3. CONSIDERATION OF REASONABLE ALTERNATIVES

3.1 Introduction

3.1.1 Overview

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 Environmental Impact Assessment Report (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 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, grid connection, construction compound and borrow pit. 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 (EPA) guidelines 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.

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 with regards to their environmental impacts.

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

- 'Do Nothing' Alternative
- Alternative Locations
- Alternative Renewable Energy Technologies
- Alternative Turbine Numbers and Model;
- Alternative Designs;
- Alternative Grid Connections
- Alternative Transport Route and Site Access; 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.

3.2 'Do-Nothing' Alternative

Annex IV, Part 3 of the EIA Directive states that the description of reasonable alternatives studied by the developer 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 developing the Proposed Development would be to leave the site as it is under its current planning permission. As detailed in Section 2.5.1 in Chapter 2 of this EIAR, a wind energy project comprising of 13 turbines and all associated infrastructure has current planning permission on the Proposed Development site. The permitted wind energy project was designed to co-exist and operate independently of land use practices of commercial peat harvesting and forestry to minimise impacts. Whilst there would be a change of land use within the footprint of the Proposed Development, to facilitate the wind turbines and infrastructure, this was found to be an acceptable part of the permitted development.

This EIAR assesses the potential for peat extraction works on the site to continue as a worst-case scenario. The Proposed Development has been designed to operate on this site in conjunction with any peat extraction activities. Should peat extraction cease, a site rehabilitation plan will be required which would be likely to encourage revegetation of bare peat areas, with targeted active management being used to enhance re-vegetation and the creation of small wetland areas. Due to the small footprint of the Proposed Development in the context of the entirety of the commercial peat extraction area, a rehabilitation plan where required would take account of the wind farm infrastructure. In doing so, the environmental effects in terms of emissions are likely to be neutral.

The section of the Proposed Development site that does not form part of the currently permitted wind energy development site has a current-land use practice of forestry and low-intensity pastoral agriculture. An alternative land-use option to developing a renewable energy project at this section of 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 pastoral agriculture and forestry. The environmental effects of this are considered to be neutral.

A second potential Do-Nothing scenario exists for this project i.e. assuming that the permitted development is not constructed. In this scenario the existing baseline environment will evolve in one of two potential ways, either the peat extraction ceases and a rehabilitation plan is developed or the peat extraction continues and then a rehabilitation plan is developed.

In implementing the 'Do-Nothing' alternatives, however, the opportunity to capture an additional part of Westmeath's valuable renewable energy resource would be lost, as would the opportunity to contribute in a more meaningful way 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 additional local employment and investment would also be lost. It is likely that the trends of population decline and rural deprivation that have been recorded within the Study Area would continue in the absence of investment, as discussed in Chapter 5 of this EIAR on Population and Human Health. Overall, the potential impact of this is considered to be long term, negative and slight.

Commercial peat harvesting works, forestry and pastoral agriculture use have been assessed in conjunction with the proposed wind energy development.

A comparison of the potential environmental effects of the 'Do-Nothing' Alternative of the permitted 13 turbine project when compared against the Proposed Development of a 15 turbine renewable energy project at this site are presented in Table 3-1 below. The potential environmental effects of developing the 15 turbine project i.e. the Proposed Development are addressed in detail in the EIAR and NIS.

Table 3-1 Comparison of environmental effects when compared against the proposed option (developing the proposed wind farm at this site)

Environmental Consideration	Do Nothing Alternative
Population & Human Health (incl. Shadow Flicker)	Additional increase in local employment and additional long-term financial contributions towards the local community due to the increase in project size. Neutral, in terms of shadow flicker as Coole Wind Farm Ltd. has committed to zero shadow flicker.
Biodiversity & Ornithology	Some additional low value habitat loss associated with the additional turbine infrastructure.
Land, Soils & Geology	Some additional ground disturbance associated with the proposed project.
Geotechnical	Neutral.
Water	Some additional groundworks will be required with the chosen option however the impact of this will be imperceptible.
Air & Climate	Will provide the opportunity for an overall increase in air quality or reduction of greenhouse gasses. The proposed project has the potential to assist further in achieving the renewable energy targets set out in the Climate Action Plan.
Noise & Vibration	There is potential for additional noise impacts associated with the proposed project which have been mitigated against in the design.
Landscape & Visual	There is potential for additional landscape & visual impacts associated with the proposed project which have been mitigated against in the design.
Cultural Heritage & Archaeology	There is potential for additional impacts on unrecorded, subsurface archaeology associated with the proposed project which will be mitigated against.
Material Assets	Neutral.

3.3 Alternative Locations

3.3.1 Strategic Site Selection

The process of identifying a suitable wind farm site is influenced by a number of factors. While wind speeds, the area of suitable or available land, and planning policy are all very important, a wind farm project must be commercially viable/competitive, as otherwise it will never attract the necessary project finance required to see it built. The grid connection, or the method by which a proposed wind farm is connected to the national grid to export electricity from the site is of critical importance. Without viable grid connection options, a wind farm cannot be built, regardless of how good the wind speeds on a site might be, how much land is available, or how favourable a planning permission may be. The distance from any potential wind farm site to the likely grid connection point, the extent and cost of grid

upgrades required to facilitate the connection of the wind farm, the delay in having those reinforcement works undertaken, are all critical factors that could render a wind farm project commercially viable or unviable.

As set out in Section 1.3 of this EIAR the applicant company, Coole Wind Farm Ltd. is affiliated with Statkraft Ireland Ltd. which is part of the wider Statkraft group, a global renewable energy company that develops, acquires, builds and operates utility-scale wind and solar power projects. The team at Statkraft Ireland has constructed a portfolio of approx. 299 Megawatts (MW) of wind projects in Ireland, operates approx. 417MW and has an established track record in wind energy in Ireland. Statkraft Ireland Ltd. invests a significant amount of time and resources identifying and investigating sites for renewable energy proposals throughout the Country.

Sites selected for the development of a wind farm must be suitable for consideration under several criteria, such as:

- Site location relative to the Westmeath Wind Energy Strategy's classification of areas considered suitable for wind farm development from a planning policy perspective;
- Access to the national electricity grid possible within a viable distance;
- Located outside areas designated for protection of ecological species and habitats;
- Sufficient area of unconstrained land that could potentially accommodate wind farm development and turbine spacing requirements;
- Consistently high average annual wind speeds;
- Low population density; and
- Visual Amenity.

The site selection process originally began at a national level with a nationwide search to identify suitable regions for wind energy development. This nationwide search identified environmental designations (e.g. SACs and SPAs) and cumulative wind farm development, in conjunction with a lack of sufficient grid capacity as significant constraints to wind development in the west, southwest and northwest of Ireland. The most suitable region for wind farm development in the nationwide search was determined to be the Midlands together with part of the Greater Dublin Area. Plates 3-1 to 3-2 identifies this area in the context of the aforementioned constraints.

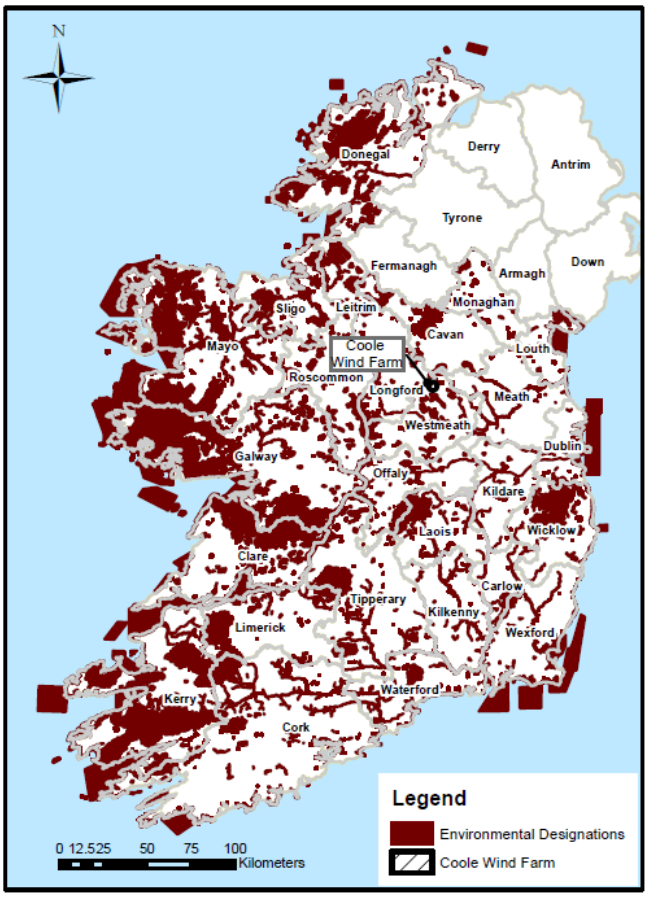


Plate 3-1 Environmental Designations in Ireland

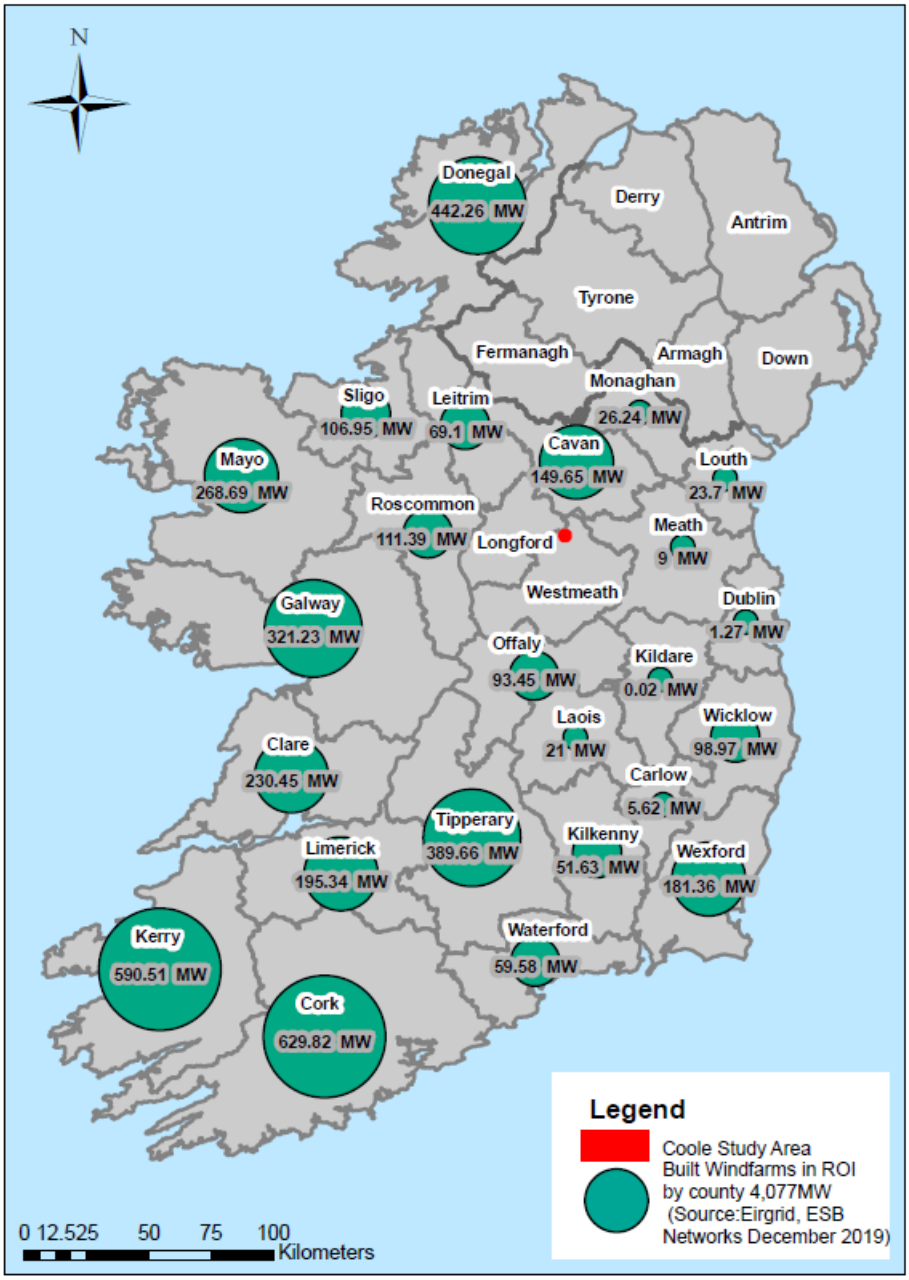


Plate 3-2 Built Wind Farms in Ireland

Within the nationwide search, the site selection process was constraints and facilitators-led. Facilitators are factors that give an advantage to a proposed project, while constraints are restrictions that inform the location and design of a project by highlighting sensitivities.

The constraints and facilitators will be explained further below in so far as they influenced the site selection exercise undertaken.

3.3.1.1 Planning Policy

3.3.1.1.1 *Westmeath County Development Plan 2014 – 2020 (as varied)*

The Westmeath County Development Plan 2014 – 2020 (WCDP) provides the strategic framework for land-use planning in the county. The Plan sets out the Vision and Strategic Aims for the county, which

are supported by a number of policies and objectives. In relation to energy it is an aim of the County Development Plan "*to support and provide for the development of indigenous energy resources, with an emphasis on renewable energy supplies".*

Section 10.5.2 of the Plan states the following:

The preferred locations for large scale energy production, in the form of wind farms, is onto cutover cutaway peatlands in the county subject to nature conservation and habitat protection requirements being fully addressed. Section 10.6 of the Plan sets out the relevant policies and objectives of Westmeath County Council in relation to large-scale wind energy projects, as follows:

- *Policy P-WIN2: To strictly direct large-scale energy production projects, in the form of Wind Farms, onto cutover cutaway peatlands in the county, subject to environmental, landscape, habitats and wildlife protection requirements being addressed. In the context of this policy, industrial scale/large-scale energy production projects are defined as follows: Projects that meet or exceed any of the following criteria:*

  - *Height: over 100 m to blade tip, or*
  - *Scale: More than five turbines*
  - *Output: Having a total output of greater than 5 MW*

In the context of the Westmeath County Development Plan and specially Policy P-WIN2, the Proposed Development is classed as an industrial-scale or large-scale wind energy project and is primarily located on cutover cutaway peatland which is in line with the requirements of the County Development Plan in relation to the preferred locations for wind farms. Turbines T1 to T4, and T6 to T13 are all located on cutover cutaway peatland, while T5 and T14 are located in areas of coniferous forestry and T15 is located within an area of agricultural (rough grazing) land.

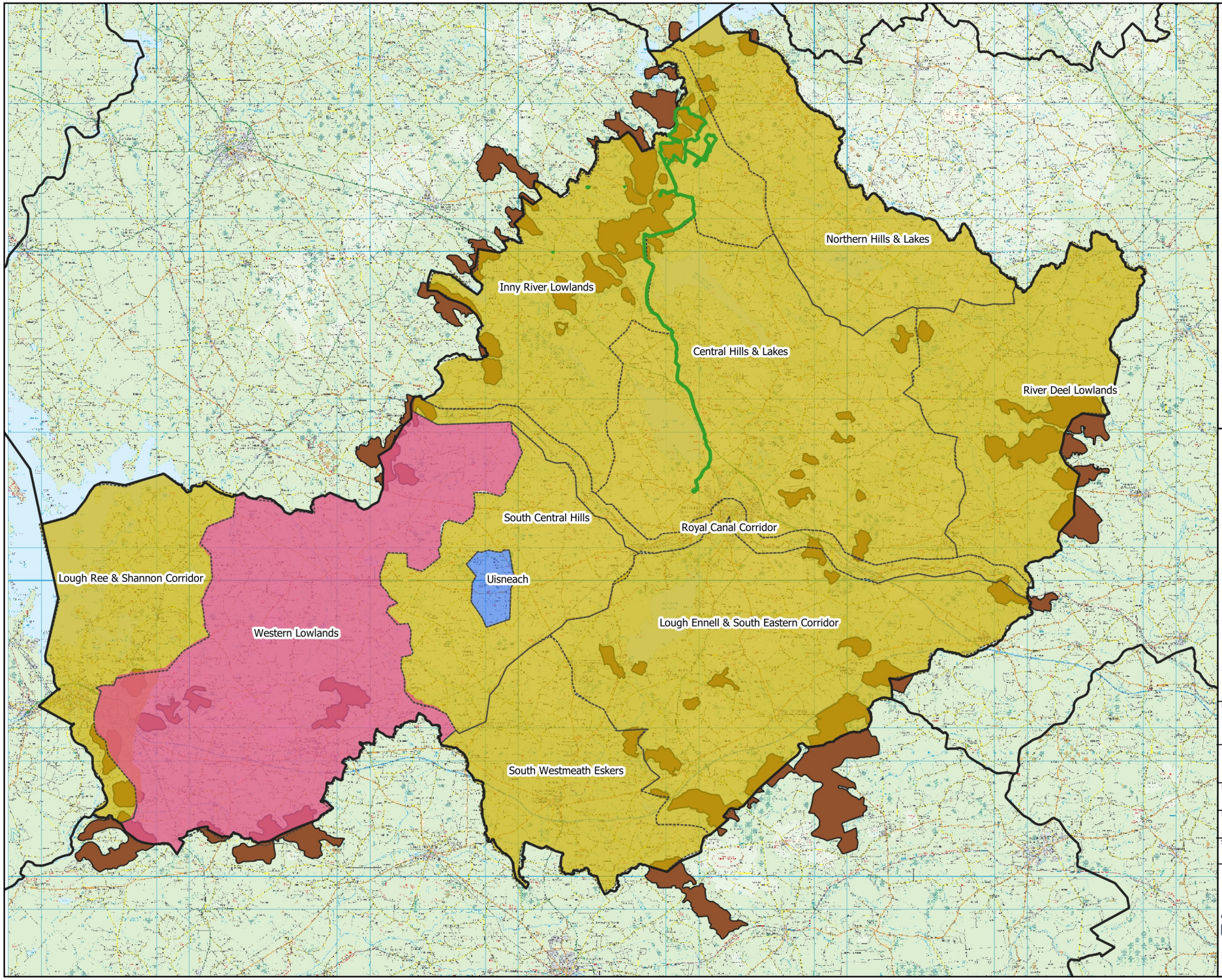
- *Policy P-WIN3: To ensure the siting and development of wind turbines is carried out in accordance with the requirements of the DoEHLG Wind Energy Development Guidelines 2006, and as otherwise amended.*
- *Objective O-WIN1: To prepare and implement a Management Plan for the Industrial Peatlands in the county, in consultation with stakeholders and adjacent Local Authorities, during the lifetime of the Plan. Said plan shall focus on recreational opportunities, renewable energy, hydrological and ecological considerations and shall be subject to environmental assessment and the requirements of Article 6 of the Habitats Directive.*

Map 04 in Volume 2 of the County Development Plan presents the Wind Energy Development map for Co. Westmeath. This map is based on the Landscape Character Assessment map for the County, which defines 11 no. distinct Landscape Character Areas (LCAs). Each LCA is classified by the Plan in terms of its capacity for wind energy development, according to the following terms:

- Low Capacity: 10 no. LCAs
- No Capacity: 1 no. LCA; Uisneach

All but one LCA of the county are classified as 'Low Capacity' for wind energy development. The Inny River Lowlands LCA, in which the Proposed Development site is located, is one of the 10 No. LCAs classified as 'Low Capacity' for wind energy development, as shown in Figure 3-1.

The Inny River Lowlands LCA is described in the Plan as comprising "*the low-lying ground around the Inny River from Finnea to Ballynacarrigy and the Royal Canal including pastoral landscapes, extensive areas of cutaway bog, industrial peat production and conifer plantations*".



Map Legend

- EIAR Site Boundary
- Peatlands
- County Boundary

Westmeath County Development Plan - Wind Energy Strategy

- Westmeath Low Wind Capacity (2015-2020) (draft 2021-2027)
- Westmeath No Wind Capacity (2015-2020) (draft 2021-2027)
- Westmeath Medium Wind Capacity (draft 2021-2027)
- Westmeath Landscape Character Areas 2015-2020 (draft 2021-2027)

Drawing Title: Westmeath Wind Energy Strategy, Landscape Character Areas & Peatlands

Project Title: Coole Wind Farm, Co. Westmeath

Drawn By	Checked By
EC	MW
Project No.	Drawing No.
200445	Figure 3-1
Scale	Date
1:300000	10.01.2021

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In relation to cutover cutaway peatlands as the preferred locations for 'industrial-scale' wind farms in Co. Westmeath, Section 10.5.2 of the County Development Plan states:

> *"The National Spatial Strategy refers specifically to the many worked out bogs in the Midlands, as being highly suited to wind energy development at a significant enough scale to support ancillary manufacturing, servicing and development activities. Furthermore, the Midland Regional Planning Guidelines 2010-2022 acknowledge the potential of the peatlands and associated cutaway areas to accommodate large scale energy production in the form of wind farms and bio-energy fuel sources. With a strong history of energy production and an extensive electricity transmission network in place, the potential exists in such peatland areas for a smooth transition to renewable energy sources. In addition the RPG's support the preparation of a Holistic Management Plan that will address the future uses of worked out industrial peatlands."*

The siting of the Proposed Development primarily on cutover cutaway peatland is recognised within the Inny River Lowlands LCA as 'extensive areas of cutaway bog' and therefore in line with the requirements of the County Development Plan in relation to preferred sites.

On the 24th April 2017, Westmeath County Council adopted Variation no. 2 of the County Development Plan 2014-2020, and was formerly incorporated into the Plan on the 19th of May, 2017. The variation made an amendment to the wind energy strategy for the council by inserting planning policy P-WIN 6 into Section 10.6 of the County Development Plan. P-Win 6 provides for the following separation distances between wind turbines and residential dwellings.

- "**500 metres**, where height of the wind turbine generator is greater than 25 metres but does not exceed 50 metres.
- **1000 metres**, where the height of the wind turbine generator is greater than 50 metres but does not exceed 100 metres.
- **1500 metres**, where the height of the wind turbine generator is greater than 100 metres but does not exceed 150 metres.
- **More than 2000 metres**, where the height of the wind turbine generator is greater than 150 metres."

In considering the variation submissions were made by the Department of Housing, Planning, and Local Government. In its submission the Department noted that the Variation was significantly in conflict with national and regional policy objectives to support the development of wind energy as a crucial component of meeting Irelands commitments to reducing greenhouse gas emissions and increasing renewable energy resources, furthermore it was considered that the imposition of such set-backs would be impractical and premature pending the issuing of revised Wind Energy guidelines following the current national review process. The Chief Executive of the Planning Authority in his report on the variation considered the variation to be "seriously in conflict with national and regional policy," ... and he strongly recommended that the Councillors would not proceed to adopt it. Notwithstanding this recommendation, the Councillors voted to proceed with the Variation and it was subsequently adopted. The provisions of this variation of the Plan and its consideration in relation to the current proposal are further discussed in Section 2.4.2.3, Chapter 2.

The wording of the variation does not specify the reasons for its inclusion in the County Development Plan and is not based on scientific evidence. However, it can be assumed by the reference to separation distances from residential properties that the primary reason is the protection of residential amenities. In this regard, the Proposed Development has been designed in accordance with national guidelines, and will not have an adverse impact on residential amenity, human beings, population or human health. The Proposed Development layout has been developed in adherence with current national policy and the detailed assessments on noise, shadow flicker, landscape, human beings, population and human health demonstrate that the proposal will not give rise to significant adverse impact on residential amenities.

3.3.1.1.2 Draft Westmeath County Development Plan 2021 - 2027

The Draft Westmeath County Development Plan (CDP) 2021-2027 was made available for public review and comment from the 28th of February 2020 to the 30th of June 2020. At the time of writing this report, it is anticipated that the new county development plan will be adopted by the Council in Q2 2021. With regard to the above policy provisions, the Draft CDP does not significantly diverge from what has been established within the WCDP 2014 – 2020 with regard to renewable energy, as indicated below:

- **Policy CPO 10.128**: Support local, regional, national and international initiatives for limiting emissions of greenhouse gases through energy efficiency and the development of renewable energy sources which make use of the natural resources in an environmentally acceptable manner and having particular regard to the requirements of the Habitats Directive.
- **Policy CPO 10.133:** Ensure the security of energy supply by supporting the potential of the wind energy resources of the County in a manner that is consistent with proper planning and sustainable development of the area.

With regard to the Proposed Development, the Council recognises the importance of wind energy as a renewable energy source which can play a vital role in achieving national targets in relation to reductions in fossil fuel dependency, and therefore, seeks to enable the renewable and wind energy resources of County Westmeath to be harnessed in a manner that is '*consistent with proper planning and sustainable development of the area*'. The Draft CDP maintains its policy that the preferred locations for large scale energy wind farms is onto cutover cutaway peatlands in the County, subject to nature conservation and habitat protection requirements being fully addressed (**Policy CPO 10.135**).

In addition, on Monday 16th November 2020, councillors voted to retain **Policy CPO 10.132** in the Draft Plan which maintains the existing separation distances regarding wind farm design.

A Landscape Character Assessment of the County has been undertaken as part of the preparation of the Draft CDP which provides an understanding of the value and sensitivity of the County's landscapes and its future management needs. The Landscape Character Assessment maintains the prior 11 Landscape Character Areas with the Proposed Development still situated within the Inny River Lowlands. Map 48 of the Draft CDP illustrates that the Inny River Lowlands have again been categorised as having 'Low Capacity'. There are no High Amenity Areas, Protected Views or Public Rights of Way through the Proposed Development site.

All 15 no. turbines proposed are within an area designated as 'Low Capacity' for wind energy development by the Wind Energy Strategy as part of Westmeath County Development Plan 2014-2020 (as varied) and the Draft CDP, and is therefore, the most suitable classification for development. Please see Figure 3-1.

3.3.1.1.3 Other County Development Plans

The Proposed Development is located exclusively within the administrative boundary of Westmeath County Council; nonetheless, the Longford county boundary partially borders the Proposed Development site and is therefore taken account of here.

The Longford County Development Plan 2015 – 2021 recognises that the county provides good opportunities for the harnessing of wind energy, and states that the wind energy potential available within the Council is 3,120 MW of power per annum. The Plan states that in determining applications for wind farm developments consideration will be given to 'Wind Energy Guidelines for Planning Authorities' (DOEHLG 2006, or any relevant updates). The Longford County Development Plan also contains a map which sets out the County's Areas of Wind Farm Potential, and designates non-preferred and preferred locations.

Policy WD 2 of the Plan states:

"Proposals for large scale industrial wind farm developments shall be directed to areas of cutaway bogs subject to the following;

- Dependent on the completion of an investigation demonstrating suitability of the areas,
- The preparation of revised Wind Energy Development Guidelines and the Renewable Energy Export Policy and Development Framework,
- Compliance with the necessary environmental assessments."

Although the Proposed Development site lies outside the functional area of the Longford County Plan, the proposal respects the general approach set out in the Plan and the Proposed Development is not located in the vicinity of any areas that have been designated as "Non-preferable locations" for wind farm development within Co, Longford. The closest such area lies approximately 10 kilometres northwest of the Proposed Development.

3.3.1.2 Grid Connection

A key driver in identifying a suitable location for a wind farm is grid capacity and connection. This rationale is supported in the '*O Grianna & ors -v- An Bord Pleanála'* High Court Judgement where Justice Mr. Peart took the view that '*the connection to the national grid, is an integral part of the overall development*' and '*The wind turbine development on its own serves no function if it cannot be connected to the national grid. In that way, the connection to the national grid is fundamental to the entire project*'.

A grid connection for the project has been sought under the Enduring Connection Policy known as ECP2.1 which opened in September 2020. The Commission for Regulation of Utilities (CRU) develop the Enduring Connection Policy in Ireland and ECP2 is the second stage of this policy. In November 2020, Coole Wind Farm Ltd received confirmation of their successful application and acceptance into the ECP2.1 process. The grid connection offer for Coole Wind Farm was issued in January 2021 for a Maximum Export Capacity of 88MW with a connection node at Mullingar substation.

It is proposed to connect the Proposed Development to the national electricity grid via an underground cable which is 26km in length and will connect the proposed onsite substation to the existing Mullingar 110 kV substation. There will be no requirement for overhead lines. The proposed grid connection has been assessed as part of this EIAR and forms part of the Proposed Development.

Initially consultation with EirGrid and a Grid Capacity Study was undertaken to inform the grid connection for the Coole Wind Farm. The Grid Capacity Study was undertaken by an independent Electrical Engineering Consultancy, MullanGrid Consulting which consisted of a review of the local network, capacity at local substations, potential connection methods and associated costs. Following this study and ongoing consultation with EirGrid, a proposal to connect the development to the existing 110kV substation at Mullingar via underground cable was identified and assessed in the planning application for the permitted 13 turbine project. Since this time ongoing consultation with EirGrid on the grid connection approach for the project has taken place. Refer to Section 3.7 below.

This area of the electricity transmission network is particularly suitable for the connection of wind generation from a grid system operator's perspective. This is supported by the latest EirGrid, All Island Ten Year Transmission Forecast Statement, 2019 which designates the area of the Proposed Development as an efficient area in the country to connect a wind farm from an electricity network perspective. There are two factors that can demonstrate this within the EirGrid All Island Ten Year Transmission Forecast Statement, 2019: the Generator Transmission Use of System values (GTUoS) (Plate 3-3) and the Transmission Loss Adjustment Factor (TLAF) (Plate 3-4).

EirGrid would apply one of its lowest TUoS values to a project connecting in this area. This is primarily due to the existing capacity that exists in the network in this area which means that less network reinforcements are required in the area to facilitate the power from the Proposed Development.

The TLAF values that EirGrid will apply for the Proposed Development are positive compared to most other areas in the country. This is a clear signal that connecting generation in this area of the network is of tangible benefit to the overall network and to all electricity users. The GTUoS and TLAF values that EirGrid will apply for the Proposed Development give it a considerable commercial advantage over wind farms connecting to the grid system in other parts of the country.

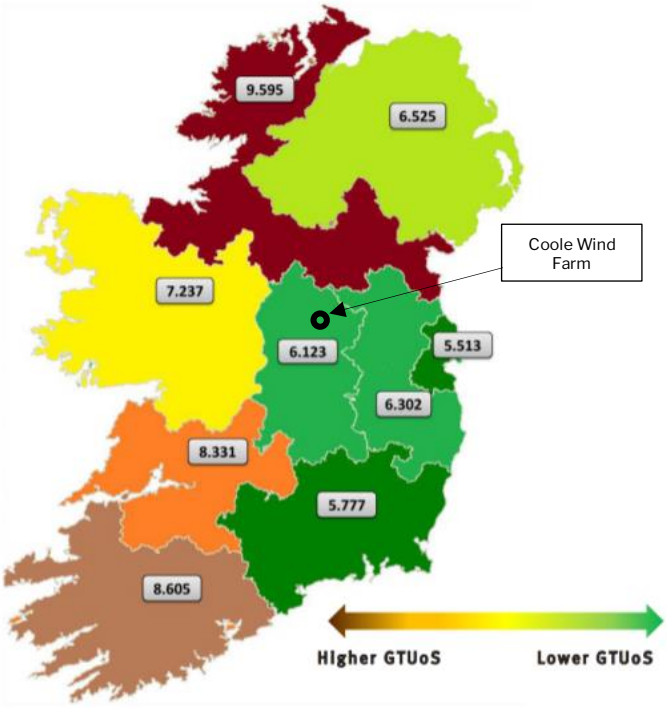


Plate 3-3 Generator Transmission Use of System values (GTUoS)

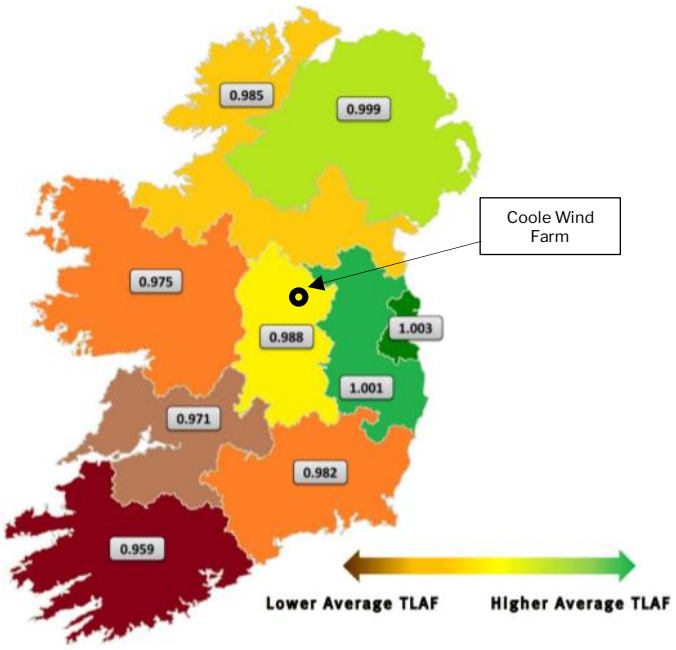


Plate 3-4 Transmission Loss Adjustment Factor (TLAF)

3.3.1.3 Designated Sites

The Proposed Development site is not located within any area designated for ecological protection. The nearest Natura 2000 site, i.e. Special Area of Conservation (SAC) or Special Protection Area (SPA) is Lough Kinale and Derragh Lough SPA, the boundary of which is located approximately 1.8 kilometres north of the Proposed Development site, at its nearest point. The nearest SAC is Derragh Bog SAC, the boundary of which is located approximately 2.5 kilometres north west of the site.

The nearest national designated site, i.e. Natural Heritage Area (NHA) or proposed NHA (pNHA), is Lough Bane pNHA, located at the northern boundary of the site.

3.3.1.4 Wind Speeds

A suitable wind regime and consistent wind speeds are required for the development of a wind energy project. The Irish Wind Atlas produced by Sustainable Energy Ireland shows average wind speeds for the country. Wind speeds in the midlands bog groups are typically between 7 – 8 m/s. While the wind resource of Ireland's midlands is lower than that of coastal and elevated regions, it is still very good in comparison with many parts of Europe. The permitted Coole Wind Farm includes for a rotor diameter of up to 70m. For the Proposed Development a rotor dimeter of up to 77.5m is proposed. The use of a greater rotor diameter allows for a greater capture of wind, increasing the efficiency of the project and allowing the project to contribute further to the Climate Action Plan targets for 2030.

3.3.1.5 Population Density

The applicants sought to identify an area with a relatively low population density. Having reviewed the settlement patterns in the vicinity, the study area emerged as suitable to accommodate the Proposed Development. The population density of the Study Area, as described in Chapter 5: Population and Human Health of this EIAR, is 10.5 persons per square kilometre. This is significantly lower than the average national population density of 69.6 persons per square kilometre.

3.3.1.6 Landscape Capacity

Detailed consideration was given to the capacity of the receiving landscape to receive the Proposed Development, including the potential for cumulative visual impacts. As detailed above Map 04 in Volume 2 of the County Development Plan presents the Wind Energy Development map for Co. Westmeath. This map is based on the Landscape Character Assessment map for the County, which defines 11 no. distinct LCA. Each LCA is classified by the Plan in terms of its capacity for wind energy development, with the Inny River Lowlands LCA, in which the Proposed Development site is located, is one of the 10 No. LCAs classified as 'Low Capacity' for wind energy development, as shown in Figure 3-1. The Inny River Lowlands LCA is described in the Plan as comprising *"the low-lying ground around the Inny River from Finnea to Ballynacarrigy and the Royal Canal including pastoral landscapes, extensive areas of cutaway bog, industrial peat production and conifer plantations".*

The siting of the Proposed Development primarily on cutover cutaway peatland is recognised within the Inny River Lowlands LCA as 'extensive areas of cutaway bog' and therefore in line with the requirements of the County Development Plan in relation to preferred sites for 'industrial-scale' wind farms in Co. Westmeath. Turbine T5, T14 and T15 are located in areas of coniferous forestry and agricultural (rough grazing) land also within the Inny River Lowlands LCA. These turbine locations have been comprehensively assessed as part of the EIAR, the findings of which indicate that these locations are suitable for the development of wind turbines.

3.3.1.7 Cultural Heritage

The Proposed Development avoids direct impacts on cultural heritage.

3.3.1.8 Land-use

Cutover cutaway peatlands have been identified as a preferred location for the siting of wind farms in the Midlands, as per the National Spatial Strategy 2002 - 2020, the Regional Planning Guidelines for the Midlands 2010 – 2022 and the Westmeath County Development Plan 2014 - 2020, subject to the relevant planning and environmental requirements being addressed. The Proposed Development is based on this plan-led approach and is primarily located on the preferred areas of cutover cutaway peatland. Turbines T5 and T14 are located in areas of coniferous forestry and T15 is located within an area of agricultural (rough grazing) land.

3.3.1.9 Access, Infrastructure and Constructability

It is preferred to use sites with good access and existing infrastructure in the form of internal roads. The Proposed Development site is easily accessible by the M4, N4 regional and local road network. A detailed study of the turbine delivery route has been carried out and is contained in Appendix 4-7 of this EIAR. Due to the relatively low-lying nature of the site, its proximity to the national road network and low risk of peat slippage would make construction feasible.

3.3.1.10 Summary

From the review of the criteria set out above, the current Proposed Development site was identified as a suitable location for the provision of a wind farm of the scale proposed. The site of the Proposed Development is predominantly located within an existing commercial peatland which allows the site to take advantage of existing access roads (which will be upgraded) where possible. The site does not overlap with any environmental designations and is accessible in terms of connection to the national grid. The site is also located in an area with a relatively low population density with appropriate annual wind speeds.

3.4 Alternative Renewable Energy Technologies

The Proposed Development will be primarily located on a site where commercial peat extraction works may continue to be carried out, and the remainder of the site is situated where forestry and pastoral agriculture are the current land-use practices. The Proposed Development has been designed to allow existing land uses to continue around the footprint of the Proposed Development. Alternative sources of renewable energy for the site include solar energy.

Commercial solar energy production is the harnessing and conversion of sunlight into electricity using photovoltaic arrays (panels). To achieve the same electricity output, as is expected from the proposed wind energy development, from solar energy would require a significantly larger development footprint. In this instance the proposed wind farm will occupy 5% of the primary site area of 530 ha. A solar PV array of the scale necessary to provide the same electricity output would require a significantly larger area. In addition, a solar development would have a higher potential environmental effect on Hydrology & Hydrogeology, Traffic & Transport (construction phase) and Biodiversity (habitat loss) at the site.

A comparison of the potential environmental effects of the development of a solar PV array when compared against the Proposed Development of a wind farm at this site is presented in Table 3-2 below.

Table 3-2 Comparison of environmental effects when compared against the proposed project (wind turbines)

Environmental Consideration	Solar PV Array (with 90 MW Output)
Population & Human Health (incl. Shadow Flicker)	No potential for shadow flicker to affect sensitive receptors. Potential for glint and glare impacts on local road users.
Biodiversity & Ornithology	Larger development footprint would result in greater habitat loss. Larger development footprint would result in a loss of opportunity for peat extraction should it be continued on site and a reduction in the area for future site rehabilitation. Potential for glint and glare impacts on birds.
Land, Soils & Geology	Larger development footprint would result in a greater volume of spoil to be excavated.
Geotechnical	Shallower excavations involved in solar PV array developments would decrease the potential for slope stability risk.
Water	A solar PV array development would require a significantly larger development footprint, therefore, increasing the potential for silt-laden runoff to enter receiving watercourses.
Air & Climate	Reduced capacity factor of solar PV array technology would result in reduced carbon savings.
Noise & Vibration	No potential for noise impacts on nearby sensitive receptors.
Landscape & Visual	Potentially less visible from surrounding area due to screening by forestry and topography.

Environmental Consideration	Solar PV Array (with 90 MW Output)
Cultural Heritage & Archaeology	Larger development footprint would give rise to increased potential in unrecorded archaeological finds in peatland.
Material Assets	Potential for greater traffic volumes during the construction phase due to the number of solar panels required to achieve the same output.

For the reasons set out above, the proposal for a wind energy development at this site is considered the most efficient method of electricity production with a lesser potential for significant environmental effects.

Another alternative renewable energy technology is bioenergy. Bioenergy is renewable energy generated by the burning of biomass fuel. Biomass fuels come from organic material such as harvest residues, purpose-grown crops and organic waste. As a majority of the Proposed Development site is situated on peatlands, it was deemed inappropriate for biomass production for bioenergy.

3.5 Alternative Turbine Numbers and Model

It is expected that the proposed wind turbines will have a potential power output in the 5 - 6 megawatt (MW) range. It is proposed to install 15 turbines at the site. Based on the turbines currently available, the site is expected to have a total output in the region of 90MW however the final output will be determined prior to construction. Such a wind farm could also be achieved on the proposed site by using smaller turbines (for example 3 MW machines). However, this would necessitate the installation of over 30 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 environmental impacts to occur. The final proposed number of turbines takes account of all site constraints and the distances to be maintained between turbines and features such as roads and houses, while maximising the wind energy potential of the site.

The 15-turbine layout selected for the site is considered the most appropriate and suitable size for the Proposed Development compared to the other alternative numbers of turbines. This layout is still achieving the optimum output at a more consistent level than would be achievable using a larger number of turbines. The other alternatives considered included a 25-turbine layout and 13-turbine layout which is discussed in further detail in Section 3.6 below.

The turbine model to be installed on the site will be the subject of a competitive tendering process. The tip height of the turbines that will be selected for construction on the site will be up to 175 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, loudest for noise 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 fewer, larger wind turbines is presented in Table 3-3.

Table 3-3 Comparison of environmental effects when compared against the proposed project (larger wind turbines)

Environmental Consideration	Larger number of smaller turbines
Population & Human Health (incl. Shadow Flicker)	Neutral, Coole Wind Farm Ltd. has committed to zero shadow flicker.
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 volume of spoil to be excavated and stored.
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.
Landscape & Visual	A larger number of turbines could have a greater 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.

3.6 Alternative Designs

The design of the Proposed Development has been an informed and collaborative process from the outset, involving the designers, developers, engineers, landowners, environmental, hydrological and geotechnical, archaeological specialists and traffic consultants. The aim being to reduce 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, which have brought the design from its first initial layout to the current proposed layout. The design process has also taken account of the recommendations and comments of the relevant statutory and non-statutory organisations, the local community and local authorities as detailed in Section 2.6 in Chapter 2 of this EIAR.

3.6.1 Constraints and Facilitators Mapping

The design and layout of the Proposed Development follows the recommendations and guidelines set out in the *'Wind Energy Development Guidelines for Planning Authorities'* (Department of the

Environment, Heritage and Local Government (DoEHLG), 2006) and the *'Best Practice Guidelines for the Irish Wind Energy Industry'* (Irish Wind Energy Association, 2008).

The '*Wind Energy Development Guidelines'* (DoEHLG, 2006) are currently the subject of a targeted review. 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'* (2013), the '*Review of the Wind Energy Development Guidelines 2006 – Preferred Draft Approach'* (June 2017), and the *Draft Revised Wind Energy Development Guidelines, December (2019).* Further details on these documents are provided in Section 2.4.3 in Chapter 2 of this EIAR.

Constraints are restrictions that inform the design of a project by highlighting onsite sensitivities and providing appropriate setback buffers. The constraints mapping process involves the placing of buffers around different types of constraints so as to clearly identify the areas within which no development works will take place. The size of the buffer zone for each constraint has been assigned using guidance presented in the Department of the Environment, Heritage and Local Government Wind Energy Guidelines (DoEHLG, 2006). As it is considered likely that the new guidelines will be issued during the application process timeframe, current proposed changes were cognisant in the design process. Further details on the *Draft Revised Wind Energy Development Guidelines, December (2019)* are provided in Section 2.4.3.4.

The constraints map for the site, as shown in Figure 3-2, was produced following a desk study of all site constraints. Figure 3-2 encompasses the following constraints and associated buffers:

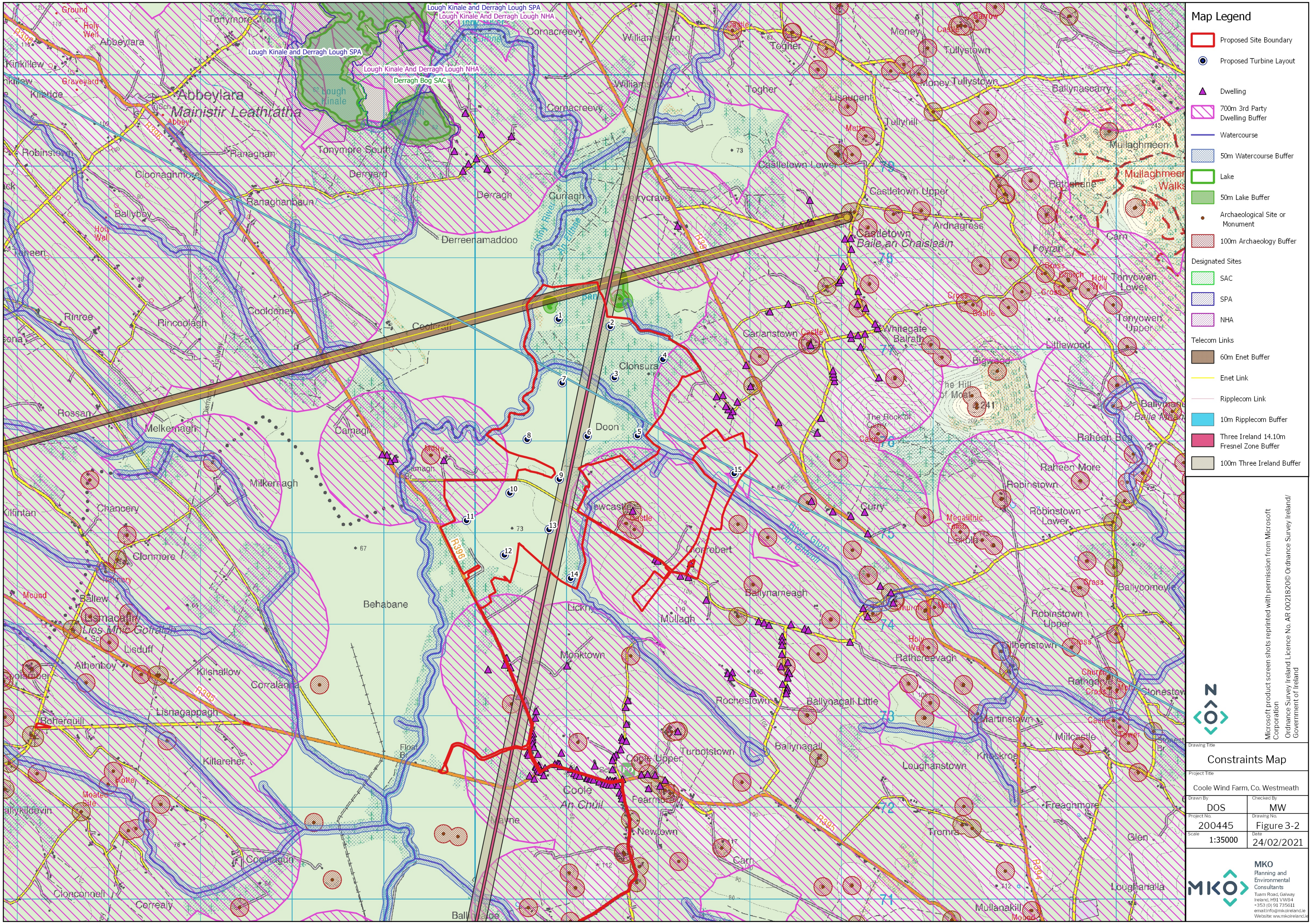
- Residential dwellings plus a minimum 700-metre buffer (achieving the requirement for a 4 x tip height separation distance from dwellings). There are two dwellings located within 700 metres of the proposed T15, approximately 638m and 679m, and both dwelling owners are involved in the Proposed Development. The remainder of the dwellings are in excess of 700 metres from the Proposed Development.
- Natura 2000 sites plus 200-metre buffer;
- Telecommunication Links plus operator specific buffer;
- Watercourses plus 50-metre buffer; and
- Archaeological Sites or Monuments, 50-metre buffer, plus 'Zone of Notification' as required by the National Monuments Service (ROI).

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

- Available lands for development;
- Separation distance from dwellings;
- 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 constraints on a map of the study area allows for a viable area to be identified. An initial turbine layout is then developed to take account of all the constraints mentioned above and their associated buffer zones and the separation distance required between the turbines.

Following the mapping of all known constraints, detailed site investigations were carried out by the project team. The ecological assessment of the site encompassed habitat mapping and extensive surveying of birds and other fauna. This assessment, as described in Chapter 6 of this EIAR on Biodiversity, optimised 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 construction compound.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Proposed Site Boundary
Proposed Turbine Layout
Dwelling
700m 3rd Party Dwelling Buffer
Watercourse
50m Watercourse Buffer
Lake
50m Lake Buffer
Archaeological Site or Monument
100m Archaeology Buffer
Designated Sites
SAC
SPA
NHA
Telecom Links
60m Enet Buffer
Enet Link
Ripplecom Link
10m Ripplecom Buffer
Three Ireland 14.10m Fresnel Zone Buffer
100m Three Ireland Buffer
Microsoft product screen shots reprinted with permission from Microsoft Corporation
Ordnance Survey Ireland Licence No. AR 0021820© Ordnance Survey Ireland/ Government of Ireland
Drawing Title
Constraints Map
Project Title
Coole Wind Farm, Co. Westmeath
Drawn By
DOS
Checked By
MW
Project No.
200445
Drawing No.
Figure 3-2
Scale
1:35000
Date
24/02/2021
MKO
Planning and Environmental Consultants
Tuam Road, Galway Ireland, H91 VW84
+353 (0) 91 735611
email:info@mkoireland.ie
Website: www.mkoireland.ie
Lough Kinale and Derragh Lough SPA
Lough Kinale And Derragh Lough NHA
Derragh Bog SAC
Abbeylara
Mainistir Leathratha
Castletown
Baile an Chaisleáin
Coole
An Chuil
Clonsura
Doon
Newcastle
Clonrobert
Mullagh
Behabane
Monktown
Coole Upper
Turbotstown
Ballynagall
Lismacaffry
Lios Mhic Gofraidh

Where specific areas were deemed as being unsuitable for the siting of turbines or roads, etc., alternative locations were proposed and assessed, taking into account the areas that were already ruled out of consideration. The proposed turbine layout was also informed by wind data and the results of noise and shadow flicker modelling as they became available.

The previous alternative turbine layouts assessed during the design process, which led to the evolution of the final proposed layout from the initial preliminary design, are described in Section 3.6.2 below.

3.6.2 Turbine Layout

The final proposed turbine layout takes account of the permitted layout, all site constraints, the distances to be maintained between turbines and from houses, roads, etc. The layout is based on the results of all survey information and site investigations that have been carried out during the EIAR process. As information regarding the Proposed Development was compiled and assessed, the proposed layout was reviewed 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. The selection of turbine numbers 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 design, always with the intention of minimising the potential for environmental impacts.

The development of the final Proposed Development layout has resulted following feedback from the various studies and assessments carried out as well as ongoing negotiations and discussions with landowners and the local community.

As outlined in Section 1.1 in Chapter 1 of this EIAR, a 13 No. turbine wind farm at the Proposed Development site was granted by An Bord Pleanála in 2019. The previously permitted 13-turbine layout has been integrated into the site layout of the Proposed Development. Therefore, the previous iterations of the Proposed Development incorporates that of the previously permitted 13-turbine layout. The Proposed Development went through 4 separate iterations. All 4 turbine site iterations are shown in Figure 3-3 to Figure 3-6 below and give an indication of how the design of the turbine layout evolved during the design process.

3.6.2.1 Proposed Layout Iteration No. 1

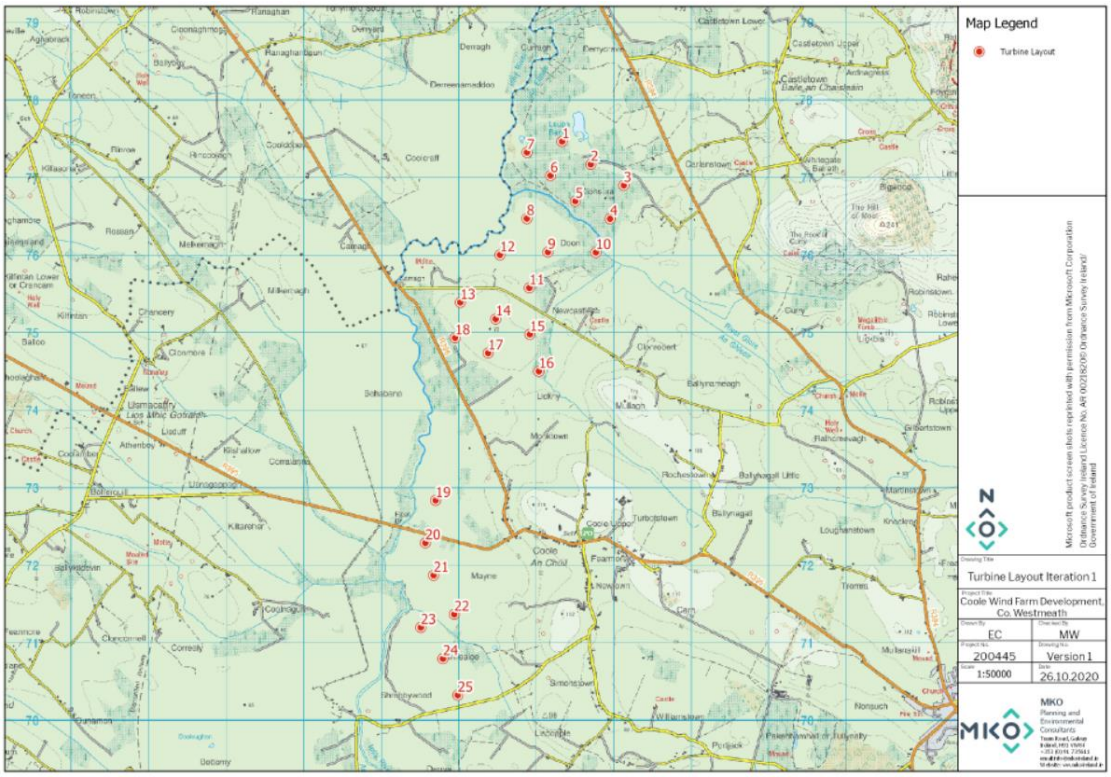

Figure 3-3 Proposed Layout Iteration No. 1

Proposed Layout Iteration No. 1 comprised a 25-turbine layout located on the current Proposed Development and an area to the south in the townlands of Mayne, Ballinealoe and Shrubbywood. At an early stage in the development process with design works ongoing this initial layout was presented to the local community through the one to one meetings to gain their feedback, understand the views of the local community and to use this information to inform the design process, allowing the local community an opportunity to have an influence on the final project design. This initial site layout (Figure 3-3) was also presented to Westmeath County Council at the first pre-planning meeting held in November 2016 to seek their input and feedback on the proposal. Based on the feedback received during consultation with the local community, the local authority and a review of current planning policy, a decision was made to significantly reduce the number of turbines from 25 to 13.

3.6.2.2 Proposed Layout Iteration No. 2

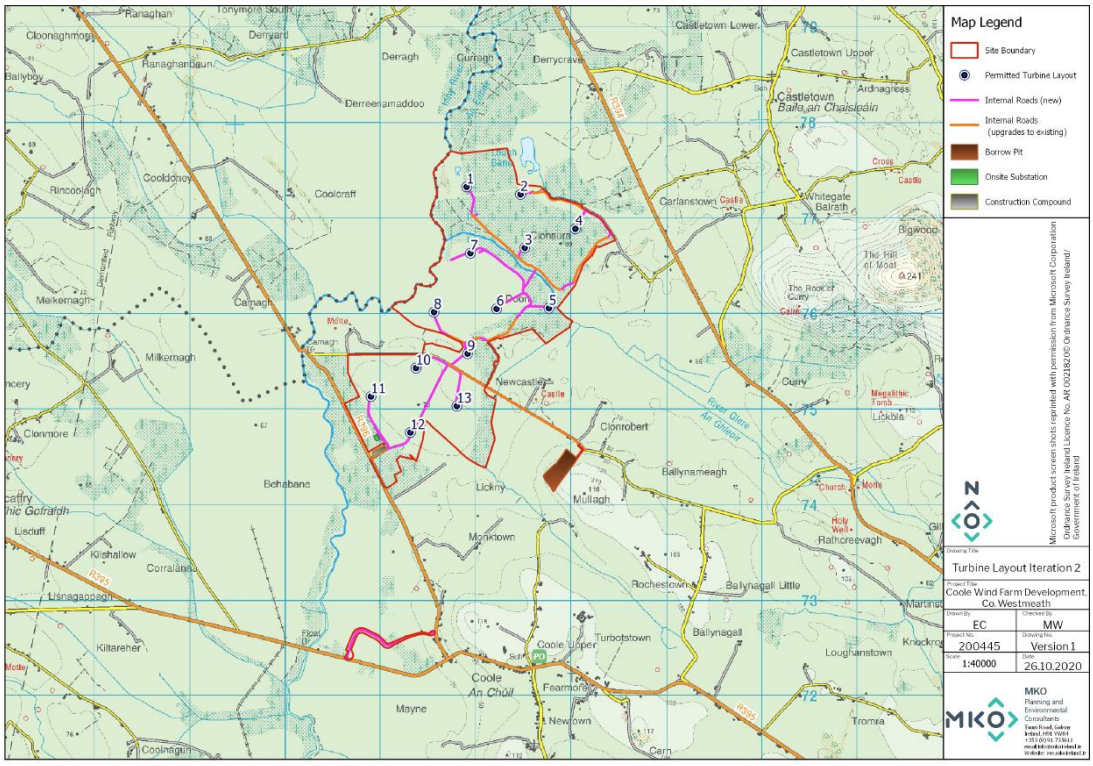

Figure 3-4 Proposed Layout Iteration No. 2

Proposed Layout Iteration No. 2 is the final 13-turbine layout for the permitted Coole Wind Farm and is shown in Figure 3-4. Through the course of scoping exercise that was conducted for the permitted Coole Wind Farm, Three Ireland Ltd identified three telecoms links in the vicinity of the Proposed Development site. Two of the links were located 1.0 kilometres west and 1.3 kilometres south of the nearest proposed turbine locations respectively, and would therefore be unaffected by the Proposed Development. The third link passes through the Proposed Development site and at that time was located in proximity to 4 no. turbine locations. During follow-up consultation with Three, the Fresnal zone around the link was calculated to accurately determine the clearance distance required from the Three link to the 4 no. turbine locations. As a result, a site layout review was undertaken and a precautionary clearance distance of 30 metres (calculated Fresnal zone radius of 22 metres plus buffer) was applied as part of the constraints mapping process, and the 4 No. turbine locations were relocated to ensure that there would be no impacts on the Three link.

This layout takes account of all site constraints and the distances/setbacks, as detailed in Section 3.6.1 above, to be maintained between turbines and from houses, roads, etc. while seeking to maximize the wind energy potential of the site. The layout is based on the results of all site investigations and environmental assessments that were carried out throughout the EIAR process for the permitted Coole Wind Farm, including geotechnical, ecological, hydrological and archaeological surveys.

3.6.2.3 Proposed Layout Iteration No. 3

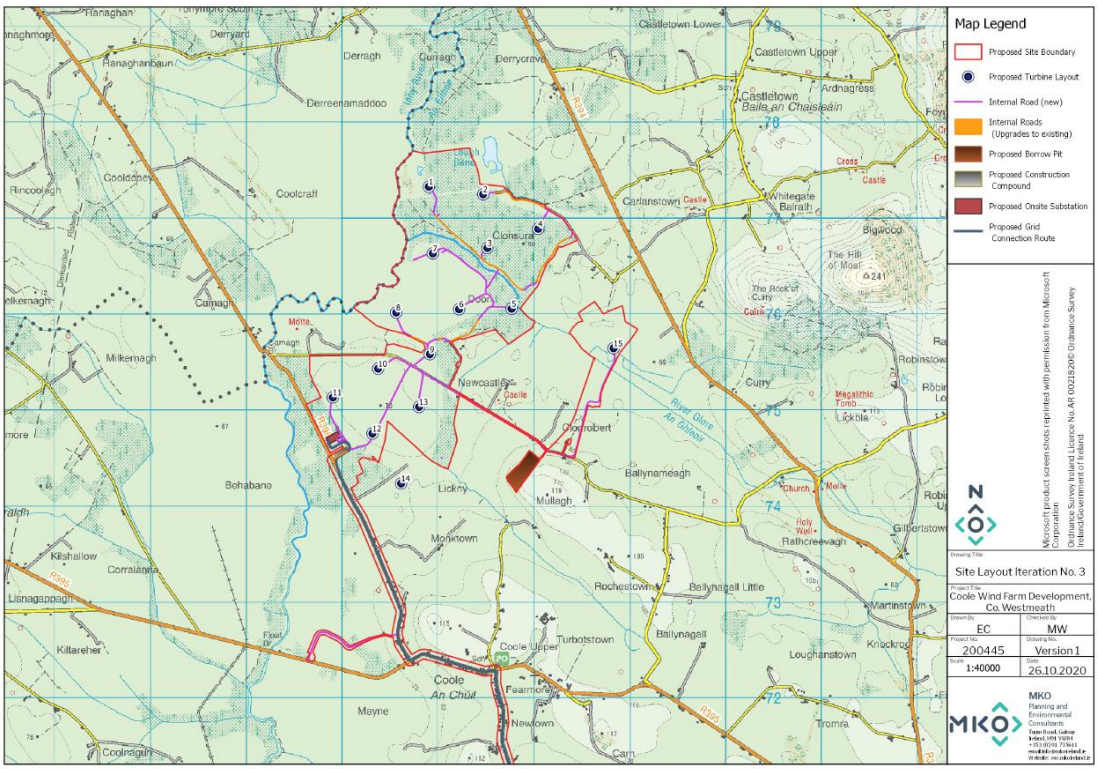

Figure 3-5 Proposed Layout Iteration No. 3

Proposed Layout Iteration No. 3 comprises of 15 turbines and is shown in Figure 3-5. The locations of the permitted 13 turbine layout (Iteration No. 2) are unchanged and there are two turbines included to the proposed turbine layout, turbines 14 and 15. The location of turbine T14, which is located on pastoral agricultural land and shown in Figure 3-5 was considered however, provision of adequate access to the turbine location from the public road was not possible. The location of turbine T14 and its access road was reconsidered and is shown as Proposed Layout Iteration No. 4 (Figure 3-6). The site road layout is unchanged from Iteration No. 2 and includes for site roads to turbine T15. Following initial site investigations for the access road to turbine T15, a raised bank in a rectangular shape was discovered. It was recommended by archaeologists to maintain a 30m buffer from this raised bank as it may be an unrecorded monument, as a result the access route indicated in Proposed Layout Iteration No. 4 (Figure 3-6) was designed. The borrow pit location, construction compound location and link road junction remain unchanged from Iteration No. 3. The footprint of the onsite substation is increased and the grid connection is also included in this layout as it forms part of the Proposed Development. The grid connection will be addressed further in Section 3.7.

3.6.2.4 Proposed Layout Iteration No. 4

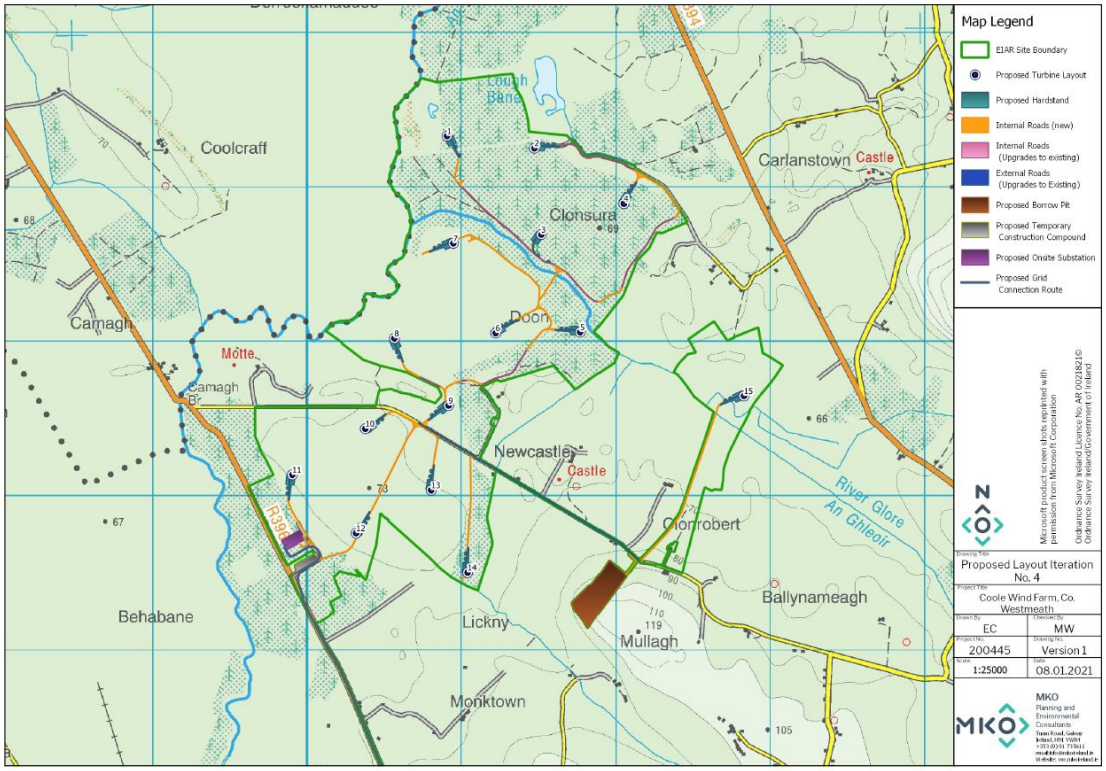

Figure 3-6 Proposed Layout Iteration No. 4

Proposed Layout Iteration No. 4 is the final layout for the Proposed Development and is shown in Figure 3-6. This layout is the same as Iteration No. 3 with the exception of the location of T14 and it's access road and the road layout to T15. This layout informed the basis for all detailed onsite surveys and investigations including geotechnical, ecological, hydrological and archaeological surveys.

As outlined in Section 1.1 in Chapter 1 of this EIAR, the Proposed Development consists of a 15 no. turbine wind farm. The proposed tip height of the turbine layout is up to 175 metres while the proposed rotor diameter is up to 155 metres. The permitted Coole Wind Farm includes for a rotor diameter of up to 140 meters (blade length of 70 meters). For the Proposed Development a greater rotor diameter is considered/assessed. The use of a greater rotor diameter allows for a greater capture of wind, increasing the efficiency of the Proposed Development and allowing the Proposed Development to contribute further to the Climate Action Plan targets for 2030. The Proposed Development will have an output in excess of 50MW with the exact output determined at pre-construction stage when a turbine model has been successful in a competitive tender process.

3.6.3 Road Layout

Access tracks are required on-site to enable transport of turbines and construction materials to each of the turbine locations. Such tracks must be of a gradient and width sufficient to allow safe movement of equipment and vehicles. As turbine locations were finalised, the most suitable routes between these points were identified, taking into account existing roads while also aiming to utilise the most direct route between turbines in order to minimise the footprint. The internal road network has also been designed to allow for the safe movement of vehicles around the Proposed Development site and using existing access tracks where possible which will be upgraded as part of the Proposed Development.

An alternative option to the current road layout design was to propose additional roads to allow for more direct access to each turbine location. This however was considered to increase the footprint of the Proposed Development, and cause potential interference with the peat harvesting operations should

they continue. This would have resulted in unnecessary disturbance to the Proposed Development site and create the potential for additional environmental impacts to occur. It would have also resulted in an unnecessary requirement for additional material to be used in the construction of new roads.

As detailed in Section 3.6.2.4 above, an alternative option to the current road layout design to proposed turbine T15 was considered, however following site investigations, a raised bank in a rectangular shape was discovered. It was recommended by archaeologists to maintain a 30m buffer from this raised bank as it may be an unrecorded monument and the proposed road layout to T15 was redesigned to maintain the recommended buffer.

As detailed in Section 2.6.4 in Chapter 2 of this EIAR, during consultation with the local community every reasonable effort was made to understand the views of those living in each household to allow the final project design to take consideration of these views to the greatest extent possible. In response to concerns expressed during the community consultation regarding the use of roads, a commitment was given not to use the local road leading to Clonsura bog from the Finea road (L57671 local road, which adjoins the R394 Regional Road) nor the local road L18266 in front of Coole National School for access purposes (as shown on Figure 4-19 in Chapter 4 of this EIAR).

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 3-4 below.

Table 3-4 Comparison of environmental effects when compared against the chosen option (maximising the use if the existing road network)

Environmental Consideration	New Road Network
Population & Human Health (incl. Shadow Flicker)	Potential for increased impacts on residential amenity due to increased disturbance during the construction stage.
Biodiversity & Ornithology	Larger development footprint would result in greater habitat loss.
Land, Soils & Geology	Larger development footprint would result in greater volumes of soil and sub-soil to be excavated and stored. Larger volume of stone required for road construction.
Geotechnical	Larger development footprint and increased potential for slope stability risk
Water	Larger 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. Potential for greater vehicular emissions due to and increased volume of construction traffic.
Noise & Vibration	Potential for increased noise impacts on nearby sensitive receptors during the construction of the new roads.

Environmental Consideration	New Road Network
Landscape & Visual	Potential for greater visual and landscape impacts due to the construction of new roads.
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.

3.6.4 Location of Ancillary Structures

The ancillary structures required for the Proposed Development include the construction compound, cabling and the borrow pit.

3.6.4.1 Construction Compound

One main temporary construction compound will be used for the temporary storage of all construction materials and turbines. The location, plan area and design of the construction compound remains unchanged from the permitted Coole Wind Farm. The proposed construction compound is located close to an existing site entrance off the R396 Regional Road, which will be used as the site entrance for the proposed wind farm. The decision to use a single temporary construction compound as opposed to two smaller compounds in the southern and northern parts of the site was made for the permitted Coole Wind Farm as it resulted in less disturbance to the site and reduced the visual impact arising from the development. The same approach is intended for the Proposed Development. The compound is also located in an area that will be screened from the R396 by roadside trees and vegetation.

3.6.4.2 Borrow Pits

Material required for the construction of access roads and turbine bases will be primarily obtained from 1 No. borrow pit located approximately 700 metres to the Southeast of the nearest turbine (T14) with some material imported as required from local commercial quarries. The location, and plan area of the proposed borrow pit remains unchanged from the permitted Coole Wind Farm. The size of the borrow pit will be increased by depth rather than surface to meet the capacity in stone requirements for the Proposed Development. The borrow pit is linked to the wind farm site via the L5755 local road. The site of the proposed borrow pit is currently used for pastoral agriculture. The use of borrow pits represent 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. The location for the borrow pit was identified taking into account the site characteristics, including topography, ground conditions, habitat type and surface water features.

An alternative to using borrow pits is the sourcing of 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 is therefore considered the least preferable option. A comparison of the potential environmental effects of obtaining all stone material offsite when compared to using an onsite borrow pit is presented in Table 3-5 below.

Table 3-5 Comparison of environmental effects when compared against the chosen option (use of onsite borrow pit)

Environmental Consideration	Obtaining all stone from off-site sources
Population & Human Health (incl. Shadow Flicker)	Potential for increased impact on residential amenity due to vehicular and dust emissions from additional traffic associated with movement of material on and off-site.
Biodiversity & Ornithology	Smaller development footprint, therefore reduced habitat loss.
Land, Soils & Geology	Neutral
Geotechnical	Neutral
Water	No requirement for drainage from onsite borrow pits to be incorporated into project drainage design
Air & Climate	Potential for increased vehicular and dust emissions from additional traffic associated with movement of material on and off-site.
Noise & Vibration	Potential for increased noise impacts on nearby sensitive receptors due to additional traffic associated with movement of material on and off-site.
Landscape & Visual	Neutral (as onsite borrow pit will be reinstated following use).
Cultural Heritage & Archaeology	Smaller development footprint, therefore reduced potential for impacts on sub-surface archaeology.
Material Assets	Less efficient construction practices and increased potential for impact on public road network due to additional traffic associated with movement of material on and off-site.

3.6.4.3 Electricity Substation

Underground electrical cables will transmit the power output from each wind turbine to an electricity substation onsite. Whereas overhead lines are less expensive and allow for easier repairs/fault finding 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 underground cables within the site will follow the route of the wind farm access roads, thereby minimising the amount of ground disturbance required.

The proposed substation is located within the Proposed Development site, near to the site entrance and the R396 Regional Road. The substation is located within an area of forestry, which will visually screen it from the surrounding area. An alternative to this was to locate the substation more centrally within the site; however, this would make the substation more visible and increase the footprint of the development on the cutover peat area. Ease of access for maintenance works was also taken into consideration.

The proposed onsite substation, which forms part of the Proposed Development, is situated at the same approximate location of the previously permitted substation (Iteration No. 2), with a reorientation and expansion of the footprint area.

3.7 Alternative Grid Connections

Initially consultation with EirGrid and a Grid Capacity Study was undertaken to inform the grid connection for the Proposed Coole Wind Farm. The Grid Capacity Study was undertaken by an independent Electrical Engineering Consultancy, MullanGrid Consulting which consisted of a review of the local network, capacity at local substations, potential connection methods and associated costs. Following this study and ongoing consultation with EirGrid, a proposal to connect the development to the existing 110kV substation at Mullingar via underground cable was identified and assessed in the planning application for the permitted 13 turbine project.

Since this time ongoing consultation with EirGrid on the grid connection approach for the project has taken place through meetings held with EirGrid in June 2019 and the 22nd April, 17th June and 16th September of 2020. At these meetings discussions included the Mullingar substation, its layout and potential connection methods.

A grid connection for the project has been sought under the Enduring Connection Policy known as ECP2.1 which opened in September 2020. The Commission for Regulation of Utilities (CRU) develop the Enduring Connection Policy in Ireland and ECP2 is the second stage of this policy. In November 2020, Coole Wind Farm Ltd received confirmation of their successful application and acceptance into the ECP2.1 process. The grid connection offer for Coole Wind Farm was issued January 2021 for a Maximum Export Capacity of 88MW with a connection node at Mullingar substation.

As part of the initial route selection process to the existing Mullingar substation, a number of routes were considered as potential cable routes, including routes through Castlepollard along the R395 and R394 Regional roads (deemed unsuitable due to long cable lengths and the potential for disruption to the town of Castlepollard during the construction phase). This left two main alternative cable route options to be considered as part of the project design to facilitate connection from the development site to the national grid; Options A and B. Route Options A and B follow the same public roads from the proposed wind farm site to the village of Multyfarnham. From here, Option A follows the public roads east of Lough Owel, while Option B follows the public roads west of Lough Owel. An overview of each route, including distance and number of watercrossings, is presented in Table 3-6 below. Both routes were driven and assessed through site visits as part of the process to identify the optimum grid connection route.

Table 3-6 Overview of Cable Route Options

Item	Option A	Option B
Description	East of Lough Owel, located partially along N4 National Primary Road	West of Lough Owel, via Bunbrosna
Distance from site entrance to Mullingar substation	25.9 km	30.1 km
No. of river / stream crossing	16	19
Rail crossing	1 – on local road at Farranistick	1 – on local road from Multyfarnham
Adjoins Main Road	• 2.3 km of R396 • 0.9 km of R395 • 3.4 km of N4	• 2.3 km of R396 • 0.9 km of R395 • Crosses N4 at Bunbrosna • 1.6 km of R393

Following this study and ongoing consultation with EirGrid, it is proposed to connect the development to the 110 kV substation at Mullingar via underground cable using route option A. This route is approximately 4.2 kilometres shorter in length and had fewer water crossing points than route option B. This minimises the potential for additional environmental effects. Furthermore, it is considered that the road works associated with the installation of the cable will be easily accommodated along the relevant public road corridors. The proposed grid connection route avoids large urban centres and uses the shortest length of single carriageway roads to minimise road closures and the potential impacts to local residents and traffic.

An alternative option to underground cabling would be to use overhead lines, however this would create a visual impact on the surrounding landscape. There will be no overhead lines required for the grid connection. Alternative shorter routes would involve crossing open fields or forestry, i.e. not using established road corridors. Placing the cable in lands currently optioned by the Coole Wind Farm Ltd along the L1826 was investigated but there was potential for greater environmental impacts to arise by doing so.

Laying the cable parallel to the public road in private lands which would minimise traffic disturbances was investigated for the first 2.5km of the grid connection route from the onsite substation. 27 landowners were identified only 3 of whom are involved in the project. This method was ruled out due to the sheer number of landowners that would need to participate if this method was employed for the entire 26km grid route as it was unlikely that all landowners would be willing to participate.

The Proposed Development achieves the following:

- Represents the most environmentally robust route
- Achieves access with minimum need for new roads/tracks
- Minimises green-field works
- Maximises use of existing and permitted infrastructure, where works can be carried out almost entirely within existing (in the case of public road corridors and the Mullingar substation) infrastructure

A further assessment of the potential environmental effects of the alternative grid connection option compared against the chosen option of the onsite connection are presented in Table 3-7 below.

Table 3-7 Comparison of environmental effects when compared against the proposed project (Option A: Grid Connection)

Environmental Consideration	Grid Connection Option B
Population & Human Health (incl. Shadow Flicker)	Potential for increased disturbance to road users and occupants of dwellings located along roads, due to works associated with laying underground cabling along a longer grid connection route.
Biodiversity & Ornithology	Increased potential for impacts on roadside habitats. Increased potential for impacts on watercourses at grid connection crossing points.
Land, Soils & Geology	Increased volume of spoil and tar to be excavated due to longer route.
Geotechnical	Neutral
Water	This route requires more watercourse crossings which would increase the potential for silt-laden runoff and hydrocarbons to enter receiving watercourses.

Environmental Consideration	Grid Connection Option B
Air & Climate	Potential for increased vehicular and dust emissions associated with grid connection works.
Noise & Vibration	Potential for increased noise and vibration nuisances during construction phase on sensitive receptors (residential dwellings) located along the public road sections of the grid connection route.
Landscape & Visual	Neutral
Cultural Heritage & Archaeology	Increased potential for impacts on features of architectural heritage, for example bridges.
Material Assets	Potential for greater traffic volumes during construction phase due to a longer grid connection route along the public road. Increased potential for impacts on existing underground services and utilities.

3.8 Alternative Transport Route and Site Access

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.

The main site entrance is located off the R396 Regional Road with access to the site for construction purposes from the L5755 which adjoins the R396 and R394. Delivery of turbine components will be through the main site entrance. An alternative option considered was to also provide a construction site entrance at an existing site entrance from the L57671 local road, which adjoins the R394 Regional Road. However, following consultation with the local community it was decided not to use this access to avoid any potential construction stage disturbance to houses located along the L57671 road.

From the R395, the turbine delivery route will connect to the R396 via a new section of access road in the townland of Coole, thereby avoiding the left-hand-turn in Coole village. Originally an access option using this left-hand turn in Coole village was considered however avoided due to land take requirements and avoiding traffic impacts closer to Coole village.

These routes have been proven suitable for the transport of turbine components, and the updated transport analysis (as presented in Section 14.1 in Chapter 14 of this EIAR), shows that only minor accommodation works will be required to accommodate the proposed turbines. The turbine transport route will utilise the national and primary roads available to ensure the road network holds the capacity to manage large loads. When considering turbine transport routes, alternative routes comprising of a more direct route with greater stretches of secondary and local roads were considered less optimal due to the increased possibility of road and roadside disruption and a greater need to carry out works. The route between the N4 National Primary Road and the proposed wind farm site utilises local and Regional roads where possible, as described in Section 4.3.17 in Chapter 4 of this EIAR. The most suitable route between the N4 and the site was identified, taking into account potential pinch points and the requirement for widening works including: hardsurfacing at the N4 in the vicinity of its junction with the L1927 Local road in the townland of Joanstown; Temporary removal of the existing hedgerow and hardsurfacing before the railway line level crossing on the L1927; hardsurfacing and widening of the

L1927 and L5828 junction in the townland of Boherquill; clearing of existing verge and vegetation and hardsurfacing at the gentle right turn from the L5828 onto the R395; hardsurfacing including clearance of vegetation and road verge to provide access and egress at proposed link road; hardsurfacing including clearance of vegetation and road verge at site access points off the R396, and at four points along the L5755.When considering the turbine delivery route, it was possible to avoid the proposed junction at Boherquill (L1927/L5828) by using the junction of the L1927 with the R395 Regional road in Lismacaffry, however this option was deemed unsuitable by the project team due to the possible requirement for significant widening works.

All construction traffic will use the designated haul routes only. An alternative to this would be to allow for more direct access to the site using multiple approach routes; however, this is more likely to give rise to additional traffic and road impacts.

When considering turbines transport routes, alternative modes of transport were also considered. Alternatively, depending on the selected turbine delivery route and the turbine manufacturer, a blade adaptor may also be used, if deemed appropriate, for delivery of turbines to the Proposed Development site.

The above haul route options were discussed at the pre-planning meetings with Westmeath County Council in November 2016 and January 2017, as described in Section 2.6.3 of Chapter 2 of this EIAR. Representatives from Westmeath County Council also agreed that the proposed haul route via the L5828 is the preferred option to use for the Proposed Development. Meetings were held with An Bord Pleanála on 1st October 2020 and Westmeath County Council on 13th November 2020 where details of the Proposed Development including haul routes were discussed. No issues were raised regarding the original haul route proposed for the development.

3.9 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 make use of existing onsite infrastructure which assists in avoiding any environmentally sensitive areas. Any forestry felled within the footprint of the site will be replaced offsite, with no net loss. The alternative to this approach is to encroach on the environmentally sensitive areas of the site and accept the potential environmental effects and risk associated with this.

The best practice design and mitigation measures set out in this EIAR will contribute to reducing any risks and have been designed to break the pathway between the site and any identified environmental receptors. The alternative is to either not propose these measures or propose measures which are not best practice and effective and neither of these options is sustainable.

3.10 Conclusion

A description of the reasonable alternatives in terms of project design, technology, location, size and scale, which are relevant to the proposed wind farm and its specific characteristics, and an indication of the main reasons for selecting the chosen option with regard to each, including a comparison of the environmental effects, has been provided in the preceding sections. The consideration and assessment of alternatives has been carried out throughout the project design so as to avoid adverse environmental impacts.