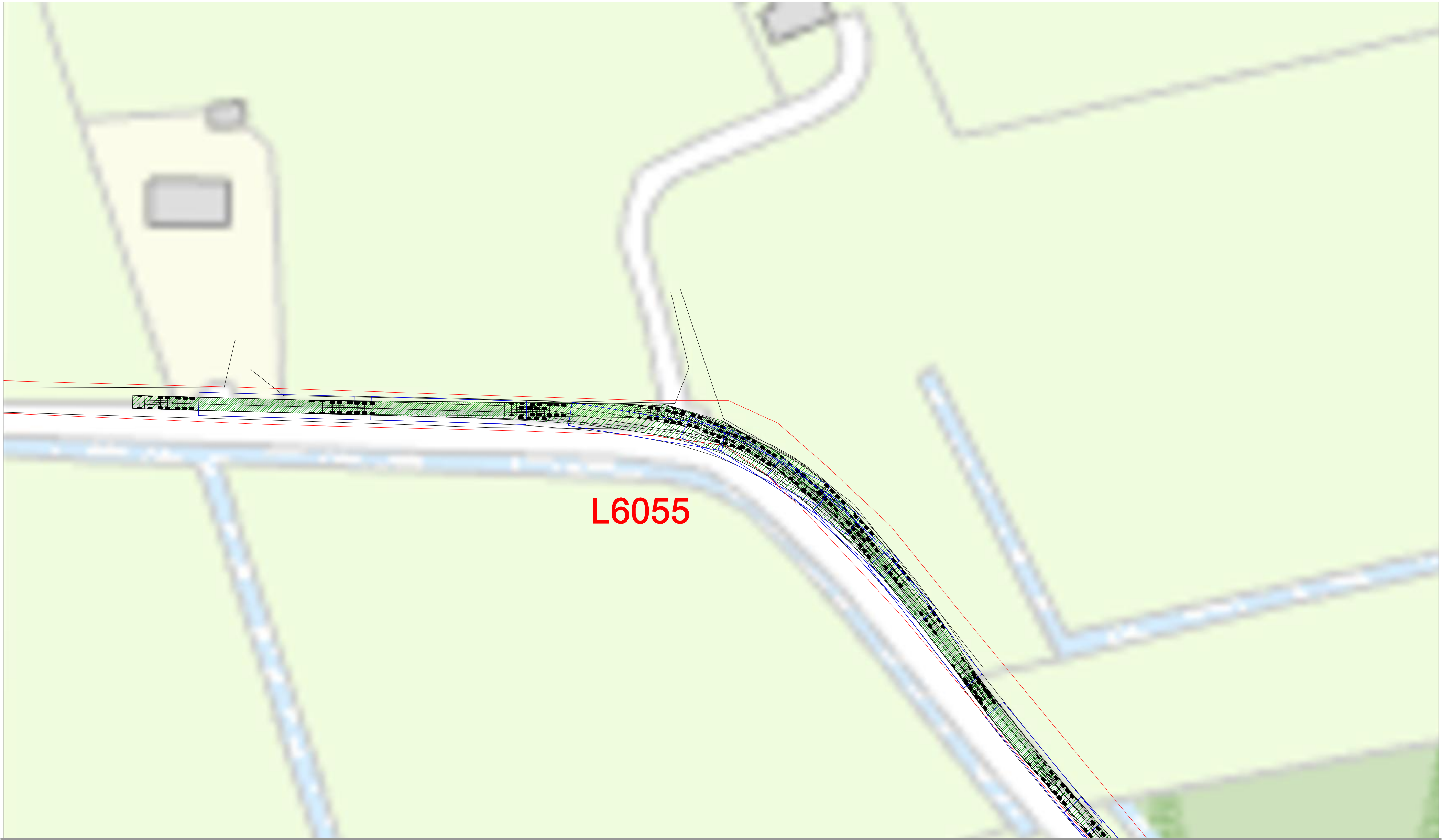
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-12 Location 4 - Bend on L6055, blade extended artic (73.65m blade)

PROJECT:	Ballynagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 19.08.21	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



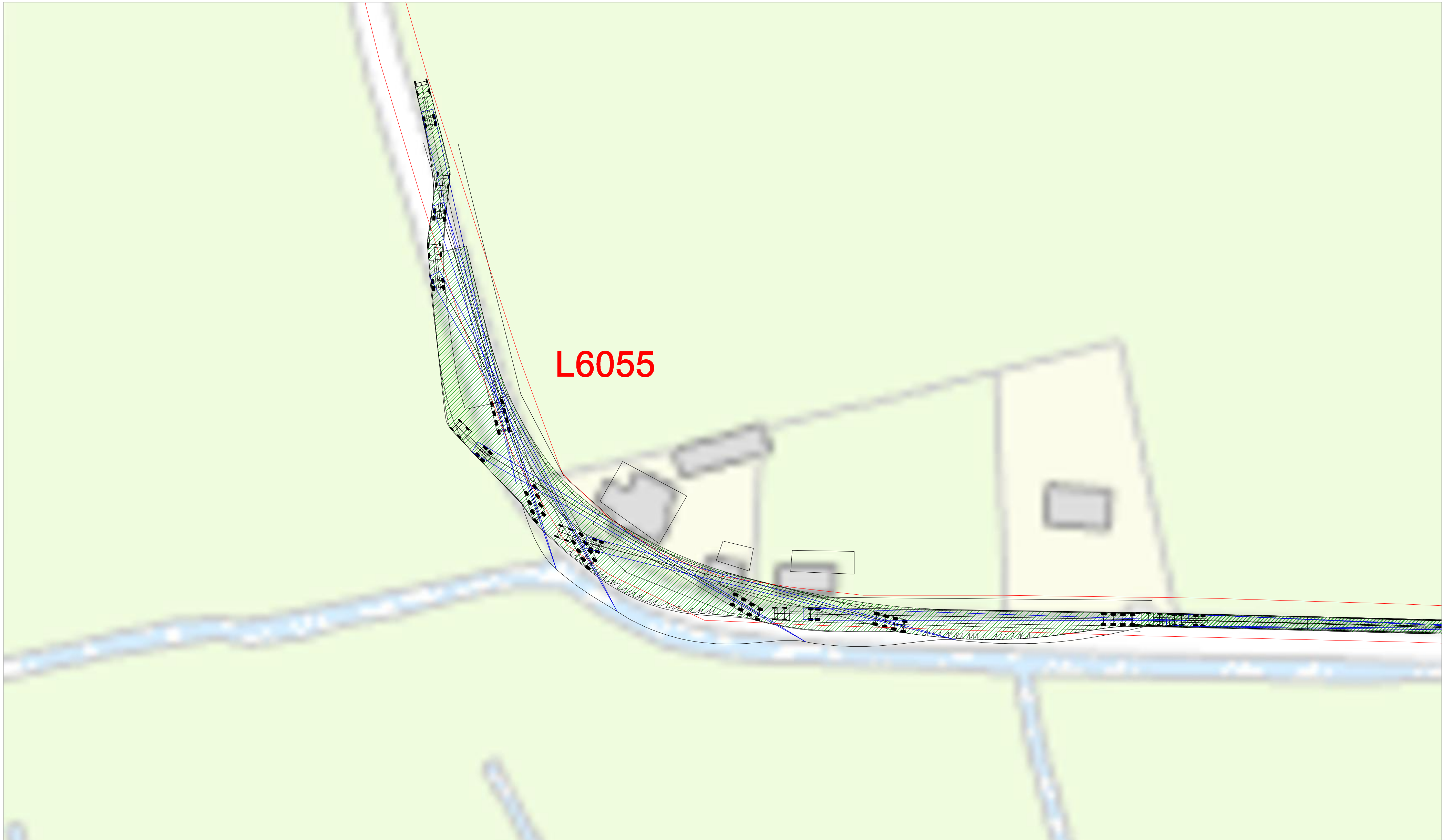
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-13 Location 4 - Bend on L6055, tower extended artic

PROJECT:	Ballynagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 19.08.21	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-14 Location 5 - Bend on L6055, blade extended artic (73.65m blade)

PROJECT:	Ballynagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 19.08.21	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-15 Location 5 - Bend on L6055, tower extended artic

PROJECT:	Ballynagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 19.08.21	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

NOTES: PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES	Figure 14-1-16 Location 6 - Bend on L6055, blade extended artic (73.65m blade)			
	PROJECT: Ballynagare Wind Farm			ALAN LIPSCOMBE TRAFFIC & TRANSPORT CONSULTANTS
	CLIENT: Ballynagare Wind Farm Ltd		SCALE: 1:1000	
	PROJECT NO: 8890	DATE: 19.03.21	DRAWN BY: AL	

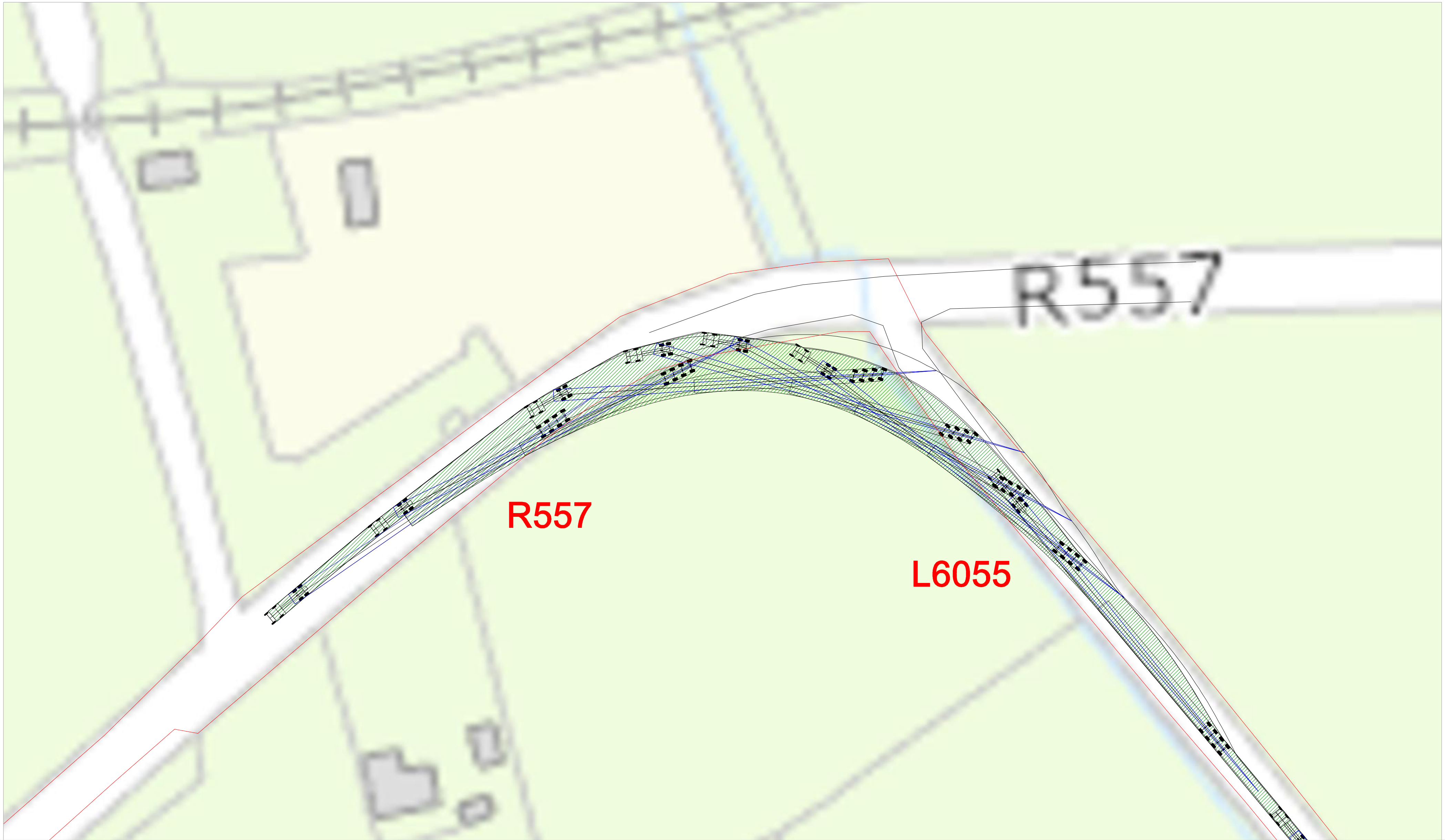
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-17 Location 6 - Bend on L6055, tower extended artic

PROJECT:	Ballynagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 19.03.21	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



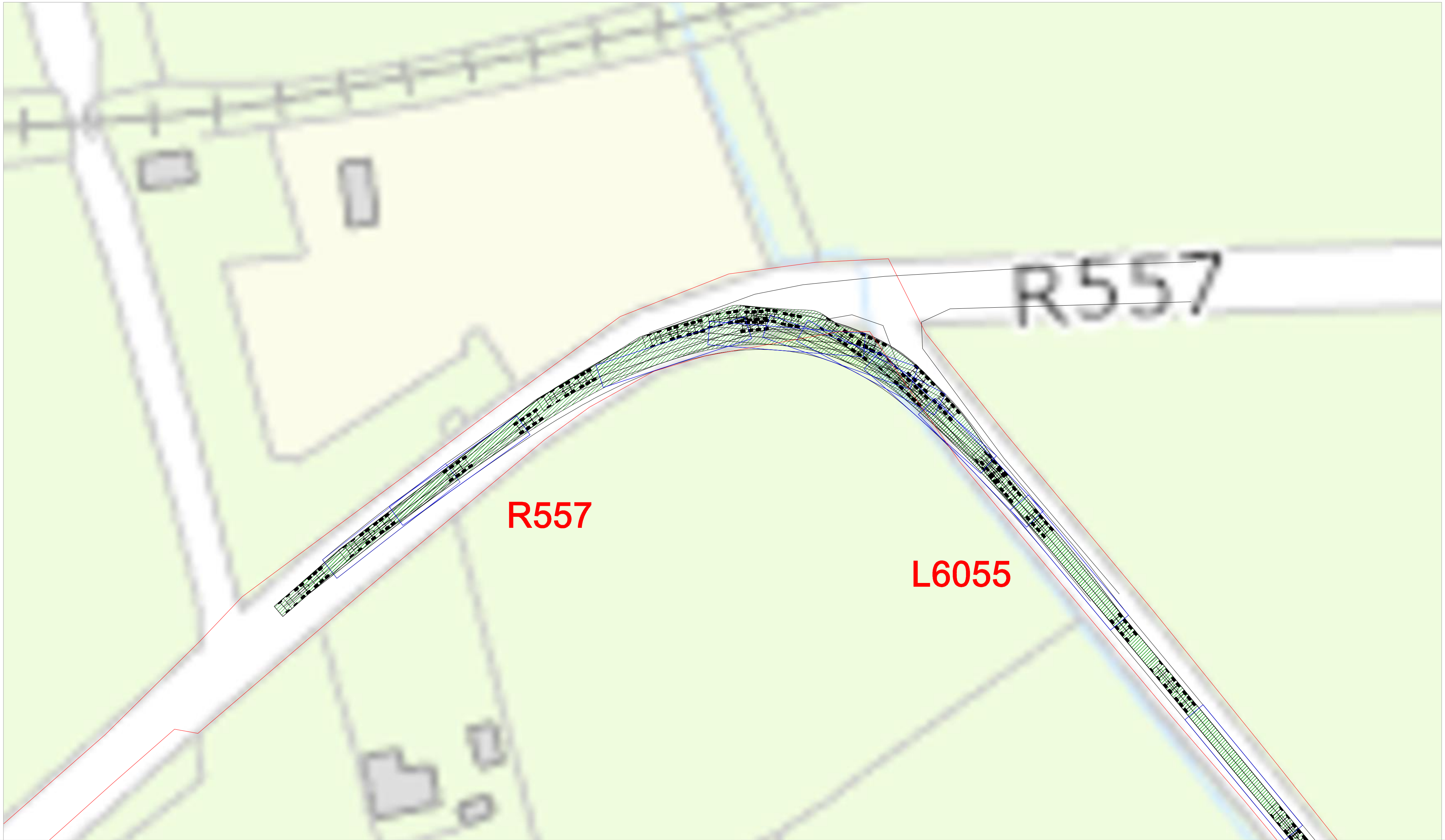
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-18 Location 7 - R557 / L6055 junction, blade extended artic (73.65m blade)

PROJECT:	Ballynagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 11.03.20	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



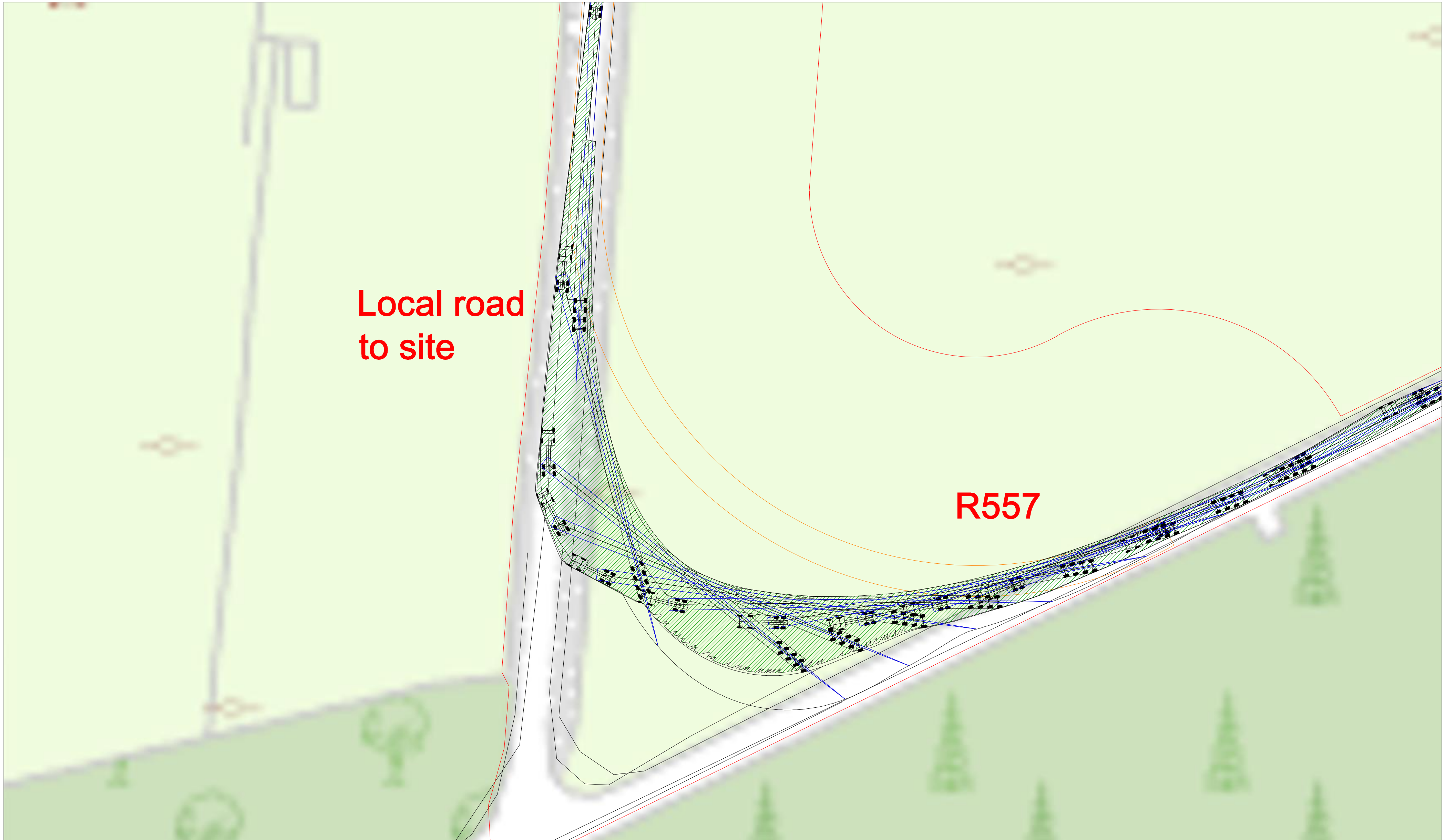
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-19 Location 7 - R557 / L6055 junction, tower extended artic

PROJECT: Ballynagare Wind Farm			
CLIENT: Ballynagare Wind Farm Ltd		SCALE: 1:1000	
PROJECT NO: 8890	DATE: 11.03.20	DRAWN BY: AL	

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



NOTES:

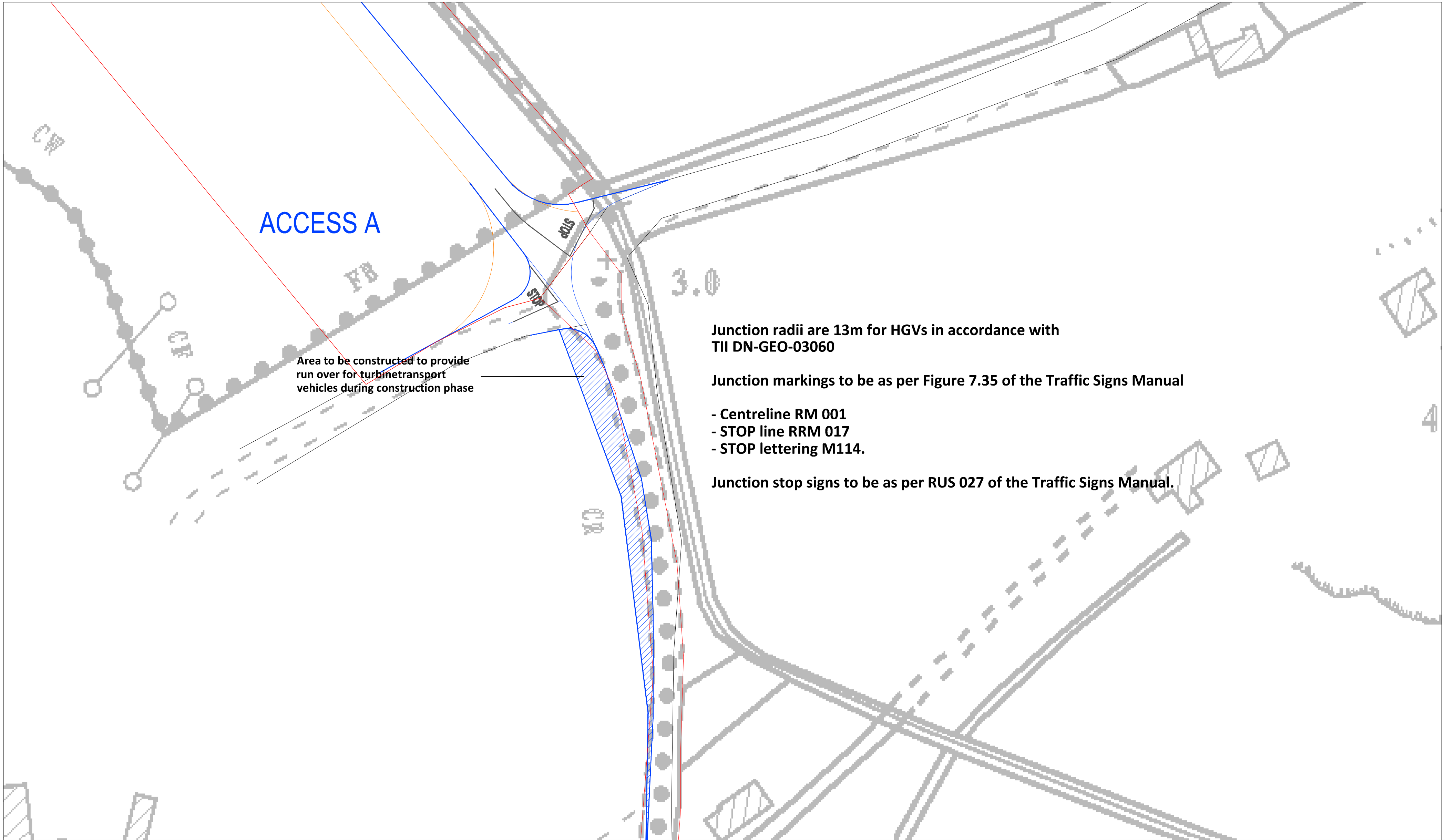
PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-20 Location 8 - R557 / Local road junction, blade extended artic (73.65m blade)

PROJECT:	Ballynagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 11.03.20	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

NOTES:	Figure 14-1-21 Location 8 - R557 / Local road junction, tower extended artic		
PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES	PROJECT: Ballynagare Wind Farm		ALAN LIPSCOMBE TRAFFIC & TRANSPORT CONSULTANTS
	CLIENT: Ballynagare Wind Farm Ltd	SCALE: 1:1000	
	PROJECT NO: 8890 DATE: 11.03.20	DRAWN BY: AL	



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-22 Location 9 - Site access junction A - junction layout

PROJECT:	Ballnagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 20.08.21	DRAWN BY:	AL

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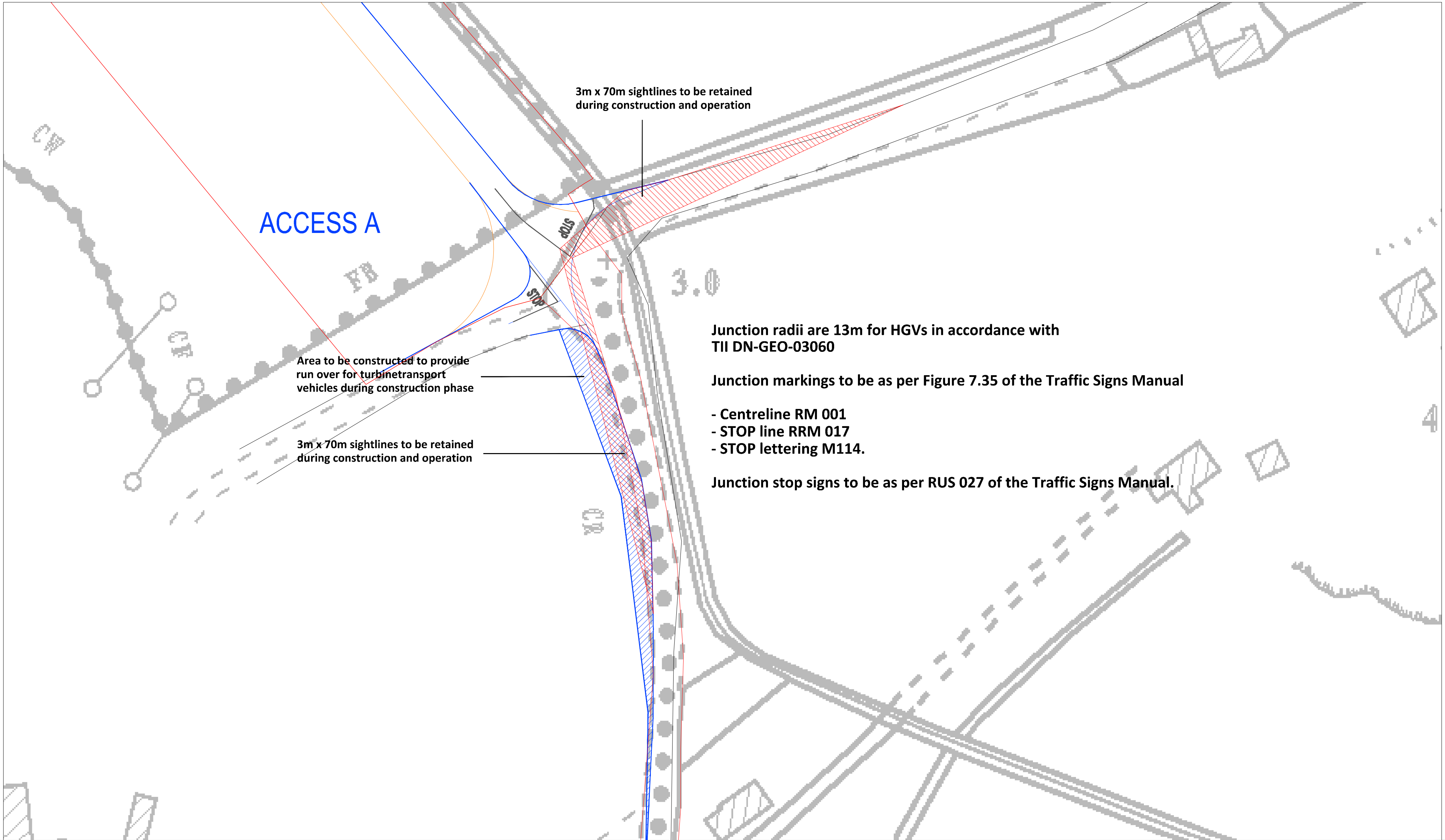
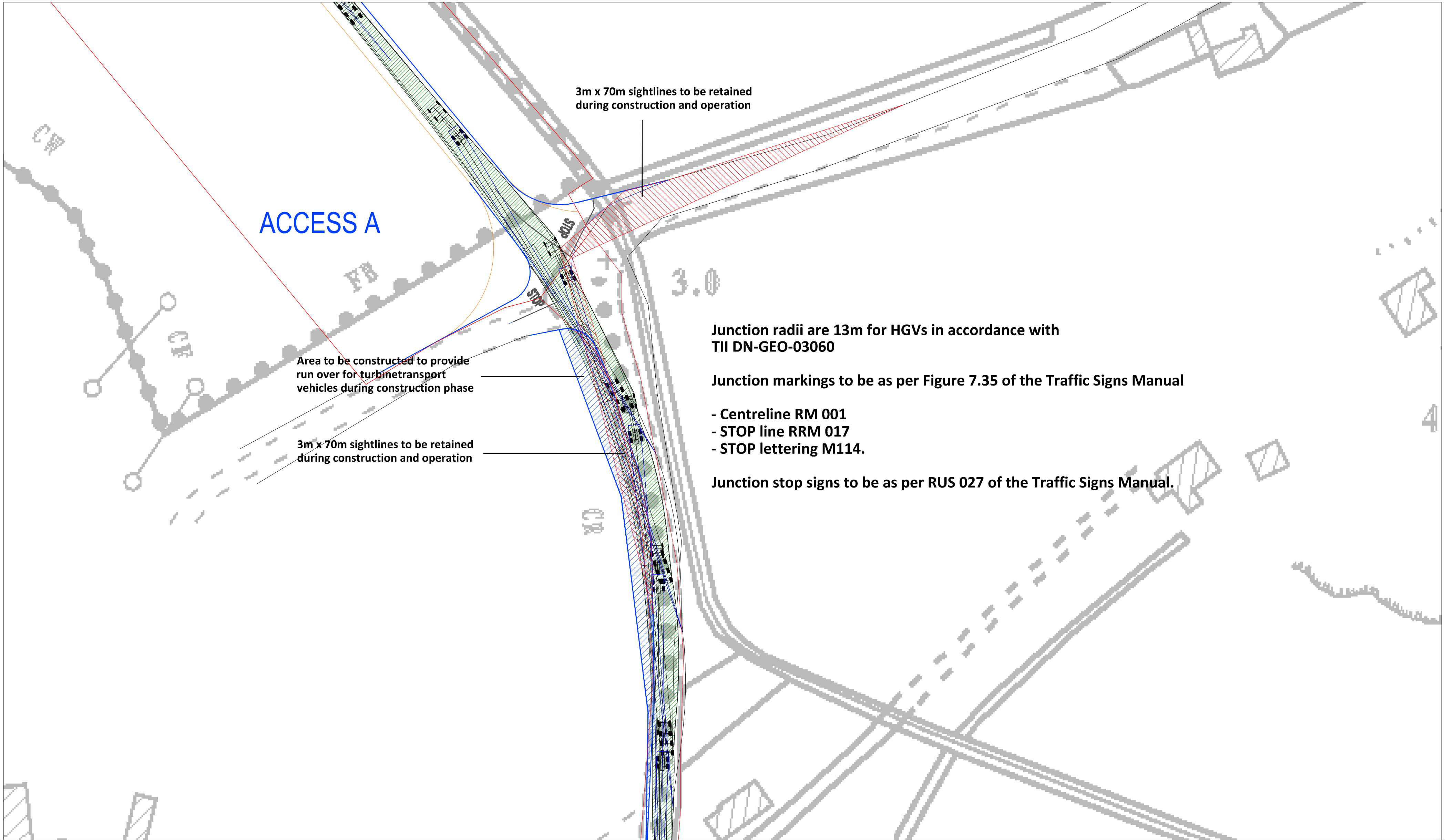


NOTES: PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES	Figure 14-1-23 Location 9 - Site access junction A - junction layout and visibility splays		
	PROJECT: Ballnagare Wind Farm		ALAN LIPSCOMBE TRAFFIC & TRANSPORT CONSULTANTS
	CLIENT: Ballynagare Wind Farm Ltd	SCALE: 1:1000	
	PROJECT NO: 8890 · DATE: 20.08.21	DRAWN BY: AL	



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-24 Location 9 - Site access junction A - blade extended artic

PROJECT:	Ballnagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 20.08.21	DRAWN BY:	AL

ALAN LIPSCOMBE
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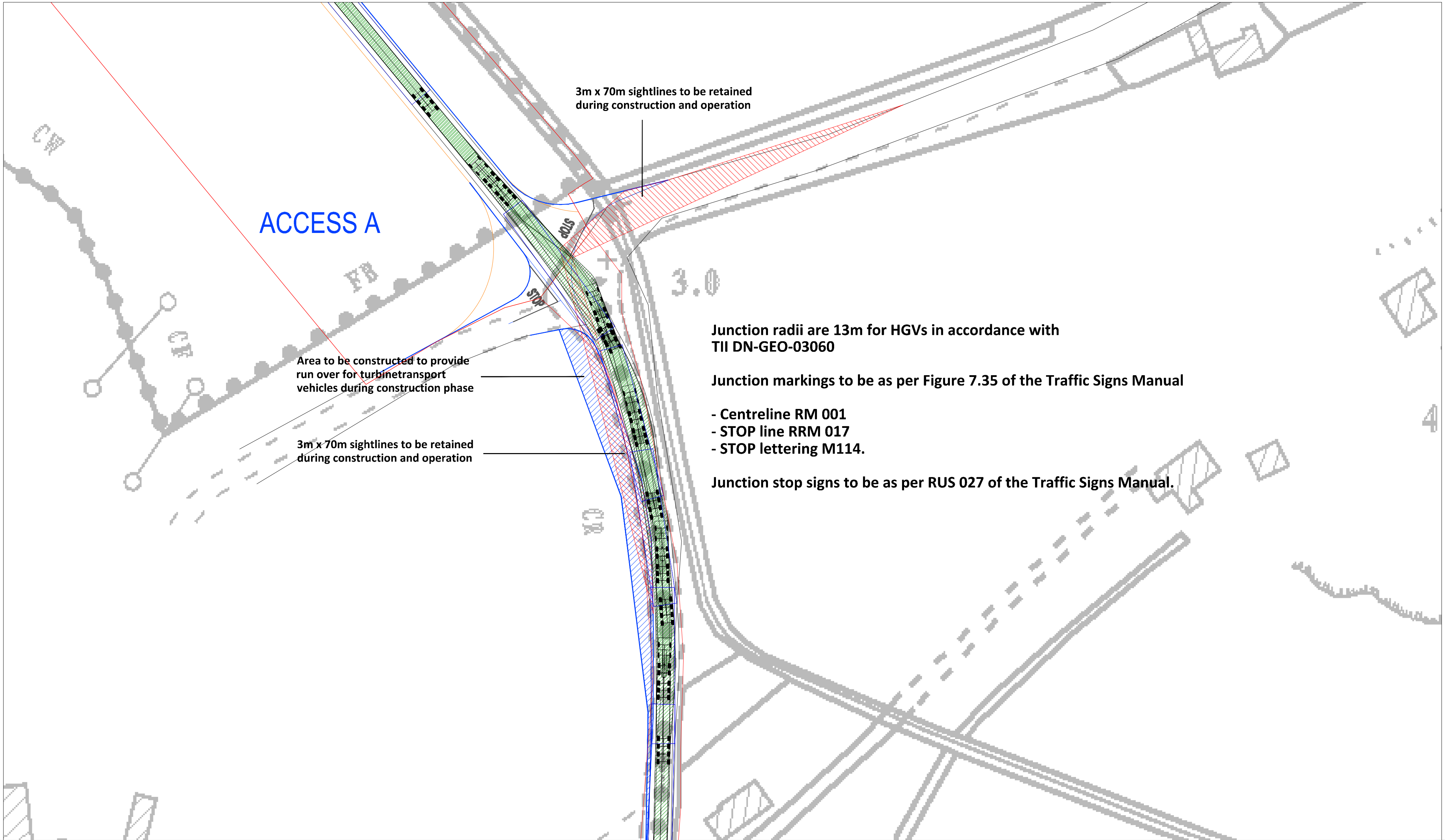


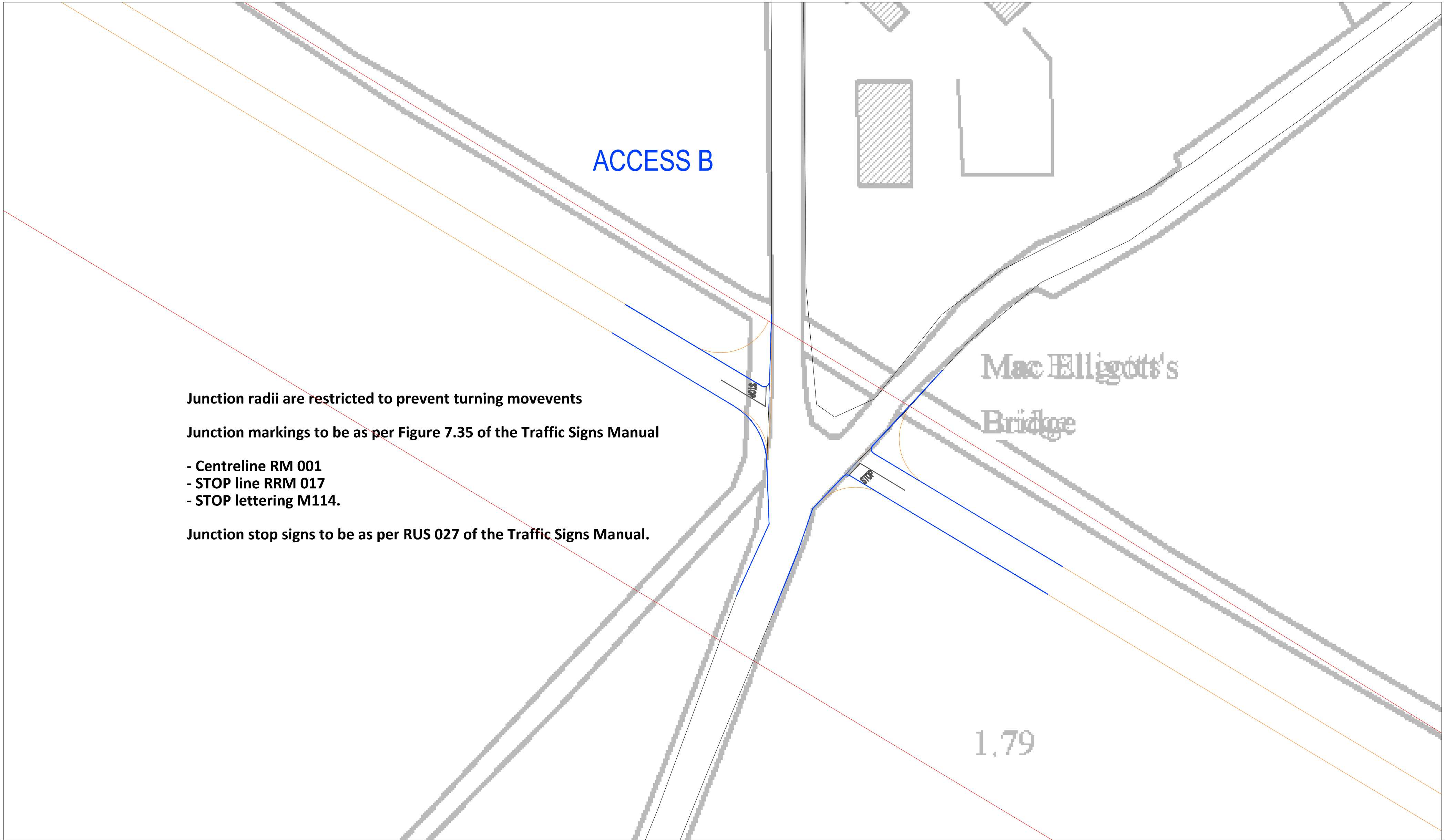
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-25 Location 9 - Site access junction A - tower extended artic

PROJECT:	Ballnagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 20.08.21	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



Junction radii are restricted to prevent turning movevents

Junction markings to be as per Figure 7.35 of the Traffic Signs Manual

- **Centreline RM 001**
- **STOP line RRM 017**
- **STOP lettering M114.**

Junction stop signs to be as per RUS 027 of the Traffic Signs Manual.

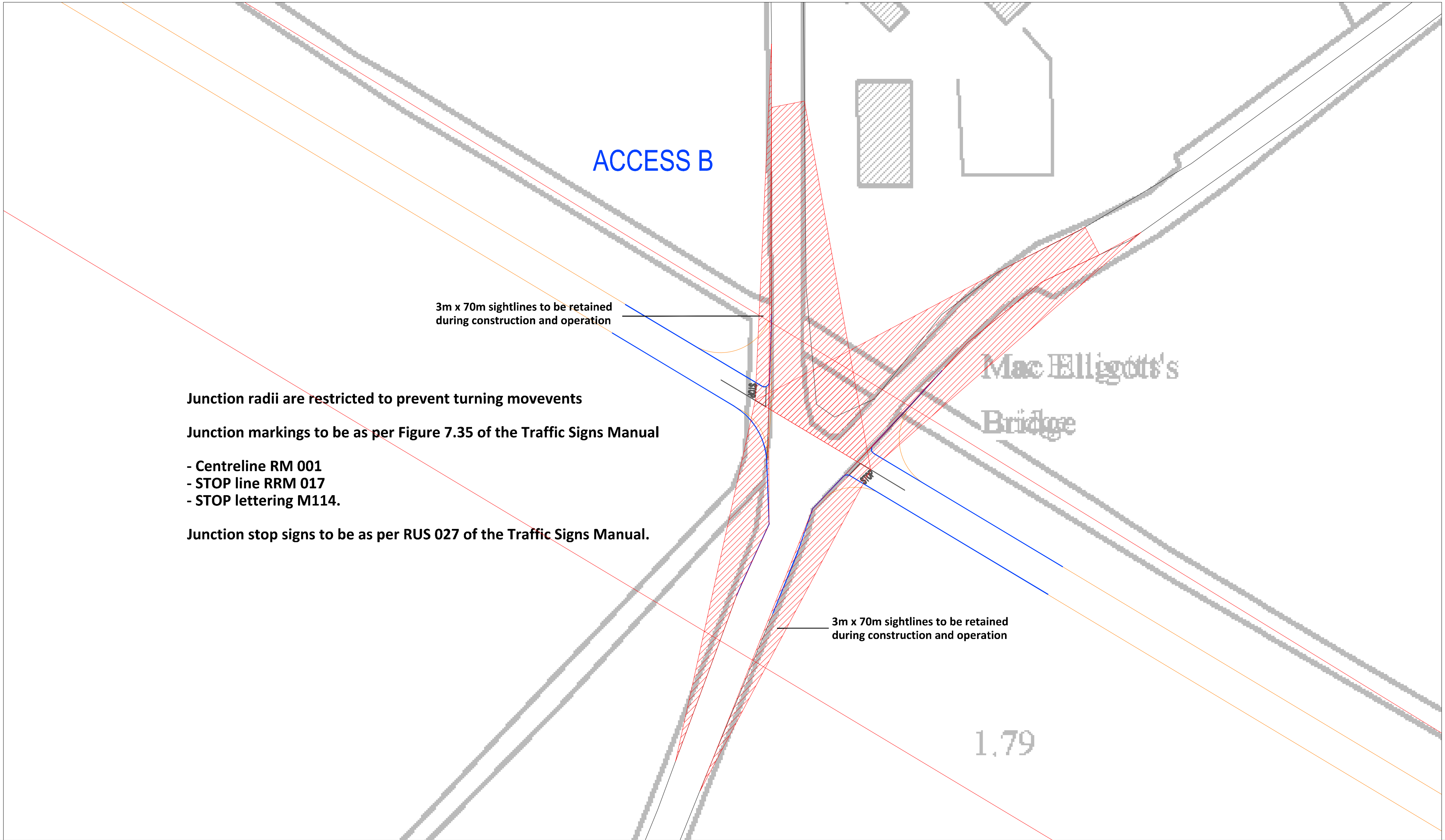
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-26 Location 10 - Site access junction B - junction layout

PROJECT:	Ballnagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 20.08.21	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

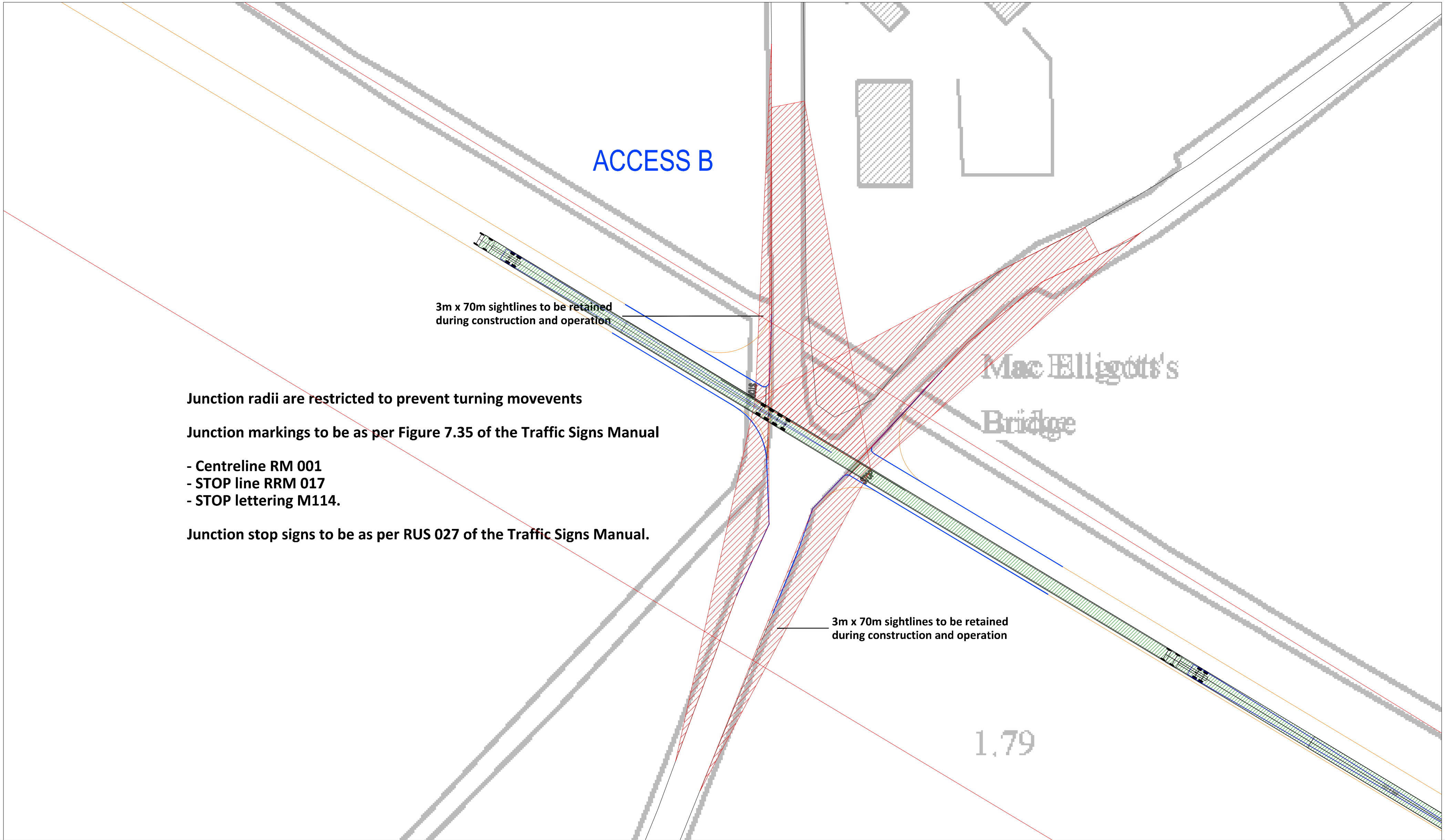
Figure 14-1-27 Location 10 - Site access junction B - junction layout and visibility splays

PROJECT: Ballnagare Wind Farm

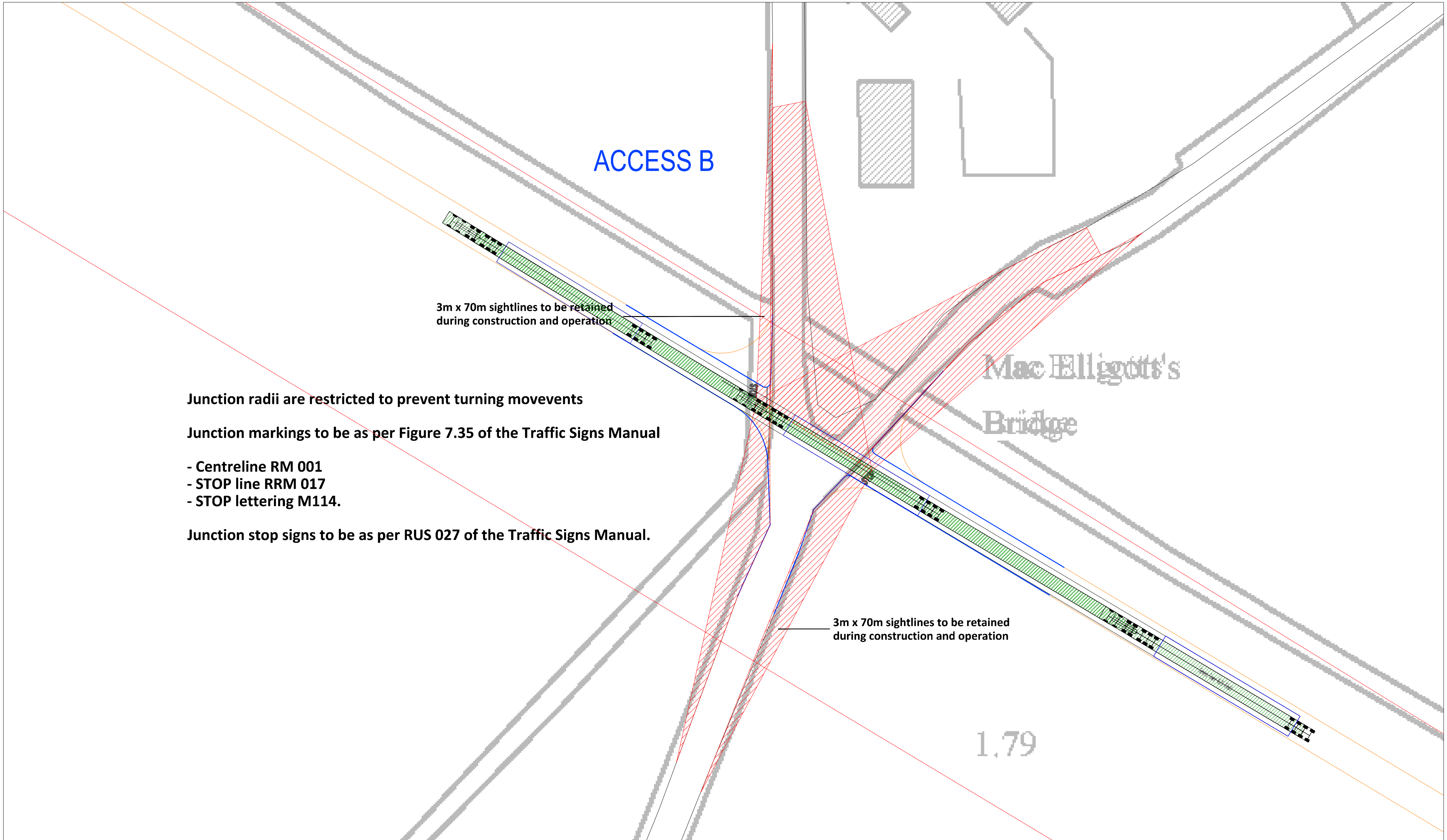
CLIENT: Ballynagare Wind Farm Ltd | SCALE: 1:1000

PROJECT NO: 8890 | DATE: 20.08.21 | DRAWN BY: AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



NOTES: PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES	Figure 14-1-28 Location 10 - Site access junction B - blade extended artic			
	PROJECT: Ballnagare Wind Farm			ALAN LIPSCOMBE TRAFFIC & TRANSPORT CONSULTANTS
	CLIENT: Ballynagare Wind Farm Ltd		SCALE: 1:1000	
	PROJECT NO: 8890	DATE: 20.08.21	DRAWN BY: AL	



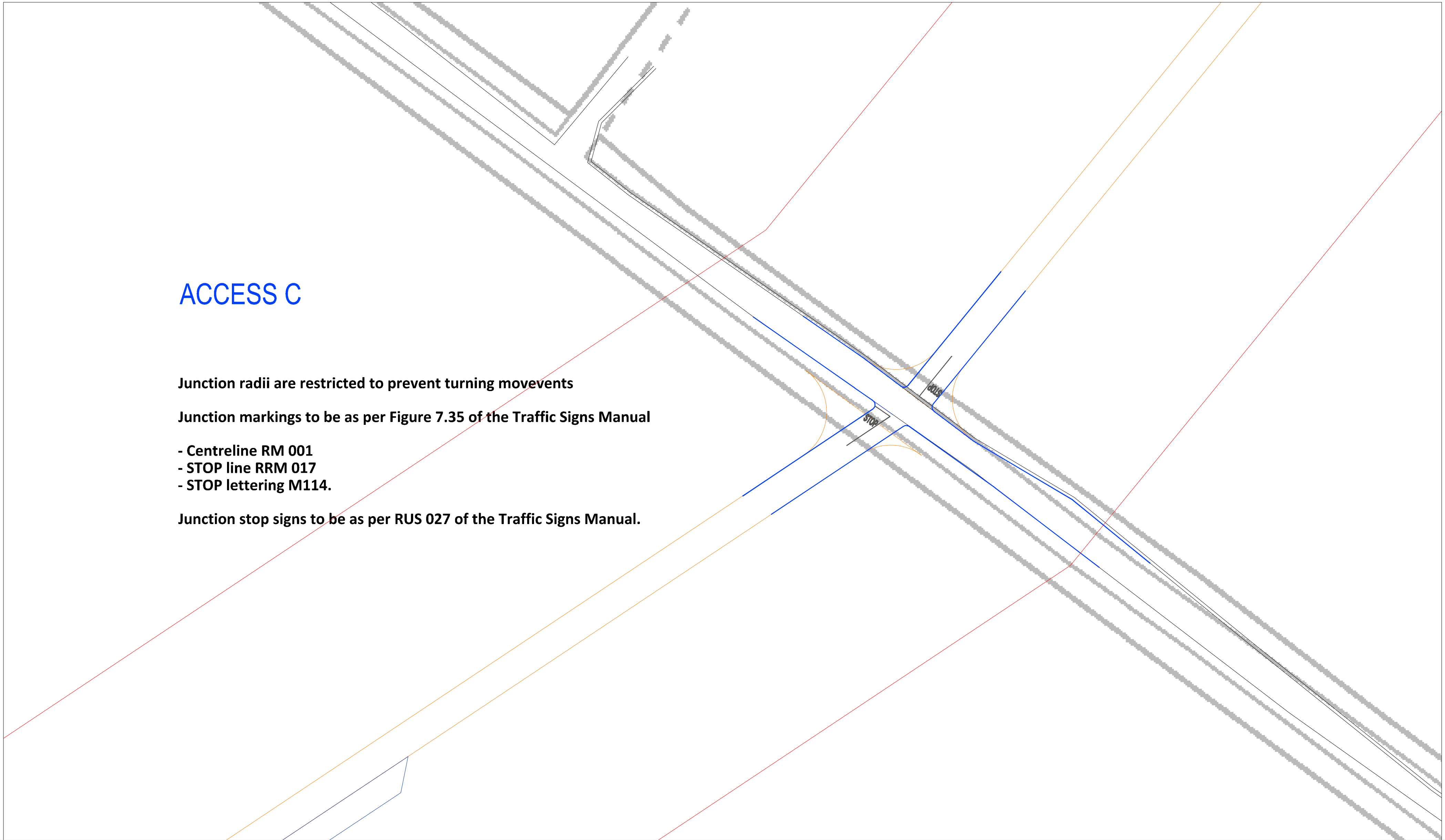
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-29 Location 10 - Site access junction B - tower extended artic

PROJECT: Ballnagare Wind Farm			
CLIENT: Ballynagare Wind Farm Ltd		SCALE: 1:1000	
PROJECT NO: 8890	DATE: 20.08.21	DRAWN BY: AL	

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



ACCESS C

Junction radii are restricted to prevent turning movevents

Junction markings to be as per Figure 7.35 of the Traffic Signs Manual

- Centreline RM 001
- STOP line RRM 017
- STOP lettering M114.

Junction stop signs to be as per RUS 027 of the Traffic Signs Manual.

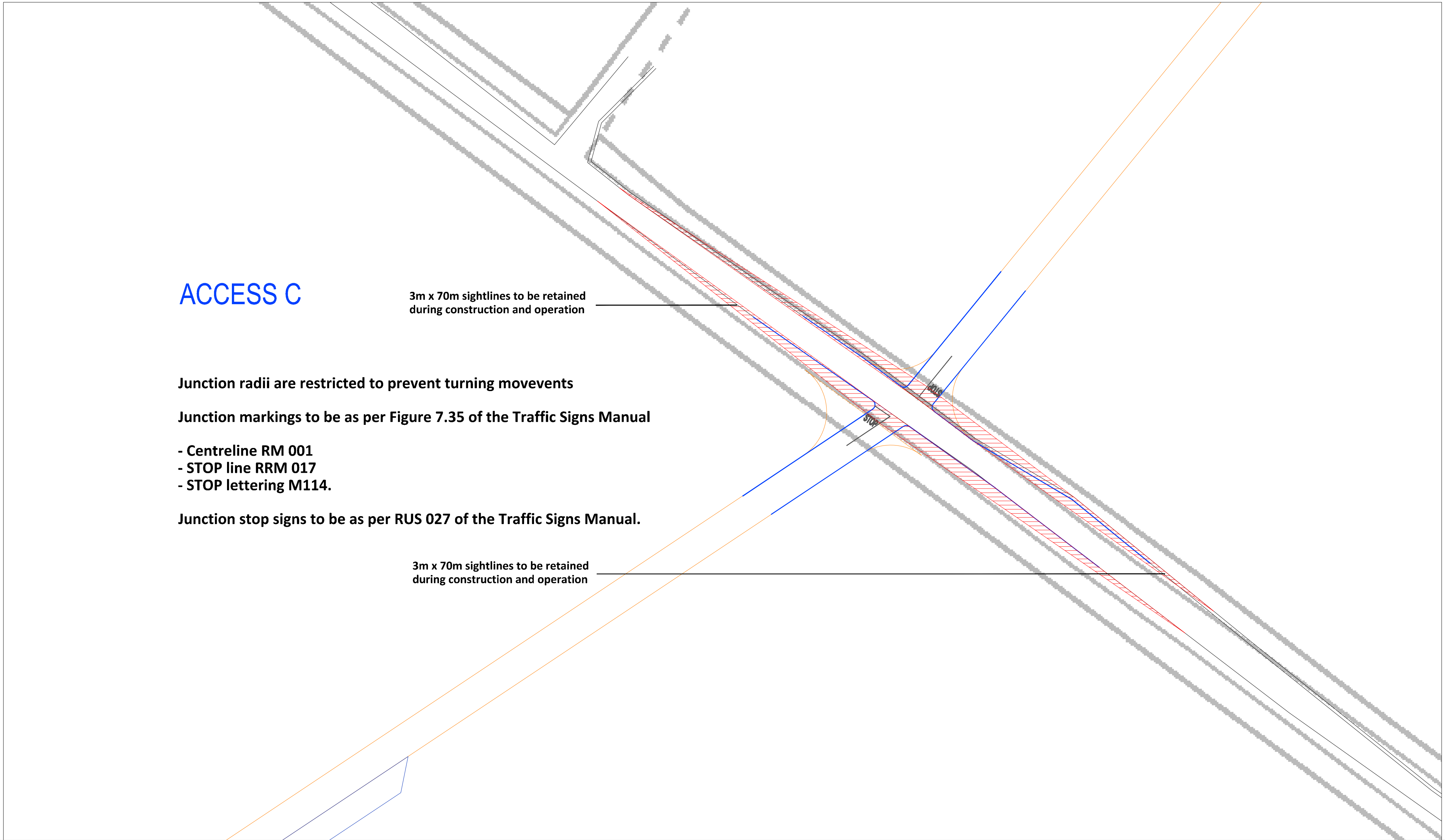
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-30 Location 11 - Site access junction C - junction layout

PROJECT:	Ballnagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 20.08.21	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



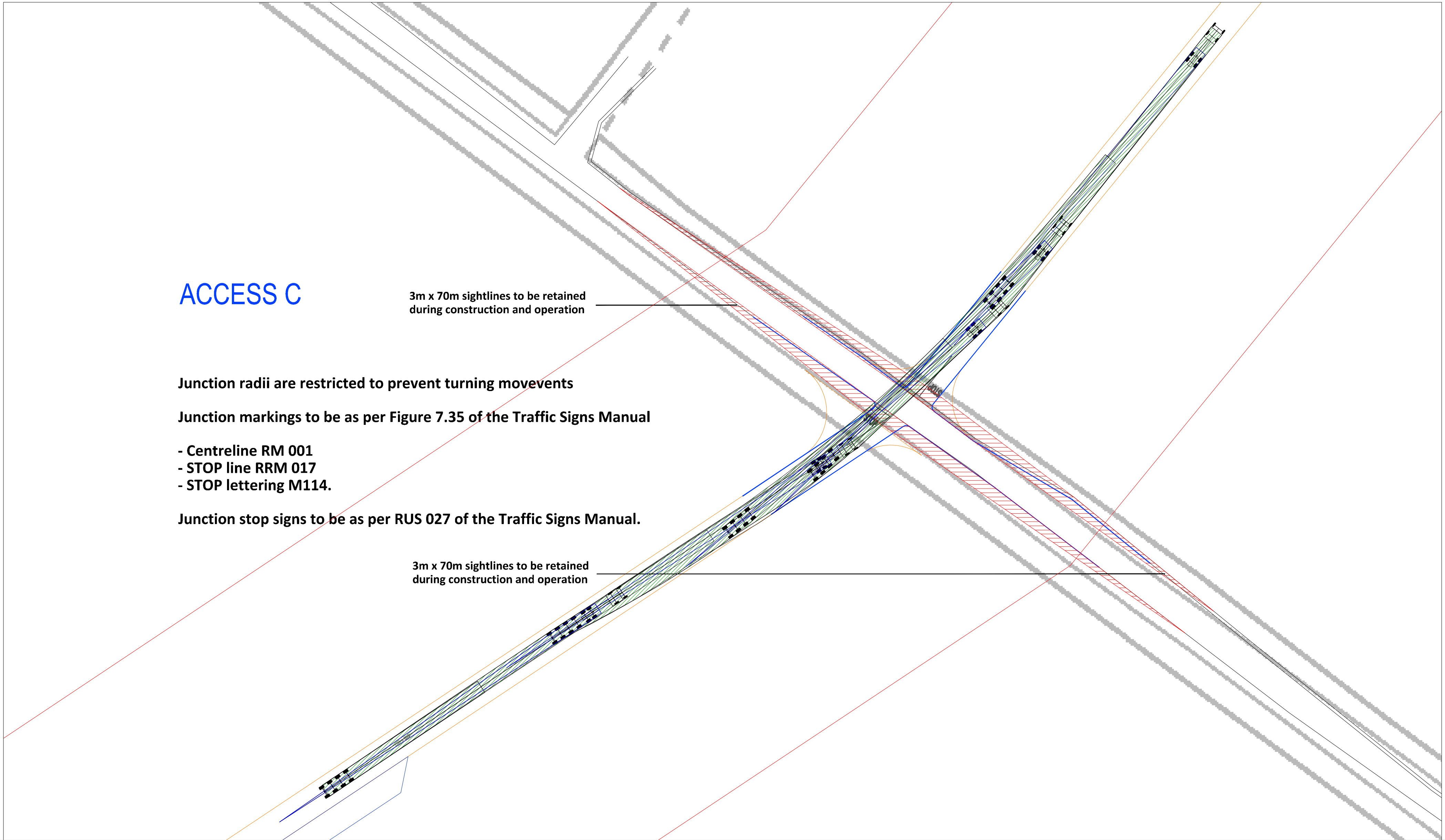
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-31 Location 11 - Site access junction C - junction layout and visibility splays

PROJECT:	Ballnagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 20.08.21	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



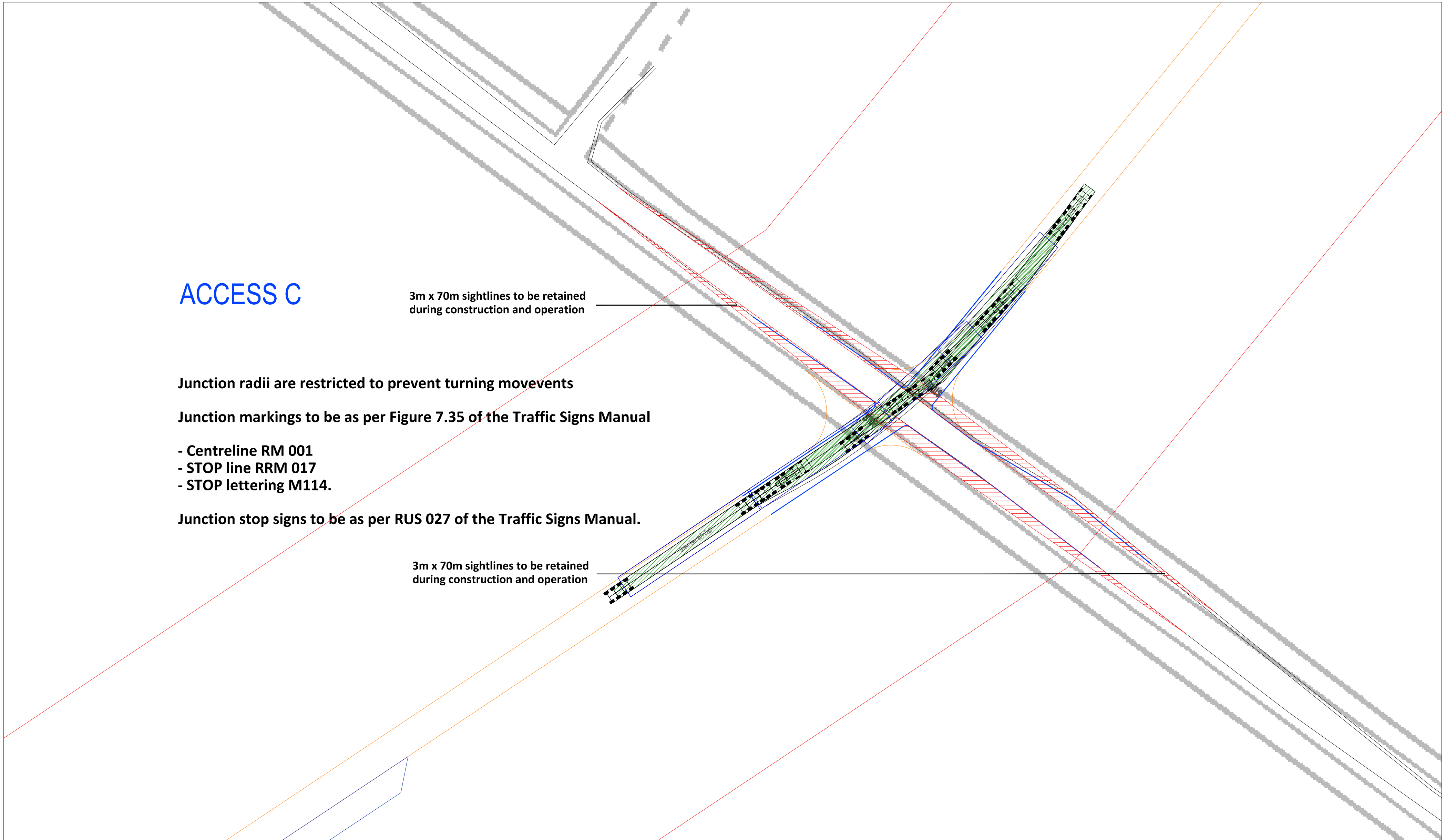
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-32 Location 11 - Site access junction C - blade extended artic

PROJECT:	Ballnagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 20.08.21	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-33 Location 11 - Site access junction C - tower extended artic

PROJECT:	Ballnagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 20.08.21	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

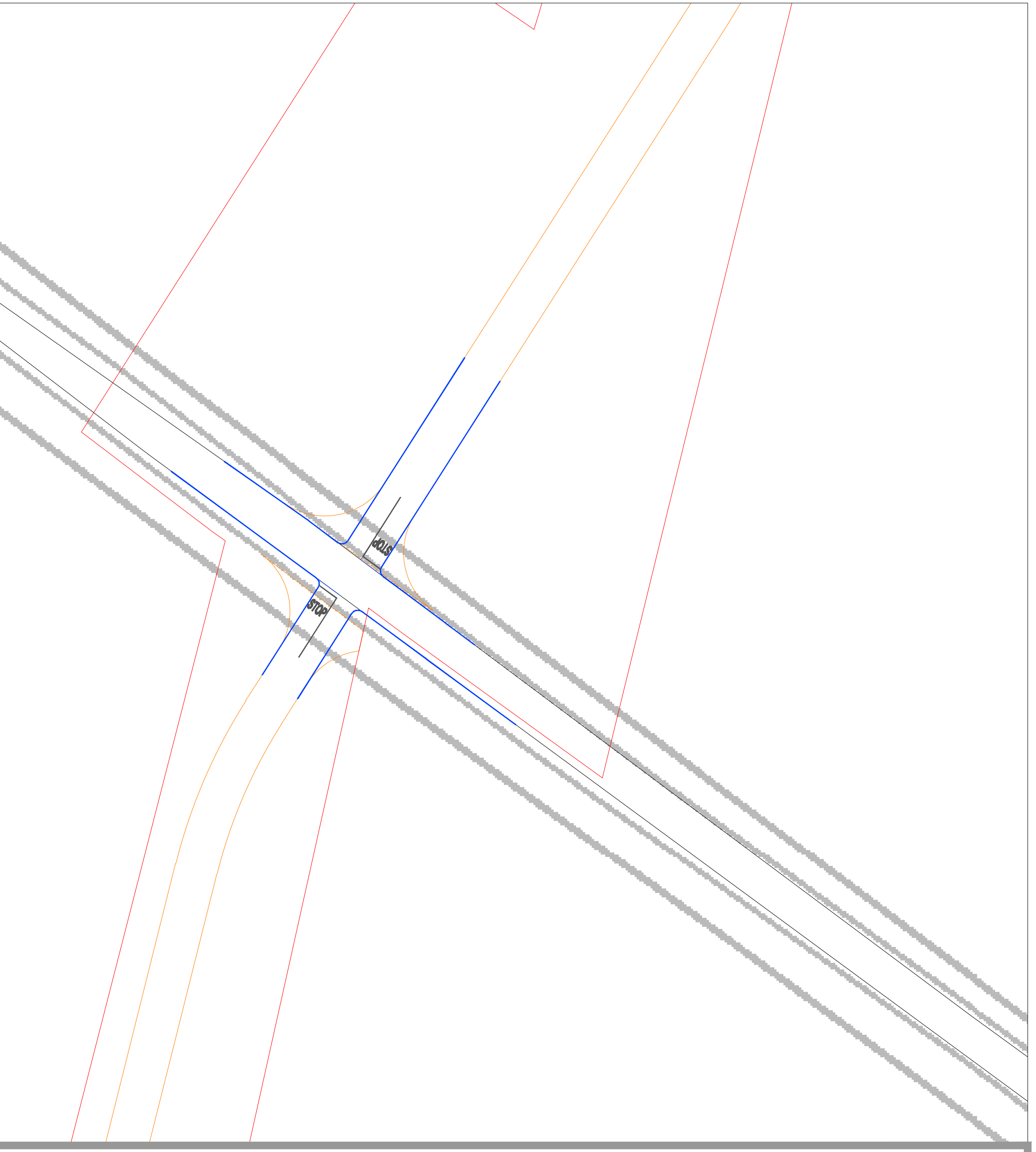
ACCESS D

Junction radii are restricted to prevent turning movevents

Junction markings to be as per Figure 7.35 of the Traffic Signs Manual

- Centreline RM 001
- STOP line RRM 017
- STOP lettering M114.

Junction stop signs to be as per RUS 027 of the Traffic Signs Manual.



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-34 Location 12 - Site access junction D - junction layout

PROJECT:	Ballnagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 20.08.21	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

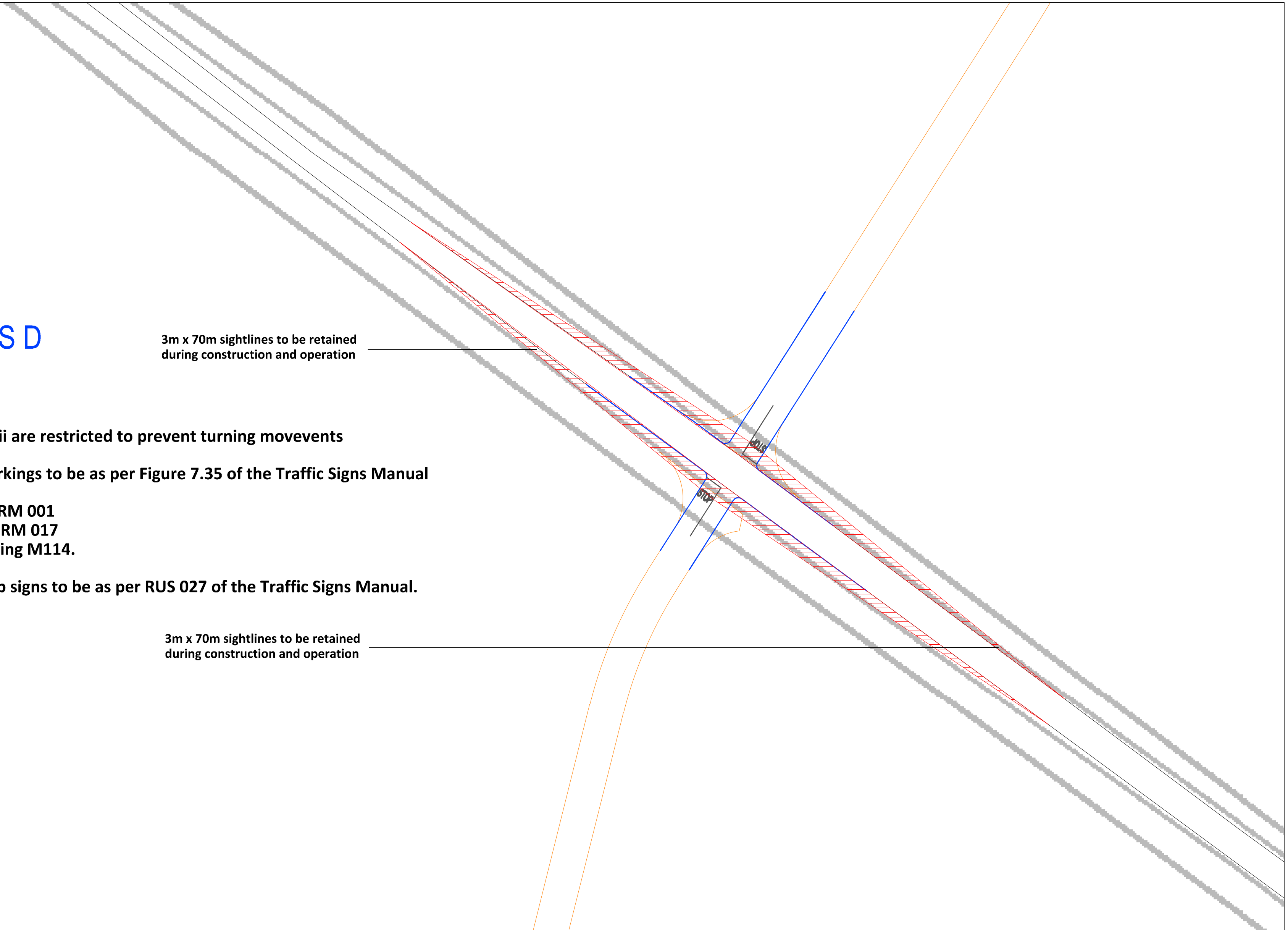
ACCESS D

Junction radii are restricted to prevent turning movevents

Junction markings to be as per Figure 7.35 of the Traffic Signs Manual

- **Centreline RM 001**
- **STOP line RRM 017**
- **STOP lettering M114.**

Junction stop signs to be as per RUS 027 of the Traffic Signs Manual.



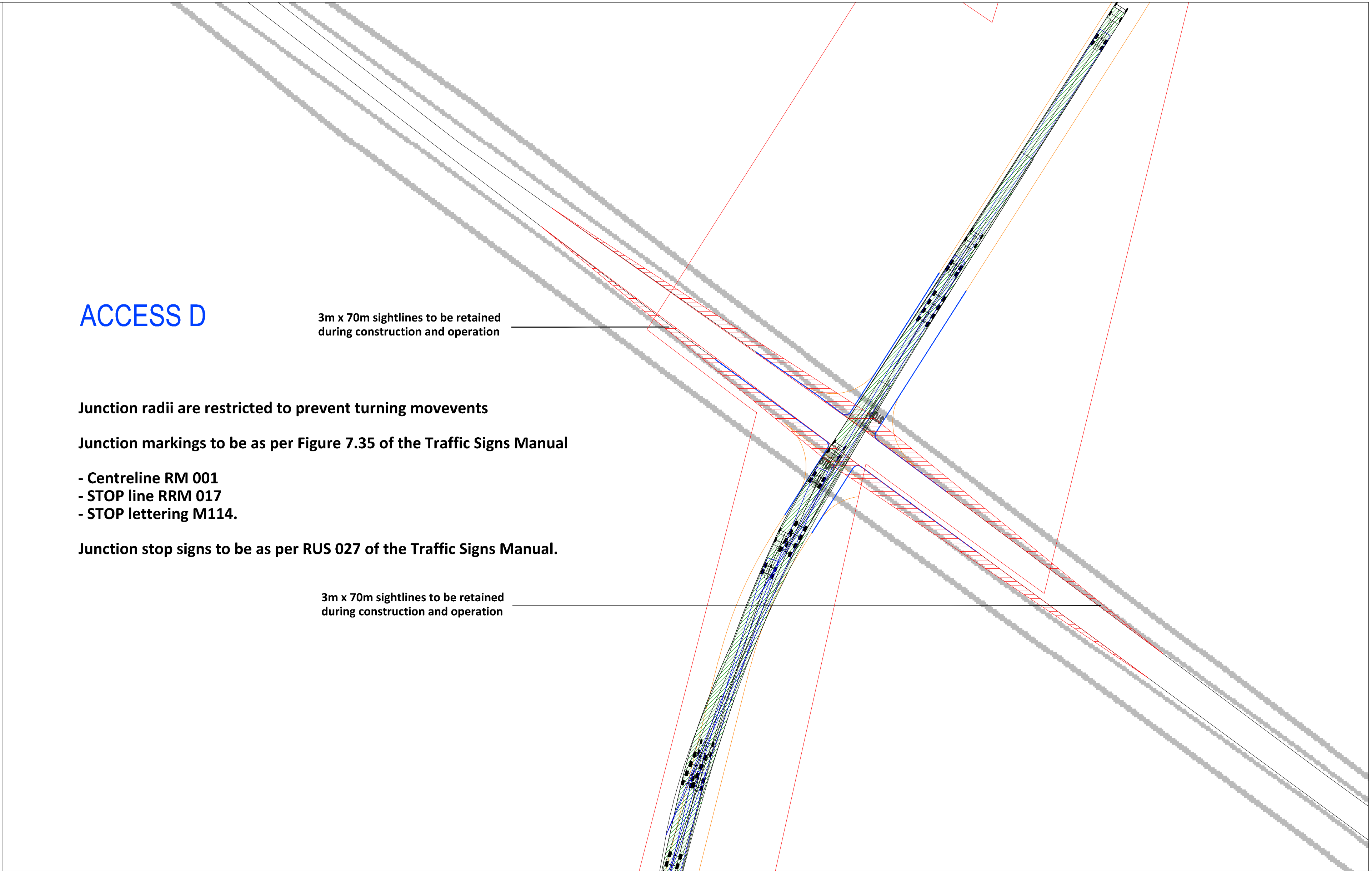
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-35 Location 12 - Site access junction D - junction layout and visibility splays

PROJECT:	Ballnagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 20.08.21	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



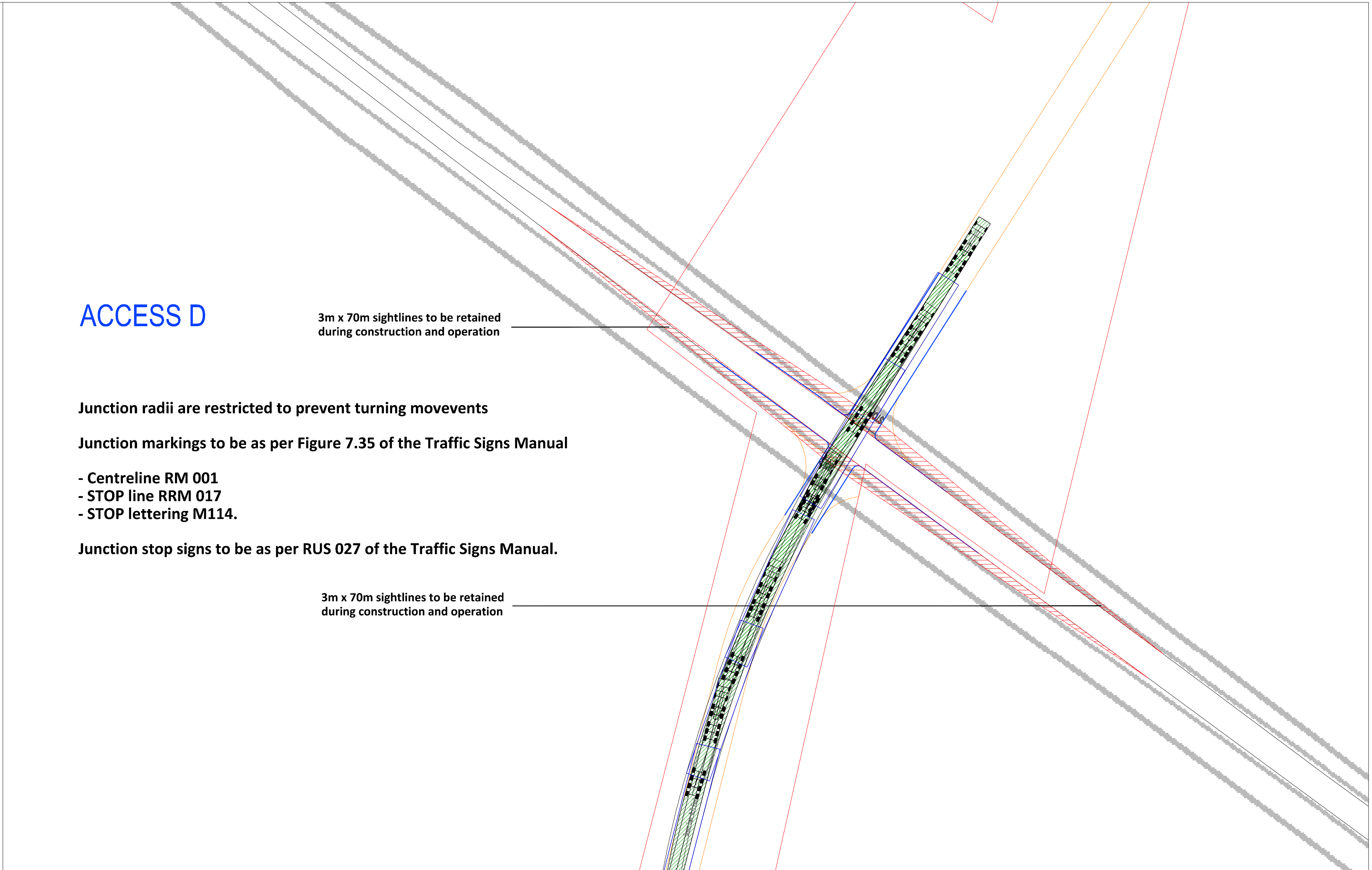
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-36 Location 12 - Site access junction D - blade extended artic

PROJECT:	Ballnagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 20.08.21	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



Junction radii are restricted to prevent turning movevents

Junction markings to be as per Figure 7.35 of the Traffic Signs Manual

- **Centreline RM 001**
- **STOP line RRM 017**
- **STOP lettering M114.**

Junction stop signs to be as per RUS 027 of the Traffic Signs Manual.

NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14-1-37 Location 12 - Site access junction D - tower extended artic

PROJECT:	Ballnagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 20.08.21	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

14.1.9 Route Assessment – National Road Network

The assessment undertaken on the National Road network is included as Appendix 14.1 with the haul route for the abnormal loads from the port of entry at Foynes, to the site shown in Figure A14.1.1. Autotrack assessments based on the 73.65m blade transporter are shown at the locations shown in Figure A14.1.2, as follows

- Location A - N21 / N23 roundabout at Castleisland (Figure A14.1.3),
- Location B - N21 / N69 roundabout at Tralee (Figure A14.1.4),
- Location C - N69 / L2015 roundabout at Tralee (Figure A14.1.5), and,
- Location D - N69 / R878 roundabout at Tralee (Figure A14.1.6).

The swept path analysis undertaken for these locations indicate that minor temporary works within the curtilage of the road corridor will be required in order to accommodate the extended wind turbine plant delivery vehicles.

14.1.10 Provision for Sustainable Modes of Travel

14.1.10.1 Walking and Cycling

The provision for these modes is not relevant during the construction stage of the development and travel distances will likely exclude any employees walking or cycling to work.

14.1.10.2 Public Transport

There are no public transport services that currently pass the site although mini-buses may be considered for transporting construction staff to and from the site in order to minimise traffic generation and parking demand on site.

14.1.11 Likely and Significant Effects and Associated Mitigation Measures

14.1.11.1 "Do Nothing" Scenario

The Do Nothing option to developing a wind farm at the proposed development site would be to leave the site as it is, with no changes made to the current land-use practices of low-intensity agriculture and peat harvesting. Should this occur the impact would be neutral in the context of this EIAR. If the proposed wind farm does not proceed, there will be no additional traffic generated or accommodation works carried out on the local road network and therefore no direct or indirect effects on roads and traffic.

14.1.11.2 Construction Phase

During the 7 days when the concrete foundations are poured the effect on the surrounding road network will be negative, resulting in an increase in traffic levels ranging from 5.1% on the N69 and 12.5% on the R557, to 65.3% on the local road leading to the site and 77.7% on the L6055. The direct effect will be temporary, and will be slight on the N69 and R557, to moderate on the L6055 and the local road leading to the site.

During the remaining 248 days for the site preparation and ground works when deliveries to the site will take place, the effect on the surrounding road network will be negative, resulting in an increase in traffic levels ranging from 1.3% on the N69 and 3.2% on the R557, to 16.9% on the local road leading to the site and 20.1% on the L6055. On these days, the direct effect will be temporary and will be slight.

During the 21 days of the turbine construction stage when the various component parts of the wind turbine plant are delivered to the site using extended articulated HGVs the delivery of construction materials will result in a negative impact on the surrounding road network, increasing traffic levels, ranging from 1.2% on the N69 and 2.9% on the R557, to an increase of 15.4% on the local road leading to the site and 18.3% on the on the L6055. The direct effect during this period will be temporary and will be moderate due to the size of vehicles involved. This will reduce to slight if these deliveries are undertaken at night as proposed.

During the 7 days when general materials are delivered to the site using standard HGVs, the effect of the additional traffic will result in increased traffic volumes between 0.7% on the N69 and 1.6% on the R557, to 8.5% on the local road leading to the site and 10.1% on the L6055. The direct effects will be temporary and will be slight.

It was established that during the construction year of 2025 the N69 is forecast to operate at 97% of its operational capacity without any additional development generated traffic. This is forecast to increase to 102% during the 7 days that the concrete foundations are poured and a maximum of 98% during the other construction stages.

It was determined that all other links in the study area will operate within operational capacity for all days within the construction period.

14.1.11.3 Operational Phase

During the operational phase the direct effect on the surrounding local highway network will be neutral and long term given that there will be approximately two maintenance staff travelling to site at any one time, resulting in typically two visits to the site on any one day made by a car or light goods vehicle.

14.1.11.4 Decommissioning Phase

The design life of the wind farm is 35 years. If the site is decommissioned, cranes will disassemble each turbine tower and all equipment.

All turbine infrastructure including turbine components will be separated and removed off-site for re-use, recycling and waste disposal.

It is proposed that turbine foundations and hardstanding areas will be left in place and covered with soil/topsoil. It is proposed to leave the access roads in situ at the decommissioning stage. It is considered that leaving the turbine foundations, access tracks and hardstanding areas in situ will cause less environmental damage than removing and recycling them. However, if removal is deemed to be required all infrastructure will be removed with mitigation measures similar to those during construction being employed. While the actual number of loads that will be required to be removed from the site in the event that the Proposed Development is decommissioned has not been determined at this stage, the impact in terms of traffic volumes will be significantly less than during the construction stage.

14.1.11.5 Cumulative Effects

A detailed assessment of all developments at varying stages in the planning process (from pre-planning to operational), is set out in Section 2.7 of this EIAR, with an assessment of the potential cumulative traffic effects with the proposed subject wind farm assessed on the following criteria;

- Project status (proposed to operational)
- Degree of overlap with the Proposed Development delivery highway network (low to high)
- Traffic volumes (low to high)

While there are various wind farm developments located within close proximity of the proposed Ballynagare Wind Farm, most are already constructed so for these developments there will be no potential for the construction phases to overlap with the Proposed Development. The only potential wind farm development in close proximity to the Proposed Development is the Ballyhorgan Development Wind Farm which is located off the L-6055 just to the south. While the Ballyhorgan Wind Farm has yet to receive planning permission, the turbine and general construction traffic delivery routes are common to both wind farm. In the event that both wind farms were constructed at the same time the potential for cumulative impacts would be slight to moderate. A remedial measure would be to ensure that the construction phases for both wind farms, if granted, do not overlap.

Reference was also made in the preparation of this assessment to other planning applications as set out in Chapter 2. These developments are all small in scale and predominantly related to one-off housing and agriculture. There is potential for the construction phases of these projects to overlap with the proposed development. However, due to the small scale of other permitted projects in the vicinity of the Proposed Development the likely cumulative effects are imperceptible, temporary, and negative.

14.1.11.6 Mitigation Measures

This section summarises the mitigation measures to minimise the effects of the Proposed Development during both the construction and operational stages.

Mitigation by Design

Mitigation by design measures includes the following;

- Selection of the most appropriate delivery route to transport the wind turbine components, requiring the minimum remedial works to accommodate the vehicles as set out in Section 14.1.8.
- Construction of temporary improvements to the local highway network at locations identified in Section 14.1.8.

Mitigation Measures During the Construction Stage

The successful completion of this development will require significant coordination and planning and it is therefore recommended that the following comprehensive set of mitigation measures will be put in place before and during the construction stage of the project in order to minimise the effects of the additional traffic generated by the proposed wind farm.

Delivery of abnormal sized loads

The following are the main points to note for these deliveries which will take place after peak evening traffic:

- The delivery of turbine components is a specialist transport operation with the transportation of components carried out at night when traffic is at its lightest and the impact minimised.
- The deliveries will be made in consultation with the Local Authority and An Garda Síochána.
- It is estimated that 63 abnormal sized loads will be delivered to the site, comprising 21 convoys of 3 vehicles, undertaken over 21 separate nights.
- These nights will be spread out over an approximate period of 11 weeks and will be agreed in advance with the relevant authorities
- In order to manage each of the travelling convoys, for each convoy there will be two police escort vehicles that will stop traffic at the front and rear of the convoy of 3 vehicles.

- There will also be two escort vehicles provided by the haulage company for each convoy.

Other traffic management measures

A detailed **Traffic Management Plan (TMP)**, will be provided specifying details relating to traffic management and included in the CEMP prior to the commencement of the construction phase of the proposed development. The TMP will be agreed with the local authority and An Garda Síochána prior to construction works commencing on site. The detailed TMP will include the following:

- **Traffic Management Coordinator** – a competent Traffic Management Co-ordinator will be appointed for the duration of the project and this person will be the main point of contact for all matters relating to traffic management.
- **Delivery Programme** – a programme of deliveries will be submitted to the County Council in advance of deliveries of turbine components to site. Liaison with the relevant local authorities and Transport Infrastructure Ireland (TII) will be carried out where required regarding requirements such as delivery timetabling. The programme will ensure that deliveries are scheduled in order to minimise the demand on the local network and minimise the pressure on the access to the site.
- **Information to locals** – Locals in the area will be informed of any upcoming traffic related matters e.g. temporary lane/road closures (where required) or delivery of turbine components at night, via letter drops and posters in public places. Information will include the contact details of the Project Co-ordinator, who will be the main point of contact for all queries from the public or local authority during normal working hours. An "out of hours" emergency number will also be provided.
- **A Pre and Post Construction Condition Survey** – Where required by the local authority, a pre-condition survey of roads associated with the proposed development can be carried out immediately prior to construction commencement to record an accurate condition of the road at the time. A post construction survey will be carried out after works are completed to ensure that any remediation works are carried out to a satisfactory standard. Where required the timing of these surveys will be agreed with the local authority. All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the local authority engineers.
- **Liaison with the relevant local authority** - Liaison with the County Council and An Garda Síochána, will be carried out during the delivery phase of the large turbine vehicles, when an escort for all convoys will be required. Once the surveys have been carried out and "prior to commencement" status of the relevant roads established, (in compliance with the provisions of the CEMP), the Roads section will be informed of the relevant names and contact numbers for the Project Developer/Contractor Site Manager as well as the Site Environmental Manager.
- **Implementation of temporary alterations to road network at critical junctions** – at locations highlighted in section 14.1.8. In addition, in order to minimise the impact on the existing environment during turbine component deliveries the option of blade adaptor trailers will also be used where deemed practicable.
- **Identification of delivery routes** – These routes will be agreed with the County Council and adhered to by all contractors.
- **Delivery times of large turbine components** - The management plan will include the option to deliver the large wind turbine plant components at night in order to minimise disruption to general traffic during the construction stage.
- **Travel plan for construction workers** – While the assessment above has assumed the worst case in that construction workers will drive to the site, the construction company will be required to provide a travel plan for construction staff, which will include the identification of routes to / from the site and identification of an area for parking.
- **Additional measures** - Various additional measures will be put in place where appropriate in order to minimise the effects of the development traffic on the

surrounding road network including wheel washing facilities on site and sweeping / cleaning of local roads as required. These are set out in the CEMP which is contained in Appendix 4-2

- **Re-instatement works** - All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the local authority engineers.

Mitigation Measures During Operational Stage

Due to the very low volumes of traffic forecast to be generated during this stage no mitigation measures are required.

Mitigation Measures During Decommissioning Stage

In the event that the Proposed Development is decommissioned after the 35 years of operation, a decommissioning plan, including material recycling / disposal and traffic management plan will be prepared for agreement with the local authority. This plan will contain similar mitigation measures to those implemented during the construction phase.

14.1.11.7 Residual Impacts

Construction Stage

The implementation of the mitigation measures discussed above, including the proposed traffic management plan will minimise potential impacts on road users during the construction stage of the project. This will result in a residual impact to other road users that is slight to moderate, temporary and negative in effect.

Operational Stage

As the traffic impact of the optimised development will be imperceptible during the operational stage, the residual effect will also be imperceptible.

Decommissioning Stage

As stated above, in the event that the wind farm is decommissioned a decommissioning plan will be prepared and implemented in order to minimise the residual impacts. The decommissioning phase of the development will likely result in a residual impact to other road users that is slight, temporary, and negative in effect.

14.1.11.8 Significance of Effects

There will be no likely significant effects on traffic and transport as a result of the proposed development during either the construction, operational, or decommissioning phases.

14.2 Telecommunications and Aviation

14.2.1 Introduction

This section of the EIAR assesses the likely significant effects of the proposed wind farm on telecommunications and aviation. Section 14.2.3 describes the way in which wind turbines can potentially interfere with telecommunications signals or aviation activities. Section 14.2.4 presents details on how such effects will be avoided, with the likely significant effects assessed (and mitigation measures proposed) in Section 14.2.5.

14.2.2 Methodology and Guidance

This section of the assessment focuses particularly on the scoping and consultation exercise conducted with telecommunications operators and aviation authorities. Scoping was carried out in line with the above EPA guidelines, and the '*Best Practice Guidelines for the Irish Wind Energy Industry'* (Irish Wind Energy Association, 2012), which provides a recommended list of telecommunications operators for consultation.

A full description of the scoping and consultation exercise is provided in Section 2.7 of Chapter 2 of this EIAR. Consultation with the telecommunications operators and aviation bodies informed the constraints mapping process, which in turn informed the layout of the proposed development, as described in Chapter 3 of the EIAR.

The assessment of likely significant effects on material assets uses the standard methodology and classification of impacts as presented in Section 1.8.1 of Chapter 1 of this EIAR. The full project description, including proposed turbine locations and elevations, is provided in Chapter 4.

14.2.2.1 Statement of Authority

This section of the EIAR has been prepared by Thomas Blackwell, a Senior Environmental Consultant with MKO with over 15 years' of progressive experience in environmental consulting and in the assessment of environmental documents for renewable energy developments, including the assessment of likely significant effects on material assets. Thomas holds a BA (Hons) in Geography from Trinity College Dublin and a M.Sc. in Environmental Resource Management from University College Dublin.

14.2.3 Background

14.2.3.1 Broadcast Communications

Wind turbines, like all large structures, have the potential to interfere with broadcast signals, by acting as a physical barrier or causing a degree of scattering to microwave links. The most significant effect at a domestic level relates to a possible flicker effect caused by the moving rotor, affecting, for example, radio signals. The most significant potential effect occurs where the wind farm is directly in line with the transmitter radio path.

14.2.3.2 Domestic Receivers

Depending on local topography, a domestic receiver may receive broadcast signals from more than one location. The strength of the signals varies with distance from the transmitter, and the receiver's antenna is generally always directed towards the most local, and usually strongest, broadcasting station.

There are two types of potential electromagnetic interference to domestic receivers, depending on the location of the receiver in relation to a wind farm. 'Shadowed' houses are located directly behind a wind farm, relative to the location from where the signal is being received. In this case, the main signal passes through the wind farm and the rotating blades can create a degree of signal scattering. In the case of viewers located beside the wind farm (relative to the broadcast signal direction), the effects are likely to be due to periodic reflections from the blade, giving rise to a delayed signal.

In both cases, i.e. shadowed houses located behind the wind farm and those located to the side of it, the effects of electromagnetic interference may depend to some degree on the wind direction, since the plane of rotation of the rotor will affect both the line-of-sight blockage to viewers located behind the wind farm and the degree of reflection to receivers located to the side.

14.2.3.3 Other Signal Types

Wind turbines have the potential to affect other signal types used for communication and navigational systems, for example tower-to-tower microwave communication links, and airborne and ground radar systems. Interference with radar systems occurs when wind turbines are located close to an airport or directly in line with the instrument landing approach. These effects are generally easily dealt with by detailed micro-siting of turbines in order to avoid alignment with signal paths or by the use of repeater relay links out of line with the wind farm.

14.2.4 Preventing Electromagnetic Interference

14.2.4.1 National Guidelines

Both the adopted 2006 and the Draft Revised 2019 '*Wind Energy Development Guidelines for Planning Authorities'* produced by the Department of the Environment, Heritage and Local Government (DOEHLG) state that interference with broadcast communications can be overcome by the installation of deflectors or repeaters where required.

Developers are advised to contact individual local and national broadcasters and mobile phone operators to inform them of proposals to develop wind farms. This consultation has been carried out by MKO as part of the assessment of the proposed development as summarised below; full details are provided in Section 2.7 in Chapter 2 of this EIAR.

The layout and design of the proposed development has taken into account nearby telecommunications links.

14.2.4.2 Scoping and Consultation

As part of the EIAR scoping and consultation exercise, MKO contacted the relevant national and regional broadcasters, fixed and mobile telephone operators, aviation authorities and other relevant consultees. Consultation was also carried out with ComReg in order to identify any other additional licensed operators in the vicinity of the proposed site to be contacted, who may not have been on the list of main operators.

The responses received from the telecommunications and aviation consultees are summarised below in Table 14.22.

Table 14.24 Telecommunications and Aviation Scoping Responses

Consultee	Response	Potential for Interference Following Consultation Exercise	Action Required	Potential for Interference Following Final Consultation Exercise
Broadcasting Authority of Ireland	Received 10.12.2020	No	N/A	N/a
Computer Zone Ltd	No response received to date	N/A	N/A	N/A
Eir Ltd	Received 25.09.2020	No	N/A	N/A
Electricity Supply Board	No response received to date	N/A	N/A	N/A
Enet Telecommunications	Received 20.08.2020	No Please see Section 14.2.4.2.2 below for details.	N/A	N/A
EOBO Ltd	No response received to date	N/A	N/A	N/A
Imagine Networks Services	Received 20.08.2020	No links within the proposed windfarm location	No	No
Irish Aviation Authority	Received 13.01.2021	Please see Section 14.2.4.2.3 below for details.	N/A	N/A
Ivertec Ltd	Received 14.09.2020	Yes Please see Section 14.2.4.2.2 below for details.	EMI Impact Assessment Study Commissioned. Concluded that no impact likely. Set of mitigation measures identified in the event of interference	No
MP&E Trading Company Ltd/EMR Solutions	Received 24.08.2020	No	N/A	N/A

PermaNET Ltd	No response received to date	N/A	N/A	N/A
Raidio Ciarrai Teoranta L	Received 03.09.2020	No Please see Section 14.2.4.2.1 below for details.	N/A	N/A
RTE Transmission Network (2rn)	Received 09.12.2020	Potential DTT interference. Please see Section 14.2.4.2.1 below for details.	No. Protocol to be agreed if planning granted	No
Shannon Airport	Received 21.01.2021	Please see Section 14.2.4.2.3 below for details.	N/A	N/A
Tetra Ireland Communications (emergency services)	No response received to date	N/A	N/A	N/A
Three Ireland	Received 21.08.2020	No	N/A	N/A
Viatel Ireland Ltd.	No response received to date	N/A	N/A	N/A
Virgin Media Ireland Ltd	Received 08.09.2020	No Please see Section 14.2.4.2.1 below for details.	N/A	N/A
Vodafone Ireland Ltd	Received 25.08.2020	One link crosses western portion of site. Requested buffer from links Please see Section 14.2.4.2.2 below for details.	Link crosses at an altitude that is well above the maximum turbine tip height. There will therefore be no interference	No

The scoping responses from the telecommunications and aviation consultees are described below. Relevant copies of scoping responses are provided in Appendix 2-3.

14.2.4.2.1 Broadcasters

A written response was received from RTÉ Transmission Network Ltd (2RN) on the 9th December, 2020 requesting that a Protocol be signed between the Developer and 2RN should the development go ahead. It is standard practice of 2RN to produce a Protocol Document for wind farm developments. The Protocol Document ensures that in the event of any interference occurring to RTÉ television or radio reception as a direct result of the wind farm, the required measures, as set out in the document, will be carried out so as to rectify this. The Protocol Document ensures that the appropriate mitigation is carried out in the event of unanticipated broadcast interference arising to RTÉ television or radio reception as a result of a proposed development.

In their response dated 9th December 2020, 2RN stated that there would be no impact on fixed microwave linking but there is a risk of interference to DTT (Digital Terrestrial Television) for viewers to the south east of the development receiving their signal from RTÉs site at Knockmoyle and Cnoc an Oir.

Virgin Media replied on the 8th of September 2020 to scoping requests from MKO stating no potential for interference.

Radio Kerry replied on the 3rd September 2020 to scoping requests from MKO noting that they have one link intersecting the proposed development. This link is between Sliabh Mish (Knockmoyle) south of Tralee and Knockanore (Cnoc an Oir) located northeast of Ballybunnion. This link is at an elevation of over 300 metres where it crosses the proposed development and therefore the proposed development will not affect this links.

14.2.4.2.2 Other Operators

Of the scoping responses received from telephone, broadband and other telecommunications operators, those who highlighted an initial potential interference risk are addressed below. The final proposed turbine layout does not overlap with any of the telecoms links or clearance zones requested by operators. The remaining consultees who responded to scoping, operate links either outside the proposed development site, and therefore are not subject to any interference risk, or do not operate any links in the area.

Vodafone Ireland

Vodafone Ireland replied on the 9th December 2020 to a scoping request from MKO, noting one link in the area of the proposed development and requested a minimum 30 metre buffer between the maximum diameter of the '1st Fresnel zone and the rotor blade tip'. This link is at a significantly higher elevation than the proposed turbines and in correspondence dated 21st December 2020 Vodafone confirmed that the link would pass over the top of the proposed turbines with no issues.

Enet

Enet replied on the 19th August 2020 to a scoping request from MKO, noting one link that could be effected by proposed development. This link is at a significantly higher elevation than the proposed turbines and in correspondence dated 20th August 2020 Enet confirmed that the link would pass over the top of the proposed turbines with no issues.

Ivertec

Ivertec replied to a scoping request from MKO on the 14th of September 2020. Ivertec Ltd identified that there would be a significant interference impact caused by the proposed wind farm. They stated that the proposed development could affect approximately 100 customers in their service coverage area.

AI Bridges was commissioned to assess the possible interference impacts that the proposed development could have on the telecommunications networks operated by Ivertec Ltd and to conduct a detailed EMI Impact Assessment of the potential interference impacts on the wireless internet service network. A series of consultations were carried out with Ivertec who operate internet services from telecommunication mast sites at Knockanore, Banemore and Leith.

A detailed technical analysis was carried out to include interference service predictions for the Ivertec wireless internet service that operates from the Knockanore, Banemore and Leith Telecommunications Mast Sites. The technical analysis concluded that there will be no interference impacts from the proposed Ballynagare Wind Farm development on Ivertec's License-Exempt telecommunication network and that no mitigation measures are required.

Based on the findings it can be concluded that there will be no impacts on the Ivertec wireless internet service network. Any potential complaints in the operational phase would have to be screened and validated as Ivertec billing customers. A series of mitigation measures were presented to Ivertec however following a review of the EMI Impact Analysis carried out by Ai Bridges, the recommended mitigation solution would be to re-align subscriber antenna to an alternative Ivertec transmitter site. A copy of the EMI Impact Assessment Study is included as Appendix 14-2 to this EIAR.

14.2.4.2.3 *Aviation*

Irish Aviation Authority

The Irish Aviation Authority (IAA) replied on the 13th January 2021 to a scoping request from MKO. The scoping response noted that, in the event of planning consent being granted, the applicant should be conditioned to contact the Irish Aviation Authority to:(1) agree an aeronautical obstacle warning light scheme for the wind farm development, (2) provide as-constructed coordinates in WGS84 format together with above mean sea level tip height elevations at each wind turbine location, and (3) notify the Authority of intention to commence crane operations with at least 30 days prior notification of their erection.

These requests will be complied with should the proposed development receive a grant of planning permission.

Shannon Airport

Shannon Airport replied on the 21st January 2021 to a scoping request from MKO. The scoping response from Shannon Airport noted that consultation with the IAA should occur.

The scoping response also requested that, should planning permission be granted for the development, the developer would deploy the appropriate obstacle avoidance lighting in accordance with Chapter Q-Visual Aids for Denoting Obstacles CS ADR-DSN.Q.851 I GMI ADR-DSN.Q.851 Marking and Lighting of wind turbines contained in the EASA Easy Access Rules for Aerodromes (Regulation (EU) No. 139/2014).

These requests, and any IAA lighting requirements will be complied with should the proposed development receive a grant of planning permission.

14.2.5 Likely Significant Effects and Associated Mitigation Measures

14.2.5.1 'Do-Nothing' Scenario

The Do Nothing option to developing a wind farm at the proposed development site would be to leave the site as it is, with no changes made to the current land-use practices of low-intensity agriculture and peat harvesting. Should this occur the impact would be neutral in the context of this EIAR.

14.2.5.2 Construction Phase

The potential for electromagnetic interference from wind turbines occurs only during the operational phase of the development. There are no electromagnetic interference impacts associated with the construction phase of the proposed development, and therefore no mitigation required. There will be no direct or indirect effects on telecommunications or aviation.

14.2.5.3 Operational Phase

14.2.5.3.1 *Telecommunications*

Pre-Mitigation Impact

Consultation regarding the potential for electromagnetic interference from the proposed development was carried out with the relevant national and regional broadcasters, fixed line and mobile telephone operators and other operators, which confirmed that no turbines are proposed within the areas requested to be left clear of turbines that relate to fixed point links.

A detailed technical analysis was carried out to include interference service predictions for the Ivertec wireless internet service that operates from the Knockanore, Banemore and Leith Telecommunications Mast Sites. Based on the findings of the technical analysis it was concluded that there will be no impacts on the Ivertec wireless internet service network. Any potential complaints in the operational phase would have to be screened and validated as Ivertec billing customers.

Mitigation Measures

It is standard practice of 2RN to produce a Protocol Document for wind farm developments, which will be signed by the developer. The Protocol Document ensures that in the event of any interference occurring to television or radio reception due to operation of the wind farm, the required measures, as set out in the document, will be carried out by the developer to rectify this. The Protocol Document ensures that the appropriate mitigation is carried out in the event of unanticipated broadcast interference arising to television or radio reception as a result of the proposed wind farm.

Based on the findings of the technical analysis it can be concluded that there will be no impacts on the Ivertec wireless internet service network. In the event that there are impacts on individual subscribers the recommended mitigation solution would be to re-align subscriber antenna to an alternative Ivertec transmitter site.

If necessary, a relay basestation will be deployed at a suitable location in the vicinity of the proposed development (e.g. Ballyheigue, North Kerry) that would provide additional contingency wireless service coverage from Ivertec to service subscribers within the vicinity of the windfarm.

In the event of further scoping responses being received from the EIA consultees, the comments of the consultees and any proposed mitigation measures will be considered in the construction and operation of the proposed development, subject to a grant of planning permission.

Residual Impact

The proposed development will have no residual impact on the telecommunications signals of any other operator, due to distance from or absence of any links in the area.

Significance of Effects

There will be no likely significant direct or indirect effect on telecommunications from the proposed development.

14.2.5.3.2 Aviation

Pre-Mitigation Impact

The scoping responses from the IAA and Shannon Airport should the development be granted planning permission the developer would agree an aeronautical obstacle warning light scheme for the wind farm development, provide as-constructed coordinates in WGS84 format together with above mean sea level tip height elevations at each wind turbine location, and notify the Authority of intention to commence crane operations with at least 30 days prior notification of their erection.

Mitigation Measures

The developer will coordinate with the Irish Aviation Authority (IAA) directly prior to construction to ensure that the development is in compliance with all IAA requirements including lighting requirements and provision of as-constructed coordinates in WGS84 format together with above mean sea level tip height elevations at each wind turbine location. Any further details will be agreed in advance of construction with the Department of Defence, Air Corps and the IAA. The coordinates and elevations for built turbines will be supplied to the IAA, as is standard practice for wind farm developments.

Residual Impact

The proposed development will have no residual impact on aviation as all lighting and other requirements will be met by the applicant.

Significance of Effects

There will be no likely significant direct or indirect effects on aviation operations due to the proposed development.

14.2.5.4 Cumulative Effect

Section 2.7 of this EIAR describes the methodology used in compiling the list of projects considered in the assessment of cumulative effects, and provides a description of each project, including current status. There is one proposed wind farm within 5 kilometres of the proposed development. As the proposed development will not have any direct or indirect effects on telecommunications or aviation, there will be no cumulative impacts relating to the proposed development and surrounding projects in relation to the same. Other permitted developments in the vicinity of the Proposed Development are small in scale and typically related to one-off housing and agriculture. There is no potential for cumulative impacts on telecommunications or aviation relating to the proposed development and other small scale developments in the area.

During the development of any large project that holds the potential to effect telecoms or aviation, the Developer is responsible for engaging with all relevant telecoms operators and aviation authorities to ensure that the proposals will not interfere with television or radio signals by acting as a physical barrier. In the event of any potential impact, the developer for each individual project is responsible for ensuring that the necessary mitigation measures are in place. Therefore, as each project is designed and built to avoid impacts arising, a cumulative impact cannot arise.

14.2.5.5 Conclusion

A comprehensive scoping and consultation exercise was carried out with the main telecommunications operators and aviation bodies, plus other regional operators identified by ComReg as operating within ten kilometres of the Proposed Development site. This impact was mitigated by design, by ensuring the proposed turbine locations were beyond the potential interference zone.

The obstacle warning light scheme required for tall structures by the Irish Air Corps and the Irish Aviation Authority will be agreed ahead of turbine construction, as is standard for permitted wind farms.

The Proposed Development will have no likely significant effects on telecommunications or aviation.

14.3 Other Material Assets

In addition to the material assets discussed above the proposed development may have the potential to impact additional material assets such as water pipes, gas pipelines, and other underground services. Potential impacts to these material assets are limited to the grid connection cable route works and temporary junction accommodation works. Potential impacts to these material assets have been considered in terms of construction phase and operational phase impacts.

14.3.1 Construction Methodology

The construction methodology detailed in Section 4.3 of this EIAR describes the manner in which the grid connection cable will be installed in the curtilage of the public road. Prior to works for the cable grid connection or temporary junction accommodation works, the area where excavations are planned will be surveyed and all existing services identified. All relevant bodies i.e. ESB, Bord Gáis, Eir, Irish Water, Kerry County Council etc. will be contacted and all drawings for all existing services sought.

Any underground services encountered along the cable routes will be surveyed for level and the ducting designed to pass over the service provided adequate cover is available. A minimum clearance of 300 mm is required between the bottom of the ducts and the service in question. Where the clearance can not be achieved the ducting will be designed to pass under the service and again 300 mm clearance between the top of the ducts and bottom of the service will be maintained. All works will be in compliance with the Eirgrid/ESB Networks specifications current at the time of construction.

14.3.2 Likely, Significant Impacts, Associated Mitigation Measures, and Residual Effects

14.3.2.1 Construction Phase

There is the potential for short term nuisance to users of local networks and services that may be accommodated underground within the existing road corridor. The construction of the underground cable grid connection and temporary junction accommodation works will not adversely affect any above ground telecommunications networks, however, there is potential for underground services to be affected during the construction of the underground cabling duct work.

Mitigation Measures

Specific measures for the provision of the proposed cable route and temporary turbine delivery accommodation works to ensure that the construction of these elements will not have any adverse impact on any service networks in the vicinity include the following:

- Any area where excavations are planned will be surveyed and all existing services will be identified prior to commencement of any works.
- Liaison will be held with the relevant sections of the Local Authority including all the relevant area engineers to ensure all services are identified.
- Excavation permits will be completed and all plant operators and general operatives will be inducted and informed as to the location of any services.
- Existing services will be left in-situ and the cable crossed either over or underneath the existing services, thus avoiding disruptions in service.

Residual Impact

The construction methodology for the cable installation, and the mitigation measures described above will ensure that the residual impact of the grid connection construction on telecoms and other services will be at worst brief, imperceptible, and of neutral effect.

Significance of the Effects

Based on the assessment above there will be No likely Significant Effect on telecoms and other services.

14.3.2.2 Operational Phase

There will be no operational phase impacts on telecoms or other services associated with the proposed development as no works will take place near local networks and services during operation.

14.3.2.3 Cumulative In-Combination Effects

The potential cumulative impacts and associated effects between the proposed development and the projects described in Section 2.7 of this EIAR, hereafter referred to as the other projects, have been considered in terms of telecoms and other services.

The measures outlined in Section 14.3.2.1 above eliminated any potential for cumulative effects in relation to other services during the construction phases of the proposed development and the other projects.

As there are no operational phase impacts on telecoms and other associated services, there will be no cumulative operational phase effects in relation to telecommunications and other services.

15. INTERACTION OF EFFECTS

15.1 Introduction

The preceding Chapters 5 to 14 of this EIAR identify the potential significant environmental effects that may occur in terms of Population and Human Health, Biodiversity (Flora and Fauna) Ornithology (Birds), Land, Soils and Geology, Water (Hydrology and Hydrogeology), Air and Climate, Noise and Vibration, Landscape and Visual, Cultural Heritage (Archaeological, Architectural and Cultural Heritage) and Material Assets (Roads and Traffic, Telecommunications and Aviation), as a result of the proposed development as described in Chapter 4 of this EIAR. All of the potential significant effects of the proposed development and the measures proposed to mitigate them have been outlined in the preceding chapters of this EIAR. However, for any development with the potential for significant environmental effects there is also the potential for interaction between these potential significant effects. The result of interactive effects may exacerbate the magnitude of the effects or ameliorate them, or have a neutral effect.

A matrix is presented in Table 15.1 below to identify potential interactions between the various aspects of the environment already assessed in this EIAR. The matrix highlights the occurrence of potential positive or negative effects during both the construction (C) and operational (O) phases. It is considered that the potential effects during the decommissioning phase will be similar to the construction phase effects but of a lesser magnitude. The matrix is symmetric, with each environmental component addressed in the chapters of this EIAR being placed on both axes of a matrix, and therefore, each potential interaction is identified twice.

Table 15.1 Interaction Matrix: Potential for Interacting Impacts

	Phase	Population and Human Health	Biodiversity, Flora and Fauna	Ornithology	Land, Soils and Geology	Water	Air and Climate	Noise and Vibration	Landscape and Visual	Cultural Heritage	Material Assets
Population and Human Health	C										
	O										
Biodiversity, Flora and Fauna	C										
	O										
Ornithology, Birds	C										
	O										
Land, Soils and Geology	C										
	O										
Water	C										
	O										
Air and Climate	C										
	O										
Noise and Vibration	C										
	O										
Landscape and Visual	C										
	O										
Cultural Heritage	C										
	O										
Material Assets	C										
	O										

Legend: **No Interacting Effect:** **Positive Effect:** **Neutral Effect:** **Negative Effect:**

The potential for interaction of effects has been assessed as part of the Impact Assessment process. While the work on all parts of the Environmental Impact Assessment Report (EIAR) were not carried out by MKO, the entire project and all the work of all sub-consultants was managed and coordinated by the company. This EIAR was edited and collated by MKO as an integrated report of findings from the impact assessment process, by all relevant experts, and effects that potentially interact have been assessed in detail in the individual chapters of the EIAR above and summarised in Section 15.2 below.

Where any potential negative impacts have been identified during the assessment process, these impacts have been avoided by design or reduced by the proposed mitigation measures, as presented throughout the EIAR.

15.1.1 Statement of Authority

This chapter of the EIAR was completed by Thomas Blackwell and Michael Watson. Thomas Blackwell is a Senior Environmentalist with MKO with over 16 years' of progressive experience in environmental consulting. Thomas holds a BA (Hons) in Geography from Trinity College Dublin and a M.Sc. in Environmental Resource Management from University College Dublin. Michael Watson is Project Director and head of the Environment Team in MKO. Michael has over 19 years' experience in the environmental sector. Following the completion of his Master's Degree in Environmental Resource Management, Geography, from National University of Ireland, Maynooth he worked for the Geological Survey of Ireland.

15.2 Interactions

15.2.1 Population and Human Health

Population and Human Health, Air and Climate, and Noise

As identified in Chapter 5 of this EIAR, the construction phase has the potential to create a short-term, negative effect on human health due to the nuisance caused by construction plant and vehicle noise emissions, should the mitigation measures outlined in Chapter 11 not be implemented.

During the operational phase the proposed development has the potential to generate noise but as identified in Chapter 11, this will be at acceptable levels.

During the operational phase, the energy generated by the proposed development will offset energy and the associated emission of greenhouse gases from electricity-generating stations dependent on fossil fuels, thereby having a positive effect on climate (i.e. slowing the rate of global warming). In doing so, there will likely be reduced effects from climate change on human health over the 'do-nothing' scenario and continuing to generate energy using fossil fuels.

Population and Human Health, Land, Soils and Geology Air and Climate

The excavation and movement of peat and spoil during the construction phase of the proposed development has the potential to create dust emissions which, consequently, have the potential to have a temporary, slight, negative effect on local air quality and human health. Mitigation measures to reduce dust emissions generated during the construction phase of the proposed development are presented in Chapter 10.

Population and Human Health and Water

As described in Chapter 9 of this EIAR, the construction phase of the proposed development has the potential to give rise to some water pollution as a result of site activities, and any water pollution could have a potential significant negative effect on the health of other users of that water within the catchment. Mitigation measures are presented in Chapter 9 to minimise the risk of any such issues.

Population and Human Health, and Material Assets

Chapter 14 of this EIAR discusses how the construction phase of the project will give rise to traffic movements of abnormal loads and increased traffic volumes on the local road network and, therefore, is likely to create some short-term inconvenience for other road users. In addition, construction of the proposed grid connection cable route will also potentially give rise to a short-term inconvenience to road users. A Traffic Management Plan will be in place to minimise all disruption insofar as possible, as described in the Construction and Environmental Management Plan (see Appendix 4.2).

Population and Human Health, and Landscape and Visual

The construction phase of the proposed development will see the temporary introduction of construction machinery and the erection of wind turbines into a natural, but already modified landscape. The erection of the turbines in particular will change the existing landscape. Whether the long-term change in landscape created by the erection of the turbines is deemed to be positive or negative is a subjective matter. What appears to be a positive visual effect to one viewer could be deemed to be a negative effect by another viewer. The landscape and visual impact assessment of the proposed development, included as Chapter 13 of this EIAR, concludes that, from 16 viewpoints assessed, the residual visual effect will be moderate from three locations and ranges from imperceptible to slight at the remaining locations. Therefore, there will be no significant effect on populations and human health resulting from visual and landscape effects.

15.2.2 Biodiversity

Biodiversity and Land, Soils and Geology

The extraction of rock onsite for use as part of the proposed development will give rise to habitat loss and some disturbance of fauna in the areas surrounding the proposed borrow pit. In addition, the removal of overburden and peat is likely to result in some disturbance of flora and fauna in non-designated areas surrounding the proposed works area thereby, potentially causing a long term, slight, negative effect on flora and fauna. Excavated peat and spoil will be stored in on-site peat repositories and used to refill the borrow pit post construction.

Biodiversity and Water

Site activities during the construction phase have the potential to give rise to some water pollution, and consequential indirect effects (such as disturbance and deterioration of habitat quality) on flora and fauna that use that water within the same catchment. The site activities during the construction phase, and continuing on for the operational phase, will give rise to additional localised drainage impacts, which has the potential to have a significant, long term, negative effect on flora and their associated habitats should the appropriate measures not be implemented. These potential impacts have been assessed in Chapter 6 and Chapter 9 of this EIAR, and the relevant mitigation measures will be in place to avoid any water pollution and subsequent effect on flora and fauna.

Biodiversity and Air and Climate

During the operational phase, the proposed development will help offset carbon emissions from fossil fuel based electricity generation plants, which will help contribute to a slower increase in the rate of global warming and a reduction in air pollution and, consequently, could in combination with other renewable energy projects, have a long term, significant positive effect on flora and fauna.

Biodiversity and Noise and Vibration

Site activity during the construction phase could give rise to noise that could be a nuisance for fauna, thereby having a temporary, slight, negative effect.

Biodiversity and Landscape

The removal of some vegetation within the development footprint and surrounding areas is likely to result in a change to the visual landscape during the construction phase, which will become part of the normal landscape of the wider area for the duration of the operational phase. The visual effect of this change is considered to be long-term, localised and slight.

15.2.3 Ornithology

Ornithology and Water

Site activities during the construction phase have the potential to give rise to some water pollution, and consequential indirect effects on birds and their prey species (such as disturbance and deterioration of habitat quality) that use that water within the same catchment. The site activities during the construction phase, and continuing on for the operational phase, are likely to give rise to additional localised drainage impacts, which has the potential to have a slight, negative effect on the habitats of particular bird species and subsequently a slight, long term, negative effect on ornithology should the measures outlined in Chapter 9 of this EIAR not be implemented.

Birds and Air and Climate

During the operational phase, the proposed development will help offset carbon emissions from fossil fuel based electricity generation plants, which will help contribute to a slower increase in the rate of global warming and, consequently, could in combination with other renewable energy projects, contribute to preventing the loss of bird species from Ireland as a result of climate change.

Birds and Noise and Vibration

Site activity during the construction phase could give rise to noise that could be a nuisance for birds that use the site, therefore, causing a temporary, slight, negative effect on ornithology. Best practice mitigation measures are included in Chapter 11 to minimise the potential negative effect of noise generated during the construction phase on ornithology.

15.2.4 Land, Soils and Geology

Land, Soils and Geology and Water

As identified in Chapter 9 of this EIAR, the movement and removal of peat and spoil during the construction phase has the potential to have a significant, negative effect on water quality. Mitigation measures to ensure there are no significant, negative effects on water quality are presented in Chapter 9.

Land, Soils and Geology and Archaeological, Architectural and Cultural Heritage

The removal of peat and spoil during the construction phase has the potential to have a permanent, significant, negative effect on previously unrecorded sub-surface archaeological site and artefacts. Mitigation measures outlined in Chapter 12 will reduce the potential for negative effects on unrecorded sites and artefacts during excavations.

Land, Soils and Geology and Landscape and Visual

The removal of peat and spoil and the subsequent replacement with crushed stone for the construction of site roads and hardstanding areas within the proposed development site has the potential to alter the local landscape. The visual effect of this change is expected to be long term, localised in nature and slight.

15.2.5 Air and Climate

Air and Climate and Material Assets

The movement of construction vehicles both within and to and from the site has the potential to give rise to dust nuisance effects during the construction phase. This is assessed further in Chapter 10 of this EIAR, and mitigation measures are presented to minimise any potential effects.

15.2.6 Landscape and Visual

Landscape and Visual and Cultural Heritage

As described in Chapter 13 of this EIAR, the proposed development has the potential to change the landscape setting of recorded sites and monuments in the wider area and, therefore, potentially having an indirect, long term, not significant to moderate, negative effect on archaeological, architectural and cultural heritage.

15.3 Mitigation and Residual Impacts

Where any potential interactive negative impacts have been identified in the above, a full suite of appropriate mitigation measures has already been included in the relevant sections (Chapters 5-14) of the EIAR. The implementation of these mitigation measures will reduce or remove the potential for these effects. Information on potential residual impacts and the significance of effects, is also presented in each relevant chapter. Proposed mitigation measures are summarised in Chapter 16 of this EIAR.

16. SCHEDULE OF MITIGATION AND MONITORING PROPOSALS

16.1 Introduction

All mitigation and monitoring measures relating to the pre-commencement, construction, operational and decommissioning phases of the Proposed Development are set out in the relevant chapters of this EIAR.

All mitigation which will be implemented during the various phases of the project are presented in Table 16-1 below. The mitigation measures have been grouped together according to their environmental field/topic and are presented under the following headings:

- Construction Management
- Drainage Design and Management
- Peat, subsoils and bedrock
- Biodiversity
- Noise and Vibration
- Air Quality/Dust
- Cultural Heritage
- Traffic

The mitigation proposals in the below format provides an easy to audit list that can be reviewed and reported on during the future phases of the project. The proposal for site inspections and environmental audits are set out in the Construction and Environmental Management Plan (CEMP) which is included as Appendix 4-2 of this EIAR. The tabular format in which the below information is presented, can be further expanded upon during the course of future project phases to provide a reporting template for site compliance audits.

All monitoring measures which will be implemented during the pre-commencement, construction, operational and decommissioning phases of the project are outlined in Table 16-2. All monitoring measures were set out in the relevant chapters of this EIAR. The monitoring proposals are presented in terms of the monitoring requirement, frequency of monitoring and the mechanism for reporting results where applicable. By presenting the monitoring proposals in the below format, it is intended to provide a monitoring schedule that can be reviewed and tracked during all phases of the project to ensure all the required monitoring is completed as required.

It is intended that the CEMP will be updated where required prior to the commencement of construction to include all mitigations and monitoring measures, conditions and or alterations to the EIAR and application documents should they emerge during the course of the planning process and would be submitted to the Planning Authority for written approval.

16.2 EIAR Mitigation Measures

Table 16-1 Schedule of Mitigation

Ref. No.	Reference Location	Mitigation Measure	Audit Result	Action Required
Pre-Commencement Phase				
MM1	EIAR Section 4	The removal and disposal of wastewater from the site will be carried out by a fully permitted waste collector holding valid Waste Collection Permits as issued under the Waste Management (Collection Permit) Regulations, 2007. Information on the appointed permitted contractor and evidence of a maintenance contract will be submitted to the Planning Authority prior to any construction works taking place.		
MM2	EIAR Section 4	All site activities will be provided for in an Environmental Management Plan, prepared prior to the commencement of any operations onsite. The environmental management plan will set out all measures necessary to ensure works are carried out in accordance with the mitigation measures set out in the EIAR and will set out the monitoring and inspections procedures and frequencies.		
MM3	EIAR Section 4 CEMP Section 4	An ECoW will oversee the site works and implementation of the Environmental Management Plan and provide on-site advice on the mitigation measures as necessary to ensure the project proceeds as intended. The level, detail and frequency of reporting expected from the ECoW for the Construction Manager, developer's project manager, and any Authorities or other Agencies, will be agreed by all parties prior to commencement of construction, and may be further adjusted as required during the course of the project.		
MM4	EIAR Section 4	The arrangements for concrete deliveries to the site will be discussed with suppliers before work starts, agreeing routes, prohibiting on-site washout and discussing emergency procedures.		
MM5	CEMP Section 3	The Project Hydrologist/Design Engineer will assist in preparing a site drainage plan before construction commences.		

MM6	CEMP Section 3	All materials and equipment necessary to implement the drainage mitigation measures will be brought on-site in advance of any works commencing. The drainage measures outlined in the EIAR will be installed prior to, or at the same time as the works they are intended to drain. An adequate amount of clean stone, silt fencing, stakes, etc. will be kept on site at all times to implement the drainage design measures as necessary.		
MM7	CEMP Section 3	The works programme for the groundworks part of the construction phase of the project will also take account of weather forecasts and predicted rainfall in particular.		
MM8	CEMP Section 3	Prior to commencement of works in sub-catchments across the site main drain inspections will be competed to ensure ditches and streams are free from debris and blockages that may impede drainage.		
MM9	EIAR Section 4	An inspection and maintenance plan for the drainage system on site will be prepared in advance of commencement of any works. Regular inspections of all installed drainage systems will be necessary, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water at parts of the systems where it is not intended. The inspection of the drainage system will be the responsibility of the site Environmental Clerk of Works or the supervising hydrologist.		
MM10	EIAR Section 4 CEMP Section 3	Culverts will be installed at locations where streams or natural drainage channels cross the new access track route. All works involving culverts, whether they are new, upgraded or extended, will be carried out to follow a method statement to be agreed with Inland Fisheries Ireland.		
MM11	EIAR Section 4 CEMP Section 3	All materials and equipment necessary to implement the drainage mitigation measures will be brought on-site in advance of any works commencing. The drainage measures outlined in the EIAR will be installed prior to, or at the same time as the works they are intended to drain. An adequate amount of straw bales, clean stone, terram, stakes, etc. will be kept on site at all times to implement the drainage design measures as necessary.		

MM12	EIAR Section 4 CEMP Section 3	The works programme for the ground works part of the construction phase of the project will also take account of weather forecasts, and predicted rainfall in particular.		
MM13	EIAR Section 4 CEMP Section 3	The ECoW or supervising hydrologist will respond to changing weather, ground or drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained in so far as is possible. This may require the installation of additional check dams, interceptor drains or swales as deemed necessary on-site.		
MM14	EIAR Section 4	All discharges from the proposed works areas or from interceptor drains will be made over vegetated ground at a minimum of 50 metres distance from natural watercourses, or directly into artificial drainage ditches but only after silt traps, check dams and/or stilling ponds have been added to these drainage ditches.		
MM15	EIAR Section 7	The removal of woody vegetation will be undertaken in full compliance with Section 40 of the Wildlife Act 1976 – 2018. Where sections of woody vegetation are removed for the purposes of the junction and road upgrades, these will be replaced with suitable hedge/tree species which are common in the local context		
MM16	EIAR Section 7	Works will commence outside the bird nesting season (1st of March to 31st of August inclusive).		
MM17	EIAR Section 6, 7	The footprint of the Proposed Development will be clearly marked out and fenced off prior to works commencing by a qualitied ecologist. There will be no access to the wider woodland area. All machinery will work from the existing access road corridor. Vegetation removal will be conducted in line with the provisions of the Wildlife Act.		

MM18	EIAR Section 6 CEMP Section 3	A pre-construction invasive species survey will be undertaken a part of the proposed project. This will provide updated data in advance of any construction given the intervention time period between the original survey work and any future grant of permission/ construction. Measures will be in place to prevent the spread of these species during the proposed works. In addition, all necessary precautions will be taken to prevent the introduction of invasive species to the site from elsewhere.		
MM19	EIAR Section 4 CEMP Section 9	The procedures for the implementation of the mitigation measures outlined in such an EMP and their effectiveness and completion is typically audited by way of an Environmental Management Plan Audit Report. The EMP Audit Report effectively lists all mitigation measures prescribed in any of the planning documentation and any further mitigation measures proposed during the detailed design stage and allows them to be audited on a systematic and regular basis.		
MM20	EIAR Section 12	Two Bridges (CH8 and CH9) Poulboy Bridge and MacElligot's Bridge are adjacent to the proposed road which extends in a south-easterly direction to the proposed borrow pit and substation. No impacts to the bridges are anticipated.		
MM21	EIAR Section 12	▪ Pre-development testing (licensed by the National Monuments Service - NMS) in areas where peat depths allow a meaningful investigation. Testing should only be undertaken in areas where ground disturbance will take place as part of the development. For example, if roads are proposed to be floated, testing would not be required. Where peat depths become a limitation to testing, monitoring at the construction stage should be undertaken. The areas to be tested will be chosen by the appointed archaeologist and the number of test trenches agreed between the archaeologist and the National Monuments Service (NMS) through the licensing system. Peat depth data and local ground conditions may dictate the number and location of test trenches to be excavated. ▪ Licensed archaeological monitoring of the proposed roads, internal cable, passing bays and entrances during the construction phase of the development should be undertaken. If archaeological finds, features or deposits are uncovered during		

		archaeological monitoring, the NMS will be informed of such findings and a method statement for the resolution of the archaeology will be provided, where relevant. The developer will be prepared to provide resources for the resolution of such features whether by preservation by record (excavation) or preservation in situ (avoidance). A report on the results of the monitoring will be compiled and submitted to the relevant authorities on completion of the project.		
Construction Phase				
Construction Management				
MM22	EIAR Section 4 CEMP Section 3	On-site refuelling will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site, and will be towed around the site by a 4x4 jeep to where machinery is located. It is not practical for all vehicles to travel back to a single refuelling point, given the size of the cranes, excavators, etc. that will be used during the construction of the proposed wind farm development. The 4x4 towing vehicle will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction when not in use.		
MM23	EIAR Section 4 CEMP Section 3	No batching of wet-cement products will occur on site. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place. Only ready-mixed concrete will be used during the construction phase, with all ready-mixed concrete being delivered from local batching plants in sealed concrete delivery trucks.		
MM24	EIAR Section 4 CEMP Section 3	No washing out of any plant used in concrete transport or concreting operations will be carried out onsite. When concrete is delivered to site, only the chute of the delivery truck will be cleaned, using the smallest volume of water necessary, before leaving the site. Concrete trucks will be directed back to their batching plant for washout.		
MM25	EIAR Section 4	No concrete will be transported around the site in open trailers or dumpers so as to avoid spillage while in transport.		

MM26	EIAR Section 4	Clearly visible signs in prominent locations will be placed close to concrete pour areas specifically stating washout of concrete lorries is not permitted on the site		
MM27	EIAR Section 4	All concrete used in the construction of turbine bases will be poured directly into the shuttered formwork from the delivery truck. If this is not practical, the concrete will be poured from the delivery truck into a hydraulic concrete pump or into the bucket of an excavator, which will transfer the concrete to the location where it is needed.		
MM28	EIAR Section 4	Main pours will be planned days or weeks in advance. Large pours will be avoided when prolonged periods of heavy rain are forecast.		
MM29	EIAR Section 4	Concrete pumps and machine buckets will be restricted from slewing over watercourses while placing concrete.		
MM30	EIAR Section 4	Excavations will be sufficiently dewatered before concreting begins. Dewatering will continue while concrete sets.		
MM31	EIAR Section 4	Covers will be available for freshly placed concrete to avoid the surface washing away in heavy rain.		
MM32	EIAR Section 4	Surplus concrete after completion of a pour will be used elsewhere at suitable locations around the site where it is required.		
MM33	EIAR Section 4 CEMP Section 3	If necessary, water will be taken from settlement ponds in the site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and site compounds to prevent the generation of dust. Silty or oily water will not be used for dust suppression.		
MM34	CEMP Section 3	All construction related traffic will have speed restrictions on un-surfaced roads to 20 kph.		

MM35	CEMP Section 3	The following additional mitigation measures will be adopted to reduce the generation of dust associated with Borrow Pit activities ○ Compact, grade and maintain internal haul roads. This will ensure that the level of surface dust is kept do a minimum particularly when periods of dry weather occur. ○ Use water sprays as a dust suppression measure during periods of dry weather. ○ All crushing and screening equipment should be used within its design capacity with regular maintenance checks carried out. ○ The height from which material drops should be minimised to reduce dust generation. This is most relevant where rock is being processed to ensure crushed material is not dropping from a height which will increase the volume of dust generation. ○ Maintain speed limits on haul roads and reduce during dry spells where dust volumes are likely to be higher. Drilling equipment should be fitted with dust extractors and collectors if blasting is used as an extraction method.		
MM36	EIAR Section 4	A temporary screening berm will be installed at the perimeter of the borrow pit. This will reduce any potential impact from dust generation associated with rock extraction.		
MM37	EIAR Section 4	A road sweeper will be available if any section of the public roads were to be dirtied by trucks associated with the proposed development.		
MM38	EIAR Section 5	During construction of the proposed development, all staff will be made aware of and adhere to the Health & Safety Authority's *'Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2006'*. This will encompass the use of all necessary Personal Protective Equipment and adherence to the site Health and Safety Plan		
MM39	CEMP Section 2	Any area where excavations are planned will be surveyed and all existing services will be identified prior to commencement of any works. Liaison will be held with the relevant sections of the Local Authority including all the relevant area engineers to ensure all services are identified. Excavation		

		permits will be completed and all plant operators and general operatives will be inducted and informed as to the location of any services.		
Drainage Design and Management				
MM40	EIAR Section 9 CEMP Section 3	Where possible, a 50-metre buffer zone will be maintained around watercourses during the windfarm construction. With the exception of access roads, road crossings of streams and associated culvert construction, no development infrastructure, vehicle or plant movement, construction activity or stock-piling of construction materials or construction waste will take place within this zone, and no vegetation will be removed from within this zone. Many of the proposed access roads cross mapped drains/streams requiring control measures, which are outlined further on in this section. These control measures will be implemented at the proposed watercourse and drain crossings and where the roads run parallel and in close proximity to drains.		
MM41	EIAR Section 4 CEMP Section 3	Swales will be used to intercept and collect run off from construction areas of the site during the construction phase, and channel it to settlement ponds for sediment attenuation.		
MM42	EIAR Section 4 CEMP Section 3	Interceptor drains will be installed upgradient of any works areas to collect surface flow runoff and prevent it reaching excavations and construction areas of the site. It will then be directed to areas where it can be re-distributed over the ground as sheet flow.		
MM43	EIAR Section 4 CEMP Section 3	Check dams will not be used in any natural watercourses, only artificial drainage channels and interceptor drains. The check dams will be left in place when the interceptor drains are backfilled at the end of the construction phase to limit linear flow in the backfilled drain. The check dams will be installed at regular intervals along interceptor drains to restrict flow velocity, minimise channel erosion and promote sedimentation behind the dam. The check dams will be installed as the interceptor drains are being excavated. The spacing and frequency of the check dams will be dependent on the gradient of the interceptor drain or swale in which they are being installed.		

MM44	EIAR Section 4	A level spreader will be constructed at the end of each interceptor drain to convert concentrated flows in the drain into diffuse sheet flow on areas of vegetated ground. The levels spreaders will be located downgradient of any works areas in locations where they are not likely to contribute further to water ingress to construction areas of the site. They will also be emplaced at end of swales carrying discharge from settlement ponds. The level spreaders will distribute clean drainage water onto vegetated areas where the water will not be re-concentrated into a flow channel immediately below the point of discharge. The discharge point will be on level or only very gently sloping ground rather than on a steep slope so as to prevent erosion. No drains will discharge directly to surface waters.		
MM45	EIAR Section 4	Vegetation filters, that is areas of existing vegetation, accepting drainage water issuing from level spreaders as sheet flow, will remove any suspended sediment from water channelled via interceptor drains or any remaining sediment in waters channelled via swales and settlement ponds.		
MM46	EIAR Section 4	Settlement ponds, placed either singly or a pair in series, will buffer volumes of run-off discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to water courses. Settlement ponds will be designed to retain the volume associated with a 1 in 50-year return period rainfall event. The embankment that forms the sloped sides of the settlement ponds will be stabilised with vegetated turves, which will have been removed during the excavation of the settlement ponds area.		
MM47	EIAR Section 4 EIAR Section 6	A siltbuster or similar equivalent piece of equipment will be available if required to filter any water pumped out of excavation areas, prior to its discharge to settlement ponds or swales. This includes turbine base excavations and borrow bit excavations. This water is likely to have a high sediment load and will be directed via swales to settlement ponds after treatment in the unit.		
MM48	EIAR Section 4 CEMP Section 3	Culverts will be installed at locations where streams or natural drainage channels cross the new access track route. All works involving culverts, whether they are new, upgraded or extended, will be carried out to follow a method statement to be agreed with Inland Fisheries Ireland.		

MM49	EIAR Section 4	Silt fences will be installed along the routes of existing watercourses or drainage ditches where site roads pass over the watercourses, immediately downstream of the construction area. Silt fences will be installed along a level contour, so water does not pond more than 400 mm at any point. The silt fence will be trenched at least 500 mm into the ground and will be stretched tight between the posts. The fences will not be allowed to sag or break away from the fence posts. During the near stream construction work double silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase.		
MM50	EIAR Section 8	Mitigation measures which will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses comprise best practice methods will be implemented		
MM51	EIAR Section 4 CEMP Section 3	The works programme for the groundworks part of the construction phase of the project will also take account of weather forecasts, and predicted rainfall in particular.		
MM52	EIAR Section 4 CEMP Section 3	The effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treat silt-laden water from the works areas, will be monitored continuously by the ECoW or supervising hydrologist on-site. The ECoW or supervising hydrologist will respond to changing weather, ground or drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained in so far as is possible. This may require the installation of additional check dams, interceptor drains or swales as deemed necessary on-site.		
MM53	EIAR Section 4 CEMP Section 2,3	Material excavated to create the working area will be stored locally for later reuse in backfilling the working area around the turbine foundation. The excavated material will be covered with polythene sheets or sealed with the excavator bucket and surrounded by silt fences to ensure sediment-laden run-off does not occur where appropriate.		

MM54	EIAR Section 9	A constraints zone will be identified and implemented at each crossing location during construction. The purpose of the constraint zone is to: ○ Avoid physical damage to surface water channels; ○ Provide a buffer against hydraulic loading by additional surface water run-off; ○ Avoid the entry of suspended sediment and associated nutrients into surface waters from excavation and earthworks; ○ Provide a buffer against direct pollution of surface waters by pollutants such as hydrocarbons; and, ○ Avoid storage of construction plant materials used during construction and chemicals or waste associated with temporary on–site sanitary facilities.		
Peat, Subsoils and Bedrock				
MM55	CEMP Section 3	General recommendation for good construction practice to minimise the risk of construction activity causing potential peat instability are outlined in Section 3.6 of the CEMP.		
MM56	EIAR Section 4 CEMP Section 2	Peat removed from turbine locations will be transported to the designated peat reinstatement areas.		
MM57	EIAR Section 4	Any excess mounded peat in temporary storage for long periods will be digger-bucket sealed and covered with polyethylene sheets or reseeded at the earliest opportunity.		
MM58	EIAR Section 4	In order to minimise runoff during the construction phase, stripping of peat should not take place during excessively dry weather (to prevent dust generation) or extremely wet periods (to prevent increased silt rich runoff).		
MM59	EIAR Section 4	Bog mats and brash mats will be used where necessary to support vehicles on soft ground, reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal should take place when they become heavily used and worn. Provision should be made for brash mats along all off-road routes, to protect the soil from compaction and rutting.		

MM60	EIAR Section 8 CEMP Section 3	The following issues incorporated into the construction phase of the project will assist in the management of the risks for this site (FT, 2020): • Appointment of experienced and competent contractors; • The site should be supervised by experienced and qualified personnel; • Allocate sufficient time for the project (be aware that decreasing the construction time has the potential to increase the risk of initiating a peat movement); • Prevent undercutting of slopes and unsupported excavations; • Maintain a managed robust drainage system; • Prevent placement of loads/overburden on marginal ground; • Set up, maintain and report findings from monitoring systems; • Ensure construction method statements are followed or where agreed modified/ developed; and, • Revise and amend the Geotechnical Risk Register as construction progresses.		
Flora and Fauna				
MM61	EIAR Section 7	The footprint of the Proposed Development will be clearly marked out and fenced off prior to works commencing by a qualitied ecologist. There will be no access to the wider woodland area. All machinery will work from the existing access road corridor. Vegetation removal will be conducted in line with the provisions of the Wildlife Acts 1976-2021		
MM62	EIAR Section 7	Construction works along the c. 0.2km section of the proposed cable route within the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA will be undertaken outside the bird breeding season (1st of March to the 31st of August inclusive)		
MM63	EIAR Section 7	If bird breeding activity of species of conservation concern are identified during the works, the nest sites will be located, and no works shall be undertaken within 500m buffer in line with industry best practise.		
MM64	EIAR Section 6	Hedgerow will be replanted along an internal farm trackway within the proposed development site which will be of a greater length than that which will be lost and will ensure that there are no long-term negative effects. The additional planting will result in a biodiversity net gain.		

MM65	EIAR Section 6	The following measures will be undertaken for the avoidance of disturbance/displacement and direct mortality will be implemented during the construction phase of the proposed development: • An exclusion zone around the sett will be maintained for the duration of the construction works. No works will be undertaken within 100m of the sett. • All of the above works will be undertaken or supervised by an appropriately qualified ecologist. To protect individual badgers during the construction phase of the proposed development, all open excavations on site will be covered when not in use and backfilled as soon as possible. Excavations will also be covered at night and any deep excavations left open will have appropriate egress ramps in place to allow mammals to safely exit excavations should they fall in.		
MM66	EIAR Appendix 6-2	Noise Disturbance During the construction phase, plant machinery will be turned off when not in use and all plant and equipment for use will comply with the Construction Plant and Equipment Permissible Noise Levels Regulations (SI 359/1996). Lighting Disturbance Where lighting is required, directional lighting will be used to prevent overspill on to woodland/forestry edges. This will be achieved using lighting accessories, such as hoods, cowls, louvers and shields, to direct the light to the intended area only.		
MM67	EIAR Appendix 6-2	Bat Buffers Felling of coniferous plantation will be conducted during the construction phase to facilitate the required bat buffers surrounding turbines located within or at the edge of conifer forestry habitats.		
MM68	EIAR Section 7	The removal of woody vegetation will be undertaken in full compliance with Section 40 of the Wildlife Act 1976 – 2018. The removal of wetland vegetation and clearance/cutting of hedges and trees will be undertaken outside the breeding season (i.e. outside of the 1st of March and the 31st of August) including along the cable route.		
MM69	CEMP Section 3	Measures will be in place to prevent the spread of these species during the proposed works. In addition, all necessary precautions will be taken to prevent the introduction of invasive species to the site from elsewhere. Best practice measures in relation to invasive species are described below: › All earthworks machinery will be thoroughly pressure-washed prior to arrival on site and prior to their further use elsewhere. › Care will be taken not to disturb or cause the movement of invasive species fragments, either intentionally or accidentally.		

		- Stands of Rhododendron will be clearly demarcated by temporary fencing and tracking within them will be strictly avoided. - Good construction site hygiene will be employed to prevent the spread of these species with vehicles thoroughly cleaned down prior to leaving any site with the potential to have supported invasive species. All plant and equipment employed on the construction site (e.g. excavator, footwear, etc.) will be thoroughly cleaned down on site to prevent the spread of invasive plant. All clean down must be undertaken in areas with no potential to result in the spread of invasive species. - Any material that is imported onto any site will be verified by a suitably qualified ecologist to be free from any invasive species listed on the 'Third Schedule' of Regulations 49 & 50 of Regulations 49 and 50 of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477 of 2011). This will be carried out by searching for rhizomes and plant material. The treatment and control of invasive alien species will follow guidelines issued by the National Roads Authority. The Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads (NRA 2010).		
Noise				
MM70	EIAR Section 11	Equipment will be sensitively located, away from sensitive properties, taking account of local topography and natural screening.		
MM71	EIAR Section 11	All construction work will be restricted to the specified working hours. Any construction work carried out outside of these hours shall be restricted to activities that will not generate noise of a level that may cause a nuisance.		
MM72	EIAR Section 11	Plant will be selected taking account of the characteristics of noise emissions from each item. All plant and machinery used on the site shall comply with E.U. and Irish legislation in relation to noise emissions. The timing of on- and off-site movements of plant near occupied properties will be controlled.		
MM73	EIAR Section 11	The contract documents will clearly specify that the Contractor undertaking the construction of the works will be obliged to adhere to the following noise abatement measures: - No plant used on site will be proposed to cause an on-going public nuisance due to noise.		

		○ The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations. ○ All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract. ○ Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers. ○ Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use. ○ Any plant, such as generators or pumps, which is required to operate near any sensitive receptors before 07:00hrs or after 19:00hrs will be surrounded by an acoustic enclosure or portable screen. ○ Residents will be notified in advance of all blasting schedules. During the course of the construction programme, supervision of the works will include ensuring compliance with the limits detailed in Table 12.10 using methods outlined in BS 5228 "*Noise and Vibration Control on Construction and open sites*".		
MM74	EIAR Section 11	All construction operations shall comply with guidelines set out in British Standard documents *'BS 5338: 'Code of Practice for Noise Control on Construction and Demolition Sites'* and *'BS5228: Part 1: 1997: Noise & Vibration Control on Construction and Open Sites'.*		
Air Quality and Dust				
MM75	EIAR Section 4 CEMP Section 3 EIAR Section 10	○ All plant and materials vehicles shall be stored in dedicated areas (on-site). ○ Areas of excavation will be kept to a minimum, and stockpiling will be minimised by coordinating excavation, spreading and compaction. ○ Turbines and construction materials will be transported to the site on specified haul routes only. ○ The agreed haul route roads adjacent to the site will be regularly inspected for cleanliness and cleaned as necessary. ○ The transport of construction materials to the site that have significant potential to cause dust, will be undertaken in tarpaulin or similar covered vehicles where necessary. ○		

MM76	EIAR Section 10	All construction machinery will be maintained in good operational order while on-site, minimising any emissions that are likely to arise.		
MM77	EIAR Section 10	In periods of extended dry weather, dust suppression may be necessary along haul roads and around the borrow pit area to ensure dust does not cause a nuisance. If necessary, water will be taken from settlement ponds in the site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and site compounds to prevent the generation of dust. Silty or oily water will not be used for dust suppression, because this would transfer the pollutants to the haul roads and generate polluted runoff or more dust. Water bowser movements will be carefully monitored, as the application of too much water may lead to increased runoff.		
Traffic				
MM78	EIAR Section 14	A comprehensive set of mitigation measures will be put in place before and during the construction stage of the project in order to minimise the effects of the additional traffic generated by the Proposed Development. For delivery of abnormal sized loads - The following are the main points to note for these deliveries which will take place after peak evening traffic: o The delivery of turbine components is a specialist transport operation with the transportation of components carried out at night when traffic is at its lightest and the impact minimised. o The deliveries will be made in consultation with the relevant Authorities and An Garda Síochána. o It is estimated that 64 abnormal sized loads will be delivered to the site, comprising 22 convoys of 3, undertaken over 22 separate nights. o These nights will be spread out over an approximate period of 11 weeks and will be agreed in advance with the relevant authorities o In order to manage each of the travelling convoys, for each convoy there will be two police escort vehicles that will stop traffic at the front and rear of the convoy of 3 vehicles. o There will also be two escort vehicles provided by the haulage company for each convoy.		

MM79	EIAR Section 14	A detailed **Traffic Management Plan (TMP)**, will be provided specifying details relating to traffic management and included in the CEMP prior to the commencement of the construction phase of the proposed development. The TMP will be agreed with the local authority and An Garda Síochána prior to construction works commencing on site. The detailed TMP will include the following: - **Traffic Management Coordinator** – a competent Traffic Management Co-ordinator will be appointed for the duration of the project and this person will be the main point of contact for all matters relating to traffic management. - **Delivery Programme** – a programme of deliveries will be submitted to the County Council in advance of deliveries of turbine components to site. Liaison with the relevant local authorities and Transport Infrastructure Ireland (TII) will be carried out where required regarding requirements such as delivery timetabling. The programme will ensure that deliveries are scheduled in order to minimise the demand on the local network and minimise the pressure on the access to the site. - **Information to locals** – Locals in the area will be informed of any upcoming traffic related matters e.g. temporary lane/road closures (where required) or delivery of turbine components at night, via letter drops and posters in public places. Information will include the contact details of the Project Co-ordinator, who will be the main point of contact for all queries from the public or local authority during normal working hours. An "out of hours" emergency number will also be provided. - **A Pre and Post Construction Condition Survey** – Where required by the local authority, a pre-condition survey of roads associated with the proposed development can be carried out immediately prior to construction commencement to record an accurate condition of the road at the time. A post construction survey will be carried out after works are completed to ensure that any remediation works are carried out to a satisfactory standard. Where required the timing of these surveys will be agreed with the local authority. All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the local authority engineers.		

		• **Liaison with the relevant local authority** - Liaison with the County Council and An Garda Síochána, will be carried out during the delivery phase of the large turbine vehicles, when an escort for all convoys will be required. Once the surveys have been carried out and "prior to commencement" status of the relevant roads established, (in compliance with the provisions of the CEMP), the Roads section will be informed of the relevant names and contact numbers for the Project Developer/Contractor Site Manager as well as the Site Environmental Manager. • **Implementation of temporary alterations to road network at critical junctions** – at locations highlighted in section 14.1.8. In addition, in order to minimise the impact on the existing environment during turbine component deliveries the option of blade adaptor trailers will also be used where deemed practicable. • **Identification of delivery routes** – These routes will be agreed with the County Council and adhered to by all contractors. • **Delivery times of large turbine components** - The management plan will include the option to deliver the large wind turbine plant components at night in order to minimise disruption to general traffic during the construction stage. • **Travel plan for construction workers** – While the assessment above has assumed the worst case in that construction workers will drive to the site, the construction company will be required to provide a travel plan for construction staff, which will include the identification of routes to / from the site and identification of an area for parking. • **Additional measures** - Various additional measures will be put in place where appropriate in order to minimise the effects of the development traffic on the surrounding road network including wheel washing facilities on site and sweeping / cleaning of local roads as required. These are set out in the CEMP which is contained in Appendix 4-2 • **Re-instatement works** - All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the local authority engineers.		
Cultural Heritage				

MM80	EIAR Section 12	A buffer zone of a minimum of 10m should be established between KE009-088– Road – unclassified togher and the hardstand for T1. No ground works or storage of peat/topsoil should take place within the buffer zone. The buffer zone should be defined by durable fencing for the duration of the construction phase of the project with 'Keep Out' signage placed on same		
Operational Phase				
MM81	EIAR Section 4	The removal and disposal of wastewater from the site will be carried out by a fully permitted waste collector holding valid Waste Collection Permits as issued under the Waste Management (Collection Permit) Regulations, 2007. Information on the appointed permitted contractor and evidence of a maintenance contract having been submitted to the Planning Authority prior to any construction works taking place.		
MM82	EIAR Section 4, 8, 9 NIS Section 5 CEMP Section 3, 5	The electrical substation will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage of any associated chemicals and to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;		
MM83	EIAR Section 5	An operational phase Health and Safety Plan will be developed to fully address identified Health and Safety issues associated with the operation of the site and providing for access for emergency services at all times.		
MM84	EIAR Chapter 6	To reduce the value of the habitat for bat species in the areas surrounding the turbines, a buffer of at least 50m between the tip of the blade and any trees or other tall vegetation that could provide high quality foraging habitat for bat species will be implemented.		
MM85	EIAR Chapter 5	Where daily or annual shadow flicker exceedances are experienced at buildings, a site visit will be undertaken to determine the level of occurrence, existing screening and window orientation. The shadow flicker prediction data will be used to select dates on which a shadow flicker event could be observed at one or multiple affected properties and the following process will be adhered to.		

		In the event of shadow flicker being noted as occurring the details of the duration (times) of the occurrence will be recorded. In the event of an occurrence of shadow flicker exceeding guideline threshold values of 30 minutes per day at residential receptor locations, mitigation options will be discussed with the affected homeowner, including: - Installation of appropriate window blinds in the affected rooms of the residence; - Planting of screening vegetation; - Other site-specific measures which might be agreeable to the affected party and may lead to the desired mitigation. If it is not possible to mitigate any identified shadow flicker limit exceedance locally using the measures detailed above, wind turbine control measures will be implemented.		
MM86	EIAR Chapter 5	Access to the turbines is through a door at the base of the structure, which will be locked at all times outside maintenance visits.		
MM87	EIAR Chapter 5	An operational phase Health and Safety Plan will be developed to fully address identified Health and Safety issues associated with the operation of the site and providing for access for emergency services at all times.		
MM88	EIAR Section 11	Modern wind turbines can be programmed to run in reduced modes of operation (or low noise modes) to achieve the attenuation required in the specific wind conditions (i.e. wind speed and direction). Operating the turbines in reduced noise modes is generally referred to as curtailment. Should predicted exceedances be confirmed at the commissioning stage of the development, it is possible to mitigate for this through curtailment of turbine(s) in the relevant wind speed and directions. The curtailment strategy would ultimately be developed for the specific turbine technology installed on the site and the associated noise emissions at the various operational wind speeds. If necessary, a detailed curtailment strategy matrix will be developed at the detailed design stage in order to achieve the relevant noise criteria at all NSL's.		

MM89	EIAR Section 6	Blade Feathering Blade feathering will be implemented as a standard across all proposed turbines when wind speeds are below the cut-in speed of the turbine. Bat Buffers The required bat buffers surrounding turbines located within or at the edge of conifer forestry habitat will remain free from vegetation for the duration of the operational phase of the proposed development. Bat Monitoring Plan Post-construction bat monitoring will be undertaken for at least three years' post construction of the renewable energy development. The monitoring will also include corpse searching in the areas surrounding the turbines to gather data on any actual collisions. The results of post construction monitoring shall be utilised to assess changes in bat activity patterns and to inform the design of any advanced site specified mitigation requirements, including curtailment if deemed necessary following post construction monitoring. Lighting The applicant commits to the use of lights during operation in line with guidance that is provided in the Institute of Lighting Professionals Guidance Note 08/18 Bats and artificial lighting in the UK and Dark Sky Ireland Lighting Recommendations. Exterior lighting will be designed to minimise light spillage by using directional accessories (Stone, 2013).		
MM90	EIAR Section 14	It is standard practice of 2RN to produce a Protocol Document for wind farm developments, which will be signed by the developer. The Protocol Document ensures that in the event of any interference occurring to television or radio reception due to operation of the wind farm, the required measures, as set out in the document, will be carried out by the developer to rectify this. The Protocol Document ensures that the appropriate mitigation is carried out in the event of unanticipated broadcast interference arising to television or radio reception as a result of the Proposed Development.		

		In the event of interference occurring to telecommunications, the Department of the Environment, Heritage and Local Government Wind Farm Planning Guidelines (2006) state that these effects are generally easily dealt with by the use of divertor relay links out of line with the proposed wind turbines.		

16.3 EIAR Monitoring Measures

Table 16-2 Monitoring Schedule

Ref. No.	Reference Location	Survey / Monitoring Measure	Frequency	Reporting Period	Responsibility
Pre-Commencement Phase					
MX1	EIAR Section 4 CEMP Section 4	An inspection and maintenance plan for the drainage system on site will be prepared in advance of commencement of any works. Regular inspections of all installed drainage systems will be necessary, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water at parts of the systems where it is not intended. The inspection of the drainage system will be the responsibility of the site ECoW or the Project Hydrologist.	On going	Monthly	ECoW
MX2	CEMP Section 3	Prior to commencement of works in sub-catchments across the site main drain inspections will be competed to ensure ditches and streams are free from debris and blockages that may impede drainage.	As Required	Monthly	
MX3	EIAR Section 7	Pre-commencement surveys will be undertaken prior to the initiation of works at the wind farm. The survey will include a thorough walkover survey to a 500m radius of the development footprint and all works areas, where access allows. If winter roosting or breeding activity of birds of high conservation concern is identified, the roost or nest site will be located and earmarked for monitoring at the beginning of the first winter or breeding season of the construction phase. If it is found to be active during the construction phase, no works shall be undertaken within a disturbance buffer (Forestry Commission Scotland, 2006; Ruddock and Whitfield, 2007) in line with industry best practise. No works shall be permitted within the buffer until it can be demonstrated that the roost/nest is no longer occupied. During pre-commencment surveys, the whooper swan enhancement lands will be visited to confirm that there is suitable high quality foraging habitat for swans. The lands should comprise agricultural pasture with a sward height of	Once	As Required	Project Ornithologist

Ref. No.	Reference Location	Survey / Monitoring Measure	Frequency	Reporting Period	Responsibility
		30cm or less. There should be no disturbance (including livestock) between the start of October until the migration of the swans in spring. Enhancement lands should be established prior to the commencement of construction activity.			
Construction Phase					
MX4	EIAR Section 12	Archaeological monitoring of ground works (to include roads, substation, turbine hardstands, bases and cable trenching) will be undertaken at the construction phase of the development.	Once	As required	Project Archaeologist
MX5	CEMP Section 3	A system of peat monitoring will be implemented under the supervision of the project geotechnical engineer. This will include movement monitoring posts the findings of which will be reviewed by the geotechnical engineer.	Monthly or more frequently as required by construction programme	Monthly	Project Geotechnical Engineer
MX6	EIAR Section 4, 9	Check dams will be inspected and maintained regularly to insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.	As Required	As Necessary	ECoW
MX7	EIAR Section 4	A daily visual inspection of each settlement pond will be undertaken to identify when sediment are nearing capacity within the pond and sediment will be cleaned out as required. Settlement ponds will also be checked for anything else that might interfere with flows.	As Required	As Necessary	ECoW
MX8	EIAR Section 4	Settlement ponds will be inspected weekly and following significant rainfall events i.e. after events of >25mm rainfall in any 24-hour period. Inlet and outlets will be checked for sediment accumulation and anything else that might interfere with flows. Inspection and maintenance of these structures during construction phase is critical to their functioning to stated purpose.	Weekly / As Required	As Necessary	ECoW
MX9	EIAR Section 4	All culverts will be inspected regularly to ensure they are not blocked by debris, vegetation or any other material that may impede conveyance.	Weekly / Monthly	As Necessary	ECoW

Ref. No.	Reference Location	Survey / Monitoring Measure	Frequency	Reporting Period	Responsibility
MX10	EIAR Section 4 CEMP Section 3 & 4	The effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treat silt-laden water from the works areas, will be monitored continuously by the ECoW or supervising hydrologist on-site. The ECoW or supervising hydrologist will respond to changing weather, ground or drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained in so far as possible. This may require the installation of additional check dams, interceptor drains or swales as deemed necessary on-site.	As Required	As Necessary	ECoW / Project Hydrologist
MX11	EIAR Section 9 CEMP Section 3	The plant used should be regularly inspected for leaks and fitness for purpose.	Before Use	As Necessary	Drivers / ECoW
MX12	EIAR Section 9	Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended. Inspections will also be undertaken after tree felling.	Weekly/ Monthly	As Necessary	ECoW
MX13	EIAR Section 9	During the construction phase field testing and laboratory analysis of a range of parameters with relevant regulatory limits and EQSs should be undertaken for each watercourse and specifically following heavy rainfall events (*i.e.* weekly, monthly and event based). This will be completed in consultation with the Fisheries Board.	Weekly, monthly and event based	As Necessary	ECoW / Project Hydrologist
MX14	CEMP Section 3	Training and supervision of drivers to ensure smooth machinery operation/driving, and to minimise unnecessary noise generation.	As Required	As Necessary	ECoW

Ref. No.	Reference Location	Survey / Monitoring Measure	Frequency	Reporting Period	Responsibility
MX15	EIAR Section 7	Works will commence outside the bird nesting season (1st of March to 31st of August inclusive). Any requirement for construction works to run into the subsequent breeding season following commencement will be subject to pre-construction bird surveys to confirm the absence of breeding birds.	Prior to the subsequent breeding season	As Necessary	Project Ornithologist
MX16	CEMP Section 3	Dust gauges to be put in place during the construction phase of the development to monitor dust emissions generated by the development of the wind farm.	Monthly	Quarterly	ECoW
MX17	CEMP Section 3	A Project Ecologist will be appointed. The responsibilities and duties of the Project Ecologist will include the following: › Undertake a pre-construction transect/walkover bird survey to ensure that significant effects on breeding birds will be avoided. › Inform and educate on-site personnel of the ornithological and ecological sensitivities within the Proposed Development area. › Oversee management of ornithological and ecological issues during the construction period and advise on ornithological issues as they arise. › Provide guidance to contractors to ensure legal compliance with respect to protected species onsite. Liaise with officers of consenting authorities and other relevant bodies with regular updates in relation to construction progress.	As required	As required	Project Ecologist
Operational Phase					
MX18	EIAR Section 6	Habitat condition monitoring will be undertaken during construction and in year 1 post construction to ensure that there are no negative effects on marsh fritillary habitat	As required	As required	
MX19	CEMP Section 3	Monthly sampling for laboratory analysis for a range of parameters adopted during pre-commencement and construction phases will continue for six	Monthly	Monthly	

Ref. No.	Reference Location	Survey / Monitoring Measure	Frequency	Reporting Period	Responsibility
		months during the operational phase. The Project Hydrologist will monitor and advise on the readings being received from the testing laboratory.			
MX20	EIAR Section 7	A detailed post-construction Bird Monitoring Programme has been prepared for the operational phase of the proposed development (refer to EIAR Appendix 7-6 for further details). The programme of works will monitor parameters associated with collision, displacement/barrier effects and habituation during the lifetime of the project. Surveys will be scheduled to coincide with Years 1, 2, 3, 5, 10 and 15 of the lifetime of the wind farm. Monitoring measures are broadly based on guidelines issued by SNH (2009). The following individual components are proposed: • Monthly flight activity surveys: vantage point surveys • Targeted bird collision surveys: corpse searches with trained dogs • Hen harrier roost monitoring: hen harrier roost surveys • Whooper swan monitoring: enhancement land site visits and adjacent Ballyouneen I-WeBS site.	Years 1, 2, 3, 5, 10 and 15 of the life of a wind farm	Annually	Project Ornithologist
MX21	EIAR Section 6	Post-construction monitoring is required to assess the effects of construction related habitat modification on bat activity The results of post construction monitoring shall be utilised to assess changes in bat activity patterns and to inform the design of any advanced site specified mitigation requirements, including curtailment, to ensure that there are no significant residual effects on bat species	Monthly or as required	Years 1, 2 and 3 of the life of a wind farm	Project Ornithologist

Ref. No.	Reference Location	Survey / Monitoring Measure	Frequency	Reporting Period	Responsibility
MX22	EIAR Section 9	Any excess build-up of silt levels at dams, the settlement pond, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed.	As Required	Weekly	ECoW
MX23	EIAR Section 11	Once the site is operational a Noise Compliance Monitoring Programme will be carried out by a suitable qualified noise consultant/engineer	Once	On completion of Programme	Project Noise Consultant

BIBLIOGRAPHY

Introduction

Department of Communications, Energy & Natural Resources (2015). White Paper on Energy Policy in Ireland 2015-2030, Dublin.

Department of Communications, Energy & Natural Resources (2014). Draft Bioenergy Plan, Dublin.

Department of the Environment, Community and Local Government (2013). Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment. DoEHLG, Dublin.

Department of the Environment, Heritage and Local Government (2006). Wind Energy Development Guidelines for Planning Authorities. DoEHLG, Dublin.

Department of Housing, Planning and Local Government (December 2019) Draft Revised Wind Energy Development Guidelines. DHPLG, Dublin.

Department of Housing, Planning and Local Government (August 2018) Guidelines for Planning Authorities and An Bord Pleanála on Carrying out Environmental Impact Assessment. DHPLG, Dublin.

Department of Housing, Planning and Local Government (June 2017) Review of the Wind Energy Development Guidelines 2006 – Preferred Draft Approach. DHPLG, Dublin.

Department of Housing, Planning and Local Government (2013) Proposed Revisions to Wind Energy Development Guidelines 2006 – Targeted Review. DHPLG, Dublin.

Eirgrid (2019). All Island Generation Capacity Statement 2019 – 2028. SONI/Eirgrid.

Environmental Protection Agency (August 2017): Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. EPA, Wexford.

Environmental Protection Agency (September 2015): Draft - Advice Notes on Current Practice (in the preparation on Environmental Impact Statements). EPA, Wexford.

Environmental Protection Agency (2003) Advice Notes on Current Practice in the Preparation of Environmental Impact Statements. EPA, Wexford.

Environmental Protection Agency (2002) Guidelines on Information to be Contained in Environmental Impact Statements. EPA, Wexford.

European Union (2014). Directive 2014/52/EU. European Parliament and European Council.

European Union (2011). Directive 2011/92/EU. European Parliament and European Council.

Irish Statute Book (2018). European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018).

Irish Statute Book (2001). Planning and Development Regulations (as amended) S.I. No. 600 of 2001. Stationery Office, Dublin.

Irish Statute Book (2000). Planning and Development Acts 2000 to 2019. Stationery Office, Dublin.

Kerry County Development Plan 2015-2021

Sustainable Energy Authority of Ireland (September 2020). Energy Security in Ireland, 2020 Report.

Sustainable Energy Authority of Ireland (2020b) Tracking effect of COVID-19 on energy supply and demand, SEAI May 2020

Background to the Proposed Development

Council of the European Union (2009). Directive on the Promotion of the Use of Energy from Renewable Sources (Directive 2009/28/EC), Brussels.

Climate Change Advisory Council (2019). Annual Review 2019, ISBN: 978-1-84095-848-5

Commission for Regulation of Utilities (2018) Enduring Connection Policy Stage 1 (ECP-1). Dublin

Commission for Regulation of Utilities (2019), Grid Connection Policy

Department of Climate Change, Action & Environment (2019). Climate Action Plan 2019

Department of Climate Change, Action & Environment. Renewable Energy Support Scheme

Department of Climate Change, Action & Environment (2018). National Adaptation Framework - Planning for a Climate Resilient Ireland 2018.

Department of Climate Change, Action & Environment (2014). National Policy Position on Climate Action and Low Carbon Development.

Department of Climate Change, Action & Environment (2015). Climate Action and Low Carbon Development Act 2015.

Department of Communications, Climate Action and Environment (2021). Climate Action and Low Carbon Development Amendment Act 2021.

Department of Climate Change, Action & Environment (2018). National Climate Change Adaptation Framework.

Department for Communications, Marine and Natural Resources (2007). Delivering a Sustainable Energy Future for Ireland: The Energy Policy Framework 2007 – 2020.

Department of Communications, Energy & Natural Resources (2015). White Paper on Energy Policy in Ireland 2015-2030, Dublin.

Department of the Environment, Heritage and Local Government (2006). Wind Energy Guidelines 2006.

Department of Housing, Planning, Community and Local Government (2017). Interim Guidelines for Planning Authorities on Statutory Plans, Renewable Energy and Climate Change.

Department of Housing, Planning, Community and Local Government (2017). Department Circular PL5/2017

Department of Housing, Planning, Community and Local Government (2019) Draft Revised Wind Energy Development Guidelines

Department of Climate Change, Action & Environment. Renewable Energy Support Scheme

Department of Agriculture, Food and Marine. Forest Service Guidelines.

EirGrid (2021) All Island Generation Capacity Statement 2021-2030, Dublin.

European Commission (2010). Europe 2020 Strategy.

European Commission (2011), Energy Roadmap 2050

Government of Ireland (2018). Project Ireland 2040 National Planning Framework

Irish Wind Energy Association (2012). Best Practice Guidelines for the Irish Wind Energy Industry.

Joint Committee on Climate Action (2019). Climate Change: A Cross-Party Consensus for Action.

Kerry County Development Plan 2015-2021

Southern Regional Assembly, Regional Spatial and Economic Strategy for the Southern Region, 2020

Sustainable Energy Authority of Ireland (2019), National Energy Projections to 2030

Sustainable Energy Authority of Ireland (2020a) *Energy in Ireland – 2020 Report*, SEAI, December 2020

Sustainable Energy Authority of Ireland (2020b) Tracking effect of COVID-19 on energy supply and demand, SEAI May 2020

Sustainable Energy Authority of Ireland (2020c), Report on Energy-related CO2 Emissions in Ireland 2005-2018

Sustainable Energy Authority of Ireland (2020d), Renewable Energy in Ireland 2020 Update

Sustainable Energy Authority of Ireland (2021) Provisional Energy Balance, SEAI, September 2021

United Nations (1992). United Nations Framework Convention on Climate Change

United Nations (1997). Kyoto Protocol to the United Nations Framework Convention on Climate Change

United Nations (2012). Doha Amendment to the Kyoto Protocol

United Nations (2015). COP21 Paris Agreement, Paris.

United Nations (2019). COP25 Climate Change Conference, Madrid.

Consideration of Reasonable Alternatives

Department of the Environment, Heritage and Local Government (2006). Wind Energy Development Guidelines

Department of Housing, Planning and Local Government (2013) Proposed Revisions to Wind Energy Development Guidelines 2006 – Targeted Review. DHPLG, Dublin.

Department of Housing, Planning and Local Government (December 2019) Draft Revised Wind Energy Development Guidelines. DHPLG, Dublin.

Department of Housing, Planning and Local Government (June 2017) Review of the Wind Energy Development Guidelines 2006 – Preferred Draft Approach. DHPLG, 2017.

Environmental Protection Agency (2017): Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports.

European Union (2017) Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU).

Irish Wind Energy Association (2008). Best Practice Guidelines for the Irish Wind Energy Industry

Kerry County Development Plan 2015-2021

Sustainable Energy Authority of Ireland (April 2013) Methodology for Local Authority Renewable Energy Strategies. RPS, Ireland.

Description of the Proposed Development

Central Statistics Office Ireland (2018). Census Results 2011 & 2016. www.cso.ie

CIRIA Construction Industry Research and Information Association (2006). CIRIA C648: Control of water pollution from linear construction projects -Technical guidance. CIRIA London.

CIRIA Construction Industry Research and Information Association (2001). CIRIA C532: Control of water pollution from construction sites - Guidance for consultants and contractors. CIRIA London.

COFORD (2004) Forest Road Manual – Guidelines for the Design, Construction and Management of Forest Roads.

Coillte (2009). Forest Operations & Water Protection Guidelines;

Environmental Protection Agency Ireland (2009) Code of Practice: Wastewater Treatment and Disposal Systems Serving Single Houses. EPA, Wexford.

Environmental Protection Agency Ireland (1999) Wastewaster Treatment Manuals - Treatment Systems for Small Communities, Business, Leisure Centres and Hotels. EPA, Wexford.

Forestry Act 2014

Forestry Regulations 2017

Forestry Commission (2004). Forests and Water Guidelines, Fourth Edition.

Forest Services (Draft, undated): Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures.

Forest Service, 2000: Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford.

Forestry Commission, 2004: Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh.

Forest Service (2000). Forestry and Water Quality Guidelines.

Gavin and Doherty Geosolutions (GDG) (2021). Peat and overburden management plan for Ballynagare Renewable Energy Development.

Inland Fisheries Ireland (2016). Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Watercourses.

PPG1 - General Guide to Prevention of Pollution (UK Guidance Note)

PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note)

Waste Management Act 1996 as amended

Scottish Natural Heritage, (2010). Good Practice During Wind Farm Construction

Safety and Health Commission for the Mining and other Extractive Industries (2001). Guidance on the Safe Use of Explosives in Quarries

Siltbuster Concrete Wash Unit. Available at: http://www.siltbuster.com. Accessed 19.08.2020.

Population and Human Health

American Wind Energy Association and Canadian Wind Energy Association (2009). Wind Turbine Sound and Health Effects - An Expert Panel Review, USA and Canada.

Australian Government National Health and Medical Research Council (NHMRC) Wind Turbines & Health (2010). A Rapid Review of the Evidence. Australia.

The British Horse Society (2015). Advice on Wind Turbines and Horses – Guidance for Planners and Developers.

Baringa (2019) Wind for a Euro: Cost-benefit analysis of wind energy in Ireland 2000-2020

BiGGAR Economics (2016). Wind Farms and Tourism Trends in Scotland. Midlothian, Scotland.

Centre for Economics and Business Research (2014) The effect of wind farms on house prices. Renewable UK, London.

Central Statistics Office Ireland (2018). Census Results 2011 & 2016. www.cso.ie

Central Statistics Office Ireland (2012). Census of Agriculture 2010 Detailed Results. www.cso.ie

Climate and Health Alliance (2012). Position Statement on Health and Wind Turbines. Australia.

Department of Communications, Climate Action and Environment (2019) Climate Action Plan (CAP).

Department of the Environment, Heritage and Local Government (2007). National Climate Change Strategy 2007 – 2012. Stationery Office, Dublin.

Department of Housing, Planning and Local Government (December 2019) Draft Revised Wind Energy Development Guidelines. DHPLG, Dublin.

Department of Housing, Planning and Local Government (June 2017) Review of the Wind Energy Development Guidelines 2006 – Preferred Draft Approach. DHPLG, 2017.

Department of the Environment, Heritage and Local Government (2006). Wind Energy Development Guidelines for Planning Authorities (Revised). Stationery Office, Dublin.

Discover Ireland www.discoverireland.ie

ESB (2017) EMF & You: Information about Electric & Magnetic Fields and the electricity transmission system in Ireland (https://esb.ie/docs/default-source/default-document-library/emf-public-information_booklet_v9.pdf?sfvrsn=0).

Fáilte Ireland (September 2019). Tourism Facts 2018. Fáilte Ireland. Available at: www.failteireland.ie

Fáilte Ireland (August 2018). 2017 Topline Tourism Performance By Region at www.failteireland.ie

Fáilte Ireland (2012). Visitor Attitudes on the Environment - Wind Farms. www.failteireland.ie

Environmental Protection Agency (2017). Draft Guidelines on the Information to be Contained in Environmental Impact Statements. EPA, Wexford.

Heblich, Dr. S. et al (2016) Impact of wind Turbines on House Prices in Scotland. Climate Xchange

HSE Public Health Medicine Environment and Health Group (2017) Position Paper on Wind Turbines and Public Health. Ireland.

Health & Safety Authority (2006) Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations.

Irish Wind Energy Association (January 2020) Interactions Opinion Poll on Wind Energy. Ireland

Irish Wind Energy Association (2014). "An Enterprising Wind" An economic analysis of the job creation potential of the wind sector in Ireland, Siemens Limited, Dublin.

Irish Wind Energy Association (2009). Jobs and Investment in Irish Wind Energy – Powering Ireland's Economy. Deloitte, Ireland

IWEA (2009) Jobs and Investment in Irish Wind Energy – Powering Ireland's Economy'

Kerry County Development Plan 2015-2021

Lawrence Berkley National Laboratory (2013). The Impact of Wind Power Projects on Residential Property Values in the United States: A multi-Site Hedonic Analysis. US Department of Energy

Lawrence Berkley National Laboratory (2013) A Spatial Hedonic Analysis of the Effects of Wind Energy Facilities on Surrounding Property Values in the United States.

Massachusetts Institute of Technology (2014) Wind Turbines and Health, A Critical Review of the Scientific Literature, Journal of Occupational and Environmental Medicine Vol. 56 (11).

Massachusetts Departments of Environmental Protection and Public Health (2012). Wind Turbine Health Impact Study -Report of Independent Expert Panel. USA.

Prime Minister's Office, Finland (June 2020). Infrasound Does Not Explain Symptoms Related to Wind Turbines. Publications of the Government's analysis, assessment and research activities 2020:34

Pőyry (2014) The Value of Wind Energy to Ireland A report to Irish Wind Energy Association. Cambridge Economics.

Renewable UK (2010). Wind Turbine Syndrome - An independent review of the state of knowledge about the alleged health condition. London, UK.

Sustainable Energy Ireland (2003). Attitudes Towards the Development of Wind Farms in Ireland'. SEI, Dublin.

Safety, Health and Welfare at Work Act 2005 (No. 10 of 2005);

Safety, Health and Welfare at Work (General Application) Regulations 2007 (S.I. No. 299 of 2007), as amended;

Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. 291 of 2013), as amended; and

Safety, Health and Welfare at Work (Work at Height) Regulations 2006 (S.I. No. 318 of 2006).

Warren, C.R. et al (2005). Green on Green: Public Perceptions of Wind Power in Scotland and Ireland. Journal of Environmental Planning and Management 48(6): 853-875.

World Health Organisation Regional Office for Europe (2018). Environmental Noise Guidelines for the European Region

Department of the Environment, Heritage and Local Government (2006). Wind Energy Guidelines 2006.

Environmental Protection Agency (August 2017): Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. EPA, Wexford.

Helimax Energy (2008). Shadow Flicker Analysis. Stantec, Ontario.

Irish Wind Energy Association (2012). Best Practice Guidelines for the Irish Wind Energy Industry.

Noble Environmental Power LLC (2006). Wind Fact Sheet #4: Shadow Flicker. Noble Environmental Power, Connecticut.

UK Department of Energy and Climate Change (2010). Update of Shadow Flicker Evidence Base. DECC, London.

Biodiversity

Bailey, M. and Rochford J. (2006) Otter Survey of Ireland 2004/2005. Irish Wildlife Manuals, No. 23. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

Birds Directive (2009/47/EC) – http://ec.europa.eu/environment/nature /legislation/birdsdirective /index _en.htm

Bowers Marriott, B. (1997) Practical Guide to Environmental Impact Assessment: A Practical Guide. Published by McGraw-Hill Professional, 1997, 320 pp.

Chanin P (2003). Ecology of the European Otter. Conserving Natura 2000 Rivers Ecology Series No. 10. English Nature, Peterborough.

Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) and Directive 2009/147/EC (codified version of Directive 79/409/EEC as amended) (Birds Directive) – transposed into Irish law as European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477/2011).

CIEEM (2018) Institute of Ecology and Environmental Management Draft Guidelines for Ecological Impact Assessment.

DEHLG (2009) Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities. DEHLG, Dublin.

DoEHLG (2010). Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities. Revision, February, 2010. Department of the Environment, Heritage and Local Government.

EC (2018) Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC, Office for Official Publications of the European Communities, Luxembourg. European Commission.

EC (2001) Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Articles 6(3) and (4) of the Habitats Directive 92/43/EEC.

EC (2002) Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC, Office for Official Publications of the European Communities, Luxembourg. European Commission.

EC (2007a) Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC – Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the commission. Office for Official Publications of the European Communities, Luxembourg. European Commission.

EC (2007b) Interpretation Manual of European Union Habitats. Version EUR 27. European Commission, DG Environment.

EPA (2002) Guidelines on the information to be contained in Environmental Impact Statements. Environmental Protection Agency.

EPA (2003) Advice Notes on current practice in the preparation of Environmental Impact Statements. Environmental Protection Agency.

EPA website: http://www.epa.ie.

European Communities (Conservation of Wild Birds) Regulations, 1985, SI 291/1985 & amendments – http://www.irishstatutebook.ie.

European Communities (Environmental Impact Assessment) Regulations, 1989 to 2001.

European Communities (Natural Habitats) Regulations, SI 94/1997, SI 233/1998 & SI 378/2005 – http://www.irishstatutebook.ie.

Fossitt, J. A. (2000). A Guide to Habitats in Ireland. Dublin: The Heritage Council.

Habitats Directive (92/43/EEC).

Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites. Eastern Regional Fisheries Board, Dublin.

National Biodiversity Data Centre website http://www.biodiversityireland.ie/

NPWS (2008) The Status of EU Protected Habitats and Species in Ireland. Conservation Status in Ireland of Habitats and Species listed in the European Council Directive on the Conservation of Habitats, Flora and Fauna 92/43/EEC.

NPWS of the DEHLG (2008) The Report on Status of Habitats and Species in Ireland: Technical Reports and Forms.

NPWS (2013) The Status of EU Protected Habitats and Species in Ireland. Conservation Status in Ireland of Habitats and Species listed in the European Council Directive on the Conservation of Habitats, Flora and Fauna 92/43/EEC.

NPWS (2019) The Status of EU Protected Habitats and Species in Ireland. Conservation Status in Ireland of Habitats and Species listed in the European Council Directive on the Conservation of Habitats, Flora and Fauna 92/43/EEC.

NPWS Protected Areas Site Synopses and maps available on http://www.npws.ie/en/ProtectedSites/.

NRA (2004) Environmental Impact Assessment of National Road Schemes – A Practical Guide, National Roads Authority, Dublin.

NRA (2005) Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes. Dublin: National Roads Authority.

NRA (2006) Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post-Construction of National Road Schemes. Dublin: National Roads Authority.

NRA (2008) Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes.

NRA (2009). Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes. Dublin: National Roads Authority.

Preston C.D. et. al. (2002). New Atlas of the British and Irish Flora. Oxford University Press.

Scottish Natural Heritage (SNH) (July 2013) Assessing Connectivity with Special Protection Areas (SPA)

The Central and Regional Fisheries Board, (2008) Cashen- Feale Estuary, Sampling fish for the water framework directive – transitional waters.

Water status data available on http://www.epa.ie and http://www.wfdireland.ie

Wildlife Act 1976 and Wildlife (Amendment) Act 2000..

Ornithology

Balmer, D.E., Gillings, S., Caffrey, B.J., Swann, R.L., Downie, I.S. and Fuller, R.J. (2013). *Bird Atlas 2007–11: The Breeding and Wintering Birds of Britain and Ireland.* Thetford, UK: BTO Books.

Band, W., Madders, M. and Whitfield, D. P. (2007). Developing field and analytical methods to assess avian collision risk at wind farms. Scottish Natural Heritage, Inverness, Scotland. Available at: https://www.natural-research.org/application/files/4114/9182/2839/Band_et_al_2007.pdf

BirdWatch Ireland (2021) I-WEBS Counter Manual. BirdWatch Ireland, Kilcoole, Ireland. Available at: https://birdwatchireland.ie/publications/i-webs-counter-manual/

Brazil, M. (2003). *The Whooper Swan.* London: T&AD Poyser.

Brown, A.F. and Shepherd, K. B. (1993). A method for censusing upland breeding waders. *Bird Study,* 40: 189-195. https://doi.org/10.1080/00063659309477182

British Trust for Ornithology (2021) Breeding Bird Survey. British Trust for Ornithology, Thetford, UK. Available at: https://www.bto.org/our-science/projects/bbs

Bright J.A., Langston, R.H.W., Bullman, R., Evans, R.J., Gardner, S., Pearce-Higgins, J. and Wilson, E. (2006). Bird sensitivity map to provide locational guidance for onshore wind farms in Scotland. Royal Society for the Protection of Birds, Bedfordshire, and Scottish Natural Heritage, Inverness, UK. Available at: https://ww2.rspb.org.uk/Images/sensitivitymapreport_tcm9-157990.pdf

Burke, B., Lewis, L., Fitzgerald, N., Frost, T., Austin, G. and Tierney, T. D. (2018) Estimates of waterbird numbers winter in Ireland, 2011/12-2015/16. *Irish Birds,* 11: 1-12.

Burke, B., (2020) Population size, breeding success and habitat use of Whooper Swan *Cygnus cygnus* and Bewick's Swan *Cygnus columbianus bewickii* in Ireland: results of the 2020 International Swan Census. *Irish Birds,* 43: 57-70.

Bukaciński, D. & Bukacińska, M. (2003). *Larus canus* Common Gull. *BWP Update The Journal of Birds of the Western Palearctic*, 5 (1): 13-47.

Calladine, J., Garner, G., Wernham, C. and Thiel, A (2009). The influence of survey frequency on population estimates of moorland breeding birds. *Bird Study,* 56: 381-388. https://doi.org/10.1080/00063650902984604

Campedelli, T., Londi, G., Cutini, S., Sorace, A. and Tellini Florenzano, G. (2013). Raptor displacement due to the construction of a wind farm: preliminary results after the first 2 years since the construction. *Ethology Ecology and Evolution,* 26: 376-391. https://doi.org/10.1080/03949370.2013.862305

CIEEM (2019). Guidelines for Ecological Impact Assessment in the UK and Ireland. Chartered Institute of Ecology and Environmental Management, Romsey, UK. Available at: https://cieem.net/resource/guidelines-for-ecological-impact-assessment-ecia/

Council Directive 92/43/EEC 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31992L0043

Council Directive 2009/147/EC 30 November 2009 on the conservation of wild birds. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32009L0147

Cummins, S., Fisher, J., McKeever, R. G., McNaghten, L. and Crowe, O. (2010). Assessment of the distribution and abundance of Kingfisher *Alcedo atthis* and other riparian birds on six SAC river systems in Ireland. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Ireland. Available at: https://www.npws.ie/sites/default/files/publications/pdf/Cummins_et_al_2010_Kingfisher_survey.pdf

DoHPLG (2018). Guidelines for planning authorities and An Bord Pleanála on carrying out Environmental Impact Assessment. Department of Housing, Planning and Local Government, Government of Ireland, Dublin. Available at: https://www.gov.ie/en/publication/53aee9-guidelines-for-planning-authorities-and-an-bord-pleanala-on-carrying/

Drewitt, A. L. and Langston, R. H. W. (2006) Assessing the impacts of wind farms on birds. *Ibis*, 148: 29-42. https://doi.org/10.1111/j.1474-919X.2006.00516.x

Drewitt, A. L. and Langston, R. H. W. (2008). Collision effects of wind-power generators and other obstacles on birds. *Annals of the New York Academy of Sciences*, 1134: 233-266. https://doi.org/10.1196/annals.1439.015

EPA (2017). Draft guidelines on the information to be contained in Environmental Impact Statement reports. Environmental Protection Agency, Johnstown Castle Estate, Wexford. Available at: https://www.epa.ie/publications/monitoring–assessment/assessment/draft-guidelines-on-the-information-to-be-contained-in-environmental-impact-asse.php

European Commission (2020). Guidance document on wind energy developments and EU nature legislation. Publications Office of the European Union, Luxembourg. https://ec.europa.eu/environment/nature/natura2000/management/docs/wind_farms_en.pdf

European Commission (2002). Assessment of plans and projects significantly affecting Natura 2000 sites. Publications Office of the European Union, Luxembourg. https://ec.europa.eu/environment/nature/natura2000/management/docs/art6/natura_2000_assess_en.pdf

European Communities (Noise Emission by Equipment For Use Outdoors) Regulations, 2001, No. 632/2001. Dublin: Stationary Office. Available at: https://www.irishstatutebook.ie/eli/2001/si/632/made/en/print

Evans P.R. and Pienkowski M.W. (1984) Population Dynamics of Shorebirds. In: Burger J., Olla B.L. (eds) *Shorebirds*. Springer, Boston, MA.

Forestry Commission Scotland (2006). Forest operations and birds in Scottish forests - the law and good practice. FCS Guidance Note 32, Forestry Commission Scotland, Inverness, Scotland.

Frederiksen, M. and Bregnballe, T. (2000). Diagnosing a decline in return rate of 1-year-old cormorants: mortality, emigration or delayed return? *Journal of Animal Ecology,* 69(5): 753-761. https://doi.org/10.1046/j.1365-2656.2000.00436.x

Garvin, J.C., Jennelle, C.S., Drake, D. and Grodsky, S.M. (2011). Response of raptors to a windfarm. *Journal of Applied Ecology,* 48: 199–209. https://doi.org/10.1111/j.1365-2664.2010.01912.x

Gibbons, D.W., Reid, J.B. and Chapman, R.A. (1993). The *New Atlas of Breeding Birds in Britain and Ireland: 1988–1991.* T.& A.D. Poyser, London, UK.

Gilbert, G., Gibbons, D.W. and Evans, J. (1998) *Bird monitoring methods.* Bedfordshire, England: Pelagic Publishing, Royal Society for the protection of Birds.

Gilbert, G., Stanbury, A. and Lewis, A. (2021). Birds of Conservation Concern in Ireland 4: 2020-2026. *Irish Birds,* 43:1-22. Available at: https://birdwatchireland.ie/birds-of-conservation-concern-in-ireland/

Gunnarsson, G., Elmber, J., Dessborn, L., Jonzén, N., Pöysä, H and Valkama, J. (2008). Survival estimates, mortality patterns, and population growth of Fennoscandian mallards *Anas platyrhynchos. Annales Zoologici Fennici,* 45: 483-495. https://doi.org/10.5735/086.045.0603

Hanfer, H., Kayser, Y., Boy, V., Fasola, M., Julliard, A-C., Pradel, R. and Cézilly, F. (1998). Local survival, natal dispersal, and recruitment in Little Egrets *Egretta garzetta. Journal of Avian Biology,* 29: 216-227. https://doi.org/10.2307/3677103

Hardey, J., Crick, H., Wernham, C., Riley, H., Etheridge, B. and Thompson, D. (2013). Raptors: a field guide to survey and monitoring. The Stationery Office, Edinburgh.

Hötker, H., Thomsen, K.-M., Jeromin, H. (2006). Impacts on biodiversity of exploitation of renewable energy sources: the example of birds and bats- facts, gaps in knowledge, demands for further research, and ornithological guidelines for the development of renewable energy exploitation. Michael-Otto-Institut, Naturschutzbund Deutschland, Bergenhusen. Available at: https://eolien-biodiversite.com/IMG/pdf/englischewindkraftstudie_1252510701.pdf

Hull, C.L., Stark, E.M., Peruzzo, S., and Sims, C.C. (2013). Avian collisions at two wind farms in Tasmania, Australia: taxonomic and ecological characteristics of colliders versus non-colliders. *New Zealand Journal of Zoology,* 40(1): 47-62. https://doi.org/10.1080/03014223.2012.757243

International Convention on Wetlands of International Importance, 1975. United Nations Treaty Series 996, entered into force 21 December 1975. Available at: https://treaties.un.org/doc/Publication/UNTS/Volume%20996/volume-996-I-14583-English.pdf

Johnson, W. P., Schmidt, P. M. and Taylor, D. P. (2014). Foraging flight distances of wintering ducks and geese: a review. *Avian Conservation and Ecology,* 9(2): 2. http://dx.doi.org/10.5751/ACE-00683-090202

Kenward, R.E., Walls, S.S., Hodder, K.H., Pahkala, M., Freeman, S.N. and Simpson, V.R. (2000). The prevalence of non-breeders in raptor populations: evidence from rings, radio-tags and transect surveys. *Oikos,* 91(2): 271-279. https://doi.org/10.1034/j.1600-0706.2000.910207.x

Kerry County Council (2015). Kerry County Development Plan 2015-2021. Kerry County Council, Tralee, Kerry.

Kerry County Council (2020). Kerry County Development Plan 2022-2028. Kerry County Council, Tralee, Kerry.

Lack, P.C. (1986). *The atlas of wintering birds in Britain and Ireland.* T & AD Poyser, UK.

Lewis et al (2019) Countryside Bird Survey: status and trends of common and widespread breeding birds 1998-2016. Irish Wildlife Manual No. 115, National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Ireland. https://www.npws.ie/sites/default/files/publications/pdf/IWM115.pdf

Madders, M. (2004) The ecology of hen harriers in Scotland in relation to windfarms.
Penbreck and Carmacoup proposed windfarm.

McGuinness, D., Muldoon, C., Tierney, N., Cummins, S., Murray, A., Egan, S. and Crowe, O. (2015). Bird Sensitivity Mapping for Wind Energy Developments and Associated Infrastructure in the Republic of Ireland. Birdwatch Ireland, Wicklow, Ireland. Available at: https://birdwatchireland.ie/app/uploads/2019/09/BWI-Bird-Wind-Energy-devt-Sensitivity-Mapping-Guidance_document.pdf

NPWS (2021) National Biodiversity Action Plan 2017-2021. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Ireland. Available at: https://www.npws.ie/sites/default/files/publications/pdf/National%20Biodiversity%20Action%20Plan%20English.pdf

Newton, I (1986). *The Sparrowhawk.* Calton: Poyser.

NRA (2009). Guidelines for Assessment of Ecological Impacts of National Road Schemes. National Roads Authority, Ireland. https://www.tii.ie/technical-services/environment/planning/Guidelines-for-Assessment-of-Ecological-Impacts-of-National-Road-Schemes.pdf

Orta, J., Boesman, P.F.D. and Marks, J.S. (2020). “Eurasian Kestrel (*Falco tinnunculus*)”. In: Billerman, S.M., Keeney, B.K., Rodewald, P.G. and Schulenberg, T.S. (eds). Ithaca, NY, USA: Cornell Lab of Ornithology.

Peach, W.J., P.S. Thompson and J.C. Coulson. (1994). Annual and long-term variation in the survival rates of British Lapwings *Vanellus vanellus*. *Journal of Animal Ecology*, 63(1): 60-7. https://doi.org/10.2307/5583

Pearce-Higgins, J.W., Stephen, L., Langston, R.H.W., Bainbridge and Bullman, R. (2009). The distribution of breeding birds around upland wind farms. *Journal of Applied Ecology*, 46(6): 1323–1331. https://doi.org/10.1111/j.1365-2664.2009.01715.x

Pearce-Higgins, J.W., Stephen, L., Douse, A. and Langston, R.H.W. (2012). Greater impacts of wind farms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis. *Journal of Applied Ecology*, 49: 386–394. https://doi.org/10.1111/j.1365-2664.2012.02110.x

Percival, S.M. (2003). Birds and wind farms in Ireland: a review of potential issues and impact assessment. Ecology Consulting, Durham, UK. Available at: https://tethys.pnnl.gov/sites/default/files/publications/Percival_2003.pdf

Picozzi, N. (1984). Sex ratio, survival and territorial behaviour of polygynous Hen Harriers Circus c. cyaneus in Orkney. *Ibis*, 126(3): 356-365. https://doi.org/10.1111/j.1474-919X.1984.tb00256.x

Planning and Development Act 2000. No. 30/2000, Dublin: Stationary Office. Available at: https://www.irishstatutebook.ie/eli/2000/act/30/enacted/en/html

Prévot-Julliard, A-C, Lebreton, J-D and Pradel, R. (1998). Re-evaluation of adult survival of black-headed gulls (*Larus Ridibundus*) in presence of recapture heterogeneity. *The Auk*, 115(1): 85-95. https://doi.org/10.2307/4089114

South West Regional Authority (2010). Regional Planning Guidelines for the South-west Region 2010-2022. South West Regional Authority, Ballincollig, Cork, Ireland. Available at: https://www.southernassembly.ie/uploads/general-files/http—www.southernassembly_.ie-images-uploads-SWRA_Planning_Guidelines_.pdf

Ruddock, M. and Whitfield, D.P. (2007). A review of disturbance distances in selected bird species. Natural Research (Projects) Ltd report to Scottish Natural Heritage. Available at: https://www.nature.scot/sites/default/files/2018-05/A%20Review%20of%20Disturbance%20Distances%20in%20Selected%20Bird%20Species%20-%20Natural%20Research%20Ltd%20-%202007.pdf

Ruddock, M., Mee, A., Lusby, J., Nagle, A., O'Neill, S. and O'Toole, L. (2016). The 2015 National Survey of Breeding Hen Harrier in Ireland. Irish Wildlife Manuals No. 93. National Parks and Wildlife Service, Department of the Arts, Heritage and the Gaeltacht, Ireland. https://www.npws.ie/sites/default/files/publications/pdf/IWM93.pdf

Sharrock, J.T.R. (1976). *The Atlas of Breeding Birds in Britain and Ireland*. T. & A. D. Poyser, Berkhamsted, UK.

Spence, I.M. (1998). Mortality of snipe estimated from a mark and recapture study. *Ringing and Migration*, 9(1): 27-31. https://doi.org/10.1080/03078698.1988.9673918

SNH (2000). Wind farms and birds: calculating a theoretical collision risk assuming no avoidance action. Scottish Natural Heritage, Inverness, Scotland. Available at: https://www.nature.scot/sites/default/files/2017-09/Guidance%20Note%20-%20Windfarms%20and%20birds%20-%20Calculating%20a%20theoretical%20collision%20risk%20assuming%20no%20avoiding%20action.pdf

SNH (2009). Monitoring the impact of onshore wind farms on birds. Scottish Natural Heritage, Inverness, Scotland. Available at: https://www.nature.scot/sites/default/files/2017-09/Guidance%20Note%20-%20Monitoring%20the%20impact%20of%20onshore%20windfarms%20on%20birds.pdf

SNH (2012). Assessing the cumulative impacts of onshore wind energy developments. Scottish Natural Heritage, Inverness, Scotland. Available at: https://www.nature.scot/doc/guidance-assessing-cumulative-landscape-and-visual-impact-onshore-wind-energy-developments

SNH (2016). Assessing connectivity with Special Protection Areas (SPAs). Scottish Natural Heritage, Inverness, Scotland. Available at: https://www.nature.scot/sites/default/files/2018-08/Assessing%20connectivity%20with%20special%20protection%20areas.pdf

SNH (2017). Recommended bird survey methods to inform impact assessment of onshore wind farms. Scottish Natural Heritage, Inverness, Scotland. Available at: https://www.nature.scot/sites/default/files/2018-06/Guidance%20Note%20-%20Recommended%20bird%20survey%20methods%20to%20inform%20impact%20assessment%20of%20onshore%20windfarms.pdf

SNH (2018) Avoidance rates for the onshore SNH wind farm collision risk model. Scottish Natural Heritage, Inverness, Scotland. Available at: https://www.nature.scot/sites/default/files/2018-09/Wind%20farm%20impacts%20on%20birds%20-%20Use%20of%20Avoidance%20Rates%20in%20the%20SNH%20Wind%20Farm%20Collision%20Risk%20Model.pdf

SNH (2018). Assessing the cumulative impacts of onshore wind farms on birds. Scottish Natural Heritage, Inverness, Scotland. Available at: https://www.nature.scot/sites/default/files/2018-08/Guidance%20-%20Assessing%20the%20cumulative%20impacts%20of%20onshore%20wind%20farms%20on%20birds.pdf

SNH (2018). Assessing significance of impacts from onshore wind farms outwith designated areas. Scottish Natural Heritage, Inverness, Scotland. Available at: https://www.nature.scot/doc/guidance-assessing-significance-impacts-bird-populations-onshore-wind-farms-do-not-affect-protected

Stevens, T.K., Hale, A.M., Karsten, K.B. and Bennett, V.J. (2013). An analysis of displacement from wind turbines in a wintering grassland bird community. *Biodiversity and Conservation,* 22:1755-1767. https://doi.org/10.1007/s10531-013-0510-8

Summers, R. W. and Critchley, C. N. R. (1990). Use of grassland and field selection by brent geese *Branta bernicla. Journal of Applied Ecology,* 27: 834-846. https://doi.org/10.2307/2404380

Thaxter, C. B., Lascelles, B., Sugar, K., Cook, A. S. C. P., Roos, S. Bolton, M., Langston, R. H. W. and Burton, N. H. K. (2012). Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protection Areas. *Biological Conservation,* 156: 53-61. https://doi.org/10.1016/j.biocon.2011.12.009

Wildlife Act 1976, No. 39/1976, Dublin: Stationary Office. Available at: http://www.irishstatutebook.ie/eli/1976/act/39/enacted/en/html?q=wildlife+act

Land, Soils and Geology

British Standards Institution (BSI). (2015) BS5930 - Code of Practice for Site Investigations.

Department of Housing, Planning and local Government, 2018: Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment.

Environmental Protection Agency (2017): Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports.

Environmental Protection Agency (September 2015): Draft - Advice Notes on Current Practice (in the preparation of Environmental Impact Statements).

Environmental Protection Agency (2003): Advice Notes on Current Practice (in the Preparation on Environmental Impact Statements).

European Union, 2017: Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU).

Gavin and Doherty Geosolutions (GDG) (2021). Peat and overburden management plan for Ballynagare Renewable Energy Development.

Gavin and Doherty Geosolutions (GDG) (2021). Peat Stability Risk Assessment (PSRA) and Peat Managing Plan (PMP) for Ballynagare wind farm.

Geological Survey of Ireland (GSI). (2005) Geology of Shannon Estuary, 1:100,000 scale Bedrock Geology Series, Sheet 17.

Institute of Geologists Ireland (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements.

National Roads Authority (2008): Guidelines on Procedures for Assessment and Treatment of Geology,

Hydrology and Hydrogeology for National Road Schemes.

Scottish Natural Heritage report (SNH) Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms (SNH, 2013).

Hydrology and Hydrogeology

CIRIA, 2006: Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006).

CIRIA, 2006: Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2006.

DoHLG, 2006: Wind Farm Development Guidelines for Planning Authorities.

DoE/NIEA, 2015. Wind farms and groundwater impacts - A guide to EIA and Planning considerations.

EPA (2017) Guidelines on the Information to be contained in Environmental Impact Assessment Reports – Draft.

EPA (September 2015): Draft - Advice Notes on Current Practice (in the preparation of Environmental Impact Statements).

EPA (September 2015): Draft – Revised Guidelines on the Information to be contained in Environmental Impact Statements.

EPA, 2003: Advice Notes on Current Practice (in the preparation of Environmental Impact Statements).

Gavin and Doherty Geosolutions (GDG) (2021). Peat and overburden management plan for Ballynagare Renewable Energy Development.

Gavin and Doherty Geosolutions (GDG) (2021). Peat Stability Risk Assessment (PSRA) and Peat Managing Plan (PMP) for Ballynagare wind farm.

Geological Survey of Ireland (GSI). (2005) Geology of Shannon Estuary, 1:100,000 scale Bedrock Geology Series, Sheet 17.

Geological Survey of Ireland. (2003) Groundwater Body Characterization Reports.

IFI, 2016: Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters, Inland Fisheries Ireland (2016).

IGI, 2013: Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements, (Institute of Geologists Ireland, 2013).

NRA, 2008: Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, (National Roads Authority, NRA, 2008).

PPG1 - General Guide to Prevention of Pollution (UK Guidance Note).

PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note).

OPW, 2009 – The Planning System and Flood Risk Management. Guidelines for Planning Authorities.

SNH, 2010: Scottish Natural Heritage report (SNH): Good Practice During Wind Farm Construction.

SNH, 2013: Scottish Natural Heritage report (SNH): Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms.

Air and Climate

Burck et al., 2020 Results 2020. Climate Change Performance Index. New Climate Institute, Bonn.

Climate Action Network Europe (2018). Off Target Report, Brussels.

Council of the European Union (2008) Council Directive 2008/50/EC on ambient air quality and cleaner air for Europe. Official Journal of the European Union No. L152.

Council of the European Union (2004) Council Directive (2004/107/EC) relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air. Official Journal of the European Union No. L23/3.

Council of the European Union (2002) Council Directive (2002/3/EC) relating to ozone in ambient air. Official Journal of the European Union No. L67/14.

Council of the European Union (2000) Council Directive 2000/69/EC relating to limit values for benzene and carbon monoxide in ambient air. Official Journal of the European Union No. L313.

Council of the European Union (1999) Council Directive 1999/30/EC relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air. Official Journal of the European Union No. L163/41

Department of Communications, Climate Action and Environment (2019) Climate Action Plan (CAP).

Department of Climate Change, Action & Environment (2015). Climate Action and Low Carbon Development Act 2015.

Department of Communications, Climate Action and Environment (2021). Climate Action and Low Carbon Development Amendment Act 2021.

Department of the Environment, Heritage and Local Government (2004). Quarries and Ancillary Activities, Guidelines for Planning Authorities.

Department of the Environment, Heritage and Local Government (2006). Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects.

Department of Climate Change, Action & Environment. Renewable Energy Action Plan (NREA) Submitted under Article 4 of Directive 2009/28/EC

Department of Climate Change, Action & Environment National Energy Efficiency Action Plan (NEEAP)

Department of Public Expenditure and Reform (2018) National Development Plan 2018-2027. Dublin.

Environmental Protection Agency (2008) Ambient Air Monitoring in Ennis 24th January 2006 to 18th April 2007

Environmental Protection Agency (2017). Irelands Environment 2017 – As Assessment. EPA, Wexford.

Environmental Protection Agency (2019) Air Quality in Ireland 2018. EPA, Ireland.

Environmental Protection Agency (July 2020) Ireland's Greenhouse Gas Emissions Projections 2019-2040. EPA, Ireland.

Environmental Protection Agency (November 2020) Ireland's Provisional Greenhouse Gas Emissions 1990 – 2020. EPA, Ireland.

Environmental Protection Agency (June 2021) Ireland's Greenhouse Gas Emissions Projections 2020-2040. EPA, Ireland.

European Commission (2019) COP25 Climate Change Conference. Available at: https://ec.europa.eu/clima/events/cop25-climate-change-conference_en

European Commission (2015). COP21 Paris Agreement. Available at: https://ec.europa.eu/clima/policies/international/negotiations/paris_en

European Commission (2010) Europe 2020 Strategy A European strategy for smart, sustainable and inclusive growth. Brussels.

European Environment Agency (2019) Air Quality in Europe - 2019 Report. European Environment Agency, Denmark.

European Environment Agency (2018). Air Quality in Europe – 2018 Report. European Environment Agency, Denmark.

European Union (2017) Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU).

Eurostat (2018), Smarter, greener, more inclusive? Indicators to Support the Europe 2020 Strategy. European Union, Luxembourg.

Met Éireann www.met.ie

Sustainable Energy Authority of Ireland (2018), Energy in Ireland 2018 Report.

Sustainable Energy Authority of Ireland (2020) *Energy in Ireland – 2020 Report*, SEAI, December 2020

Sustainable Energy Authority of Ireland (2021) Provisional Energy Balance, SEAI, September 2021

United Nations (2015) Transforming our World: the 2030 Agenda for Sustainable Development. Available at: https://sustainabledevelopment.un.org/sdgs

United Nations (2012). Doha Amendment to the Kyoto Protocol. United Nations Framework Convention on Climate Change.

United Nations (1998). Kyoto Protocol to the United Nations Framework Convention on Climate Change. United Nations Framework Convention on Climate Change, Bonn.

Noise and Vibration

EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports Draft August 2017 (EPA, 2017)

Transport Infrastructure Ireland (TII) (formerly National Roads Authority (NRA)) document Guidelines for the Treatment of Noise and Vibration in National Road Schemes (NRA, 2004).

BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise.

Design Manual for Roads and Bridges (DMRB), Highways England, Transport Scotland, The Welsh Government and The Department of Infrastructure 2019.

BS 7385 Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration (1993)

BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration.

Department of Trade & Industry (UK) Energy Technology Support Unit (ETSU) publication The Assessment and Rating of Noise from Wind Farms (1996)

Department of the Environment, Heritage and Local Government Wind Energy Development Guidelines (2006)

Institute of Acoustics (IoA) document A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (2013)

ISO 9613: Acoustics – Attenuation of sound outdoors, Part 2: General method of calculation (1996).

EPA Guidance Note for Noise Assessment of Wind Turbine Operations at EPA Licensed Sites (NG3) (2011)

World Health Organisation (WHO) Community Noise (1995)

UK Health Protection Agency published a report entitled Health Effects of Exposure to Ultrasound and Infrasound, Report of the independent Advisory Group on Non-ionising Radiation.

South Australian Environment Protection Authority namely, Infrasound levels near windfarms and in other environments (EPA, 2013)

State Office for the Environment, Measurement and Nature Conservation of the Federal State of Baden-Württemberg Low Frequency Noise incl. Infrasound from Wind Turbines and Other Sources (2016)

DIN 45680:2013-09 – Draft Measurement and Assessment of Low-frequency Noise Immissions (November 2013)

IOA Noise Working Group (Wind Turbine Noise) Amplitude Modulation Working Group (AMWG) document A Method for Rating Amplitude Modulation in Wind Turbine Noise (IOA, 2016)

RenewableUK AM project (2013)

Department of Environment Food and Rural Affairs (DEFRA), the Department of Business, Enterprise and Regulatory Reform (BERR) and the Department of Communities and Local Government (CLG) Research into Aerodynamic Modulation of Wind Turbine Noise (2007).

National Health and Medical Research Council (NHMRC) Evidence on Wind Farms and Human Health 2015

Health Canada Wind Turbine Noise and Health Study: Summary of Results (2014)

Journal of Occupational and Environmental Medicine Wind Turbines and Health: A Critical Review of the Scientific Literature (2014)

EPA Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR), Draft (August 2017)

ISO 1996: 2017: Acoustics — Description, measurement and assessment of environmental noise.

ISO 9613: Acoustics – Attenuation of sound outdoors, Part 2: General method of calculation, (ISO, 1996).

EPA Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) (2016)

Landscape and Visual

Clare County Council (2017), Clare County Development Plan 2017-2023

Clare County Council (2017), Clare Wind Energy Strategy 2017-2023

Carmarthenshire County Council (2013), Cumulative Impact of Wind Turbines on Landscape and Visual Amenity.

Department of Housing, Planning and Local Government (2019), Draft Revised Wind Energy Development Guidelines. DHPLG, Dublin.

Department of the Environment, Heritage and Local Government (2006), Wind Energy Development Guidelines for Planning Authorities. DoEHLG, Dublin.

Department of the Environment and Local Government, (2000), Landscape and Landscape Assessment: Consultation Draft of Guidelines for Planning Authorities' DoEHLG, Dublin.

Kerry County Council (2012) Draft Renewable Energy Strategy

Kerry County Council (2012) Landscape Character Assessment prepared for the Renewable Energy Strategy 2012 & Adopted / Proposed Archaeological Landscapes

Kerry County Council (2015) The Kerry County Development Plan 2015-2021

Landscape Institute (2017), Visual Representation of Development Proposals. Guidance Note 02/17. London, UK.

Landscape Institute (2011), Photography and photomontage in landscape and visual impact assessment. Advice Note 01/11. London, UK.

The Landscape Institute/Institute of Environmental Management and Assessment, UK, (2013), Guidelines for Landscape and Visual Impact Assessment.

Scottish Natural Heritage (2017), Siting and Designing Wind Farms in the Landscape, Version 3a. SNH, Stirling, UK.

Scottish Natural Heritage (2017), Visual Representation of Wind Farms: Version 2.2 SNH, Stirling, UK

Scottish Natural Heritage (2015), Spatial Planning for Onshore Wind Turbines – natural heritage considerations. SNH, Stirling, UK.

Scottish Natural Heritage (2012), Assessing the Cumulative Impact of Onshore Wind Energy Developments. SNH, Stirling, UK.

Scottish Natural Heritage (2002), Visual Assessment of Wind Farms: Best Practice SNH, Stirling, UK.

Archaeological and Cultural Heritage

Architectural Heritage Guidelines for Planning Authorities (2011)

Bennett, I. (ed.) Excavations.ie, database of Irish excavation reports. Available at http://www.excavations.ie.

Department of Arts, Heritage, Gaeltacht and the Islands, 1999, Framework and Principles for the Protection of the Archaeological Heritage, 1999.

Guidelines on the information to be contained in Environmental Impact Statements, EPA 2017.

Kerry County Development Plan 2015-2021

Guidance on Setting and the Historic Environment, Historic Environment Division, February 2018

Record of Monuments and Places (RMP) for County Kerry.

1st Edition 6 inch OS maps (1835)

2nd Edition 25 inch OS maps (1903)

www.webgis.archaeology.ie/historicenvironment

www.excavations.ie

www.buildingsofireland.ie

www.logainm.ie

Material Assets

Department of the Environment, Community and Local Government (2013). Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment. DoEHLG, Dublin.

Department of the Environment, Heritage and Local Government (2006). Wind Energy Development Guidelines for Planning Authorities. DoEHLG, Dublin.

Department of Housing, Planning and Local Government (December 2019) Draft Revised Wind Energy Development Guidelines. DHPLG, Dublin.

Department of Housing, Planning and Local Government (August 2018) Guidelines for Planning Authorities and An Bord Pleanála on Carrying out Environmental Impact Assessment. DHPLG, Dublin.

Department of Housing, Planning and Local Government (June 2017) Review of the Wind Energy Development Guidelines 2006 – Preferred Draft Approach. DHPLG, Dublin.

Irish Wind Energy Association (2012). Best Practice Guidelines for the Irish Wind Energy Industry.

National Roads Authority (2011). Project Appraisal Guidelines, Unit 5.5 Link Based Traffic Growth Forecasting. NRA, Dublin.

National Roads Authority (2011). NRA TD 41-42/11 Geometric Design of Major/Minor Priority Junctions and Vehicular Access to National Roads. NRA, Dublin.

National Roads Authority (2007). Traffic and Transport Assessment Guidelines. NRA, Dublin.

National Roads Authority (2003). Future Traffic Forecasts, 2002 to 2040. NRA, Dublin.

TII (May 2019) Project Appraisal Guidelines for National Roads Unit 5.3 – Travel Demand Projections PE-PAG-02017, Transport Infrastructure Ireland.

TII (October 2016) Project Appraisal Guidelines for National Roads Unit 5.2 – Data Collection PE-PAG-02016, Transport Infrastructure Ireland.

TII (May 2014) Traffic and Transport Assessment Guidelines PE-PDV-02045. Transport Infrastructure Ireland.