Planning and Environmental Consultants

Environmental Impact Assessment Report (EIAR)

Killoshulan Wind Farm, Co. Kilkenny

Chapter 3 – Site Selection and Reasonable Alternatives



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GLOSSARY OF TERMS

Term	Definition
'Do-Nothing' Alternative	The environment of the site and its environs should the Proposed Project not be developed
Natura 2000 site	A designated, protected area for biodiversity within the European Union. These sites are legally protected under the European Union Habitats Directive and Birds Directive.
Natural Heritage Area	The basic designation for wildlife is the Natural Heritage Area. This is an area considered important for the habitats present, or which holds species of plants and animals whose habitat needs protection.
Proposed Natural Heritage Area	Wildlife protection areas that have not been statutorily proposed or designated. These sites are of significance for wildlife and habitats and cover approximately 65,000ha across Ireland. Designation will proceed on a phased basis over the coming years.
Special Area of Conservation	Prime wildlife conservation areas in Ireland, considered to be important on a European as well as an Irish level. The legal basis on which SACs are selected and designated is the EU Habitats Directive, transposed into Irish law by the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011), as amended.
Shadow Flicker	A phenomenon when rotating wind turbine blades cast moving shadows over a narrow opening causing a rapidly alternating flickering light intensity
Special Protection Area	Protected sites designated under the EU Birds Directive (2009/147/EC) to conserve rare, vulnerable, and migratory bird species, along with their wetland habitats in Ireland.

GLOSSARY OF ACRONYMS

Acronym	Definition
BEMP	Biodiversity Enhancement and Management Plan
BESS	Battery Energy Storage System
CAP	Climate Action Plan
CRA	Collision Risk Assessment
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report

EPA	Environmental Protection Agency
GIS	Geographical Information Systems
MW	Megawatt
HDD	Horizontal Directional Drilling
HGV	Heavy Goods Vehicle
KCCDP	Kilkenny City and County Development Plan
LVIA	Landscape and Visual Impact Assessment
NHA	Natural Heritage Area
NOF	National Planning Framework
OHL	Overhead Line
PV	Photovoltaic
pNHA	Proposed Natural Heritage Area
SAC	Special Area of Conservation
SEAI	Sustainable Energy Authority of Ireland
SPA	Special Protection Area
TDR	Turbine Delivery Route
ZTV	Zone of Theoretical Visibility

3. SITE SELECTION AND 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 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."*

As detailed in Section 1.1.1 in Chapter 1, for the purposes of this EIAR, the various project components are described using the following references: the 'Proposed Project', the 'Proposed Wind Farm', the 'Proposed Grid Connection' and the 'Site'.

This chapter of the EIAR contains a description of the reasonable alternatives that were studied by the developer and discipline leads, 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 Proposed Project, connection to the national grid and transport route options to the Site. This section also outlines the design considerations in relation to the Proposed Wind Farm and the Proposed Grid Connection. It provides an explanation 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 '*Guidelines on The Information to be Contained in Environmental Impact Assessment Reports*' (Environmental Protection Agency (EPA), 2022), the presentation and consideration of reasonable alternatives investigated is an important part of the overall EIA process.

Non-Environmental Factors

EIA is focused on the potential significant environmental effects of the Proposed Project 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, 2022 states 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.

3.2 Consideration of Reasonable Alternatives

3.2.1 Methodology

The EU Guidance Document on the preparation of EIAR (EU, 2017) 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 EU guidance (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 EPA Guidelines 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 in 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 Site Locations
- Alternative Renewable Energy Technologies
- Alternative Project Design Options
    - Alternative Turbine Numbers and Model;
    - Alternative Turbine Layout and Design;
    - Alternative Borrow Pit Option
    - Alternative Turbine Delivery Route
    - Alternative Design of Ancillary Structures
    - Alternative Substation and Grid Connection Options
- Alternative Mitigation Measures.

Each of these is addressed in the following sections.

When considering the Proposed Project, given the intrinsic link between layout and design, the two will be considered together in this chapter.

3.2.2 '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 a renewable energy project at the Proposed Wind Farm site would be to leave the Proposed Wind Farm site as it is, with no changes made to the current land use practices of low intensity agriculture and commercial forestry; and public road corridor. In doing so, the environmental effects in terms of emissions are likely to be neutral at site level.

The land-uses at the site of the Proposed Grid Connection would be left as it is, with no changes made to existing land-use practices. Current land use practices of low intensity agriculture would continue at the Proposed 110kV Substation and public road corridor (approximately 12.6km for the Proposed 110kV Underground Cabling route) would continue. In doing so, the environmental effects in terms of emissions are likely to be neutral.

However, by implementing the 'Do-Nothing' alternative, the opportunity to capture the available 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 and investment would also be lost.

On the basis of the positive environmental effects arising from the Proposed Project when compared to the 'Do-Nothing' scenario, the 'Do-Nothing' scenario was not the chosen option. The existing land uses can and will continue in conjunction with the Proposed Project. 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 Proposed Wind Farm site are presented in Table 3-1 below.

Table 3-1 Comparison of environmental effects of the 'Do-Nothing' alternative with the Proposed Project

Environmental Consideration	Do-Nothing Alternative (existing land uses continue)	Chosen Option of developing a renewable energy project
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 and noise to affect sensitive receptors. No potential for effects on visual amenity due to the construction and operation of turbines. No potential to supply an estimated 49,560 Irish households with clean renewable electricity	Approximately 100-120 jobs during the construction phase and 3-4 jobs during operational and maintenance phases could be created as a result of the Proposed Project. Based on the assessment and mitigation measures detailed in Chapter 5 Population & Human Health, there will be no significant effects related to shadow flicker and noise during the operational phase. As detailed in the assessment in Chapter 10, the overall impact will be a Long-term Moderate Positive Impact on air quality As detailed in the assessment in Chapter 11, the Proposed Project will have a long-term significant positive effect on climate during the operational phase. As detailed in Chapter 12, Noise and Vibration will have no significant effects on sensitive receptors during the construction and operational phase.

Environmental Consideration	Do-Nothing Alternative (existing land uses continue)	Chosen Option of developing a renewable energy project
		As detailed in Chapter 13 Landscape and Visual, the landscape type and character of the area where the Proposed Turbines are sited comprises modified working landscape types of low sensitivity and can effectively accommodate wind energy development. Of the 20 no. viewpoints (VPs) assessed, residual visual effects for 3 no. were deemed not significant, 11 no. were deemed slight, 5 no. were deemed moderate, and 1 no. were deemed significant. The number of receptors experiencing these effects is very low as the landscape surrounding the proposed turbines has a low population density.. Visual effects will decrease with distance from the proposed turbines. The Proposed Turbine locations adhere to the recommended 500m setback distance in the '*Wind Energy Development Guidelines for Planning Authorities'* (DoEHLG, 2006) (hereafter referred to as the 'Guidelines (DoEHLG, 2006)') and also the 4 times tip height set-back distance set out in the '*Draft Wind Energy Development Guidelines'* (December 2019) (hereafter referred to as the '(Draft 2019 Guidelines (DoHPLG, 2019)) for the purpose of protecting visual amenity and ensuring no significant effects arise from noise and shadow flicker.
Biodiversity (including Ornithology)	No habitat loss. No potential for collision risk for birds and bats. No potential biodiversity enhancement measures would be put in place.	As detailed in Chapter 6 Biodiversity, the Proposed Project has been designed to avoid or mitigate impacts on biodiversity including bats and downstream aquatic receptors. The Proposed Project includes a Biodiversity Enhancement and Management Plan (BEMP) proposal providing a local boost to biodiversity, birds, and water quality. Please see Appendix 6-4 for details. With regard to collision risk, as detailed in the Bat Survey Report in Appendix 6-1 of this EIAR, site-level collision risk for high collision risk bat species with Proposed Turbines was typically Low to Medium. Therefore, there will be no significant effects on bats. As detailed in Chapter 7 Ornithology, the Proposed Project has been designed to avoid or mitigate impacts on ornithological receptors. As detailed in the Collision Risk Assessment (CRA) in Appendix 7-6, there will be a short-term slight negative effect on birds due to collision risk prior to mitigation being applied. No significant effects will occur post-mitigation.

Environmental Consideration	Do-Nothing Alternative (existing land uses continue)	Chosen Option of developing a renewable energy project
Land, Soils & Geology	Neutral	As detailed in the assessment in Chapter 8, there is no net loss of topsoil or subsoil as a result of the Proposed Project. Topsoil and subsoil will be relocated within the Proposed Wind Farm. Geotechnical investigations followed by careful design will result in no significant environmental impacts. Please see Appendix 8-2 for further details on the geotechnical investigations undertaken as part of the Proposed Project. A kart risk assessment is included as Appendix 8-3 which concludes no significant residual effects on karst features will occur as the result of the Proposed Project. Some material arising from the construction of the Proposed Grid Connection will be sent to an appropriate licenced facility as outlined in the Construction and Environmental Management Plan (CEMP) in Appendix 4-3). The spoil management proposals discussed in Section 4.3.1.9 of Chapter 4 sets out the optimal treatment for spoil excavated/ generated on site without creating significant impacts for biodiversity, hydrology, land use, etc.
Hydrology and Hydrogeology	Neutral	As detailed in the assessment in Chapter 9, no significant effects on surface water or groundwater quality will occur.
Air Quality	Neutral. Will not provide the opportunity for an overall increase in air quality	As detailed in Chapter 10, there will be no significant effects on air quality during the construction, and decommissioning phases. The Proposed Project will have a long-term, significant, positive effect on air quality during the operational phase
Climate	Neutral. Will not provide the opportunity for a contribution to the reduction of greenhouse gases. No potential to assist in achieving the renewable energy targets set out in the Climate Action Plan (CAP) 2025.	As detailed in the assessment in Chapter 11 Climate, 28,277 tonnes of carbon dioxide per annum will be saved as a result of the operation of the Proposed Wind Farm and not relying on fossil fuel-generated electricity. Over the proposed 35-year lifetime of the Proposed Wind Farm, therefore, 989,687 tonnes of carbon dioxide will be saved. The addition of an estimated 62MW clean energy to the national grid will be a positive contribution to the Ireland's renewable energy targets set out in CAP25.
Noise & Vibration	No potential for noise and vibration impacts on nearby sensitive receptors.	Based on the assessment detailed in Chapter 12 Noise and the mitigation measures proposed, there will be no significant effects on sensitive receptors due to noise and vibration levels from the Proposed Project during the construction and operational phases.

Environmental Consideration	Do-Nothing Alternative (existing land uses continue)	Chosen Option of developing a renewable energy project
Landscape & Visual	Landscape and visual impacts avoided on nearby sensitive receptors.	As detailed in Chapter 13 Landscape and Visual, the landscape type and character of the area where the Proposed Turbines are sited comprises modified working landscape types of low sensitivity and can effectively accommodate wind energy development. Of the 20 no. viewpoints (VPs) assessed, residual visual effects for 3 no. were deemed not significant, 11 no. were deemed slight, 5 no. were deemed moderate, and 1 no. were deemed significant. The number of receptors experiencing these effects is very low as the landscape surrounding the proposed turbines has a low population density. Visual effects will decrease with distance from the proposed turbines.
Cultural Heritage	No potential for impacts on unrecorded, subsurface archaeology.	As detailed in Chapter 14 Cultural Heritage, there will be no significant direct or indirect effects on known or unknown archaeology and cultural heritage during the construction, and decommissioning phases. During the operational phase, following an assessment of over 574 no. National Monuments, Recorded Monuments, Protected Structures and NIAH structures, the Proposed Project will not have any significant effects on these cultural heritage sites located within the proximity of the Proposed Wind Farm site
Material Assets – Traffic and Transport	No potential for impacts on the public road network due to no material transport to the Proposed Wind Farm	As detailed in Section 15.1 of Chapter 15 Material Assets, there will be no significant effects on traffic and transport during the construction, operational, and decommissioning phases of the Proposed Project. A detailed Traffic Management Plan (Appendix 15-2) incorporating all the mitigation measures will be agreed with the roads authority prior to construction works commencing on site.
Material Assets – Telecommunications and Other Material Assets	No potential for impacts on telecommunications links, aviation built services or waste management.	As detailed in Section 15.2 and 15.3 of Chapter 15, there will be no significant effects post-mitigation on telecommunications, aviation and other material assets during the construction, operational, and decommissioning phases of the Proposed Project. In order to assess the potential for significant effects on built services and waste management in the vicinity of the Proposed Project, scoping requests were made to EirGrid, Uisce Éireann

Environmental Consideration	Do-Nothing Alternative (existing land uses continue)	Chosen Option of developing a renewable energy project
		and numerous sections of Kilkenny County Council including Water Services and Environment. Refer to Section 2.7 of Chapter 2 of this EIAR for details in relation to the EIA scoping exercise. There is potential for and underground services to be impacted during the construction phase, specifically during the delivery of turbine components and the laying of grid connection cables along the public road corridor. Following the implementation of the mitigation measures (listed in Section 15.3, Chapter 15), there will be a short-term imperceptible negative residual effect on services during the construction phase of the Proposed Project.
Major Accidents and Natural Disasters	No potential to be affected by or to cause major accidents or natural disasters.	As demonstrated in Chapter 16, the risk of a major accident and/or disaster during the construction of the Proposed Project is considered 'low' in accordance with the '*Guide to Risk Assessment in Major Emergency Management'* (DoEHLG, 2010). The highest risk scenarios to the Proposed Project (i.e., contamination and fire/explosion) are considered to be unlikely to occur at any phase of the Proposed Project. In relation to the Battery Energy Storage System (BESS) within the Proposed 110kV Substation, Appendix 4-4 of the EIAR sets out the Fire Risk Management and Emergency Response Plan for the proposed BESS, detailing mitigation measures, emergency procedures, and actions to protect people, emergency responders, and the environment in the event of a fire. The Proposed Project will be designed and built in accordance with current best practice and, as such, mitigation against the risk of major accidents and/or disasters will be embedded through the design. With the implementation of all mitigation and monitoring measures detailed in the EIAR, there will be no significant residual effects associated with the construction, operation and decommissioning of the Proposed Project.

For the reasons set out above, the proposal for a renewable energy development at the Project Wind Farm was progressed over the 'Do-Nothing' Alternative, this decision is cognisant of the potential environmental effects identified, both negative and positive arising from the Proposed Project. By progressing the Proposed Wind Farm there is an opportunity to create employment and investment in the local area and to capture the available renewable energy resource within Co. Kilkenny, thus contributing to meeting national and international climate targets.

3.2.3 Alternative Site Locations

To ensure that the Levelised Costs of building each Megawatt (MW) of electricity-generating capacity on a wind farm is controlled efficiently, it is incumbent on the design team to ensure that the most suitable site for development of a wind farm development is chosen. 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, proximity to a grid connection point 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 build it.

The Proposed Wind Farm site has been identified as having potential for a wind energy development as a result of a nationwide search of suitable lands. The site selection process has been 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. A nationwide constraints analysis was undertaken and included avoidance of environmental designations (Natura 2000 sites), review of national, regional and local policies and objectives, suitable wind speeds, adequate setbacks from sensitive receptors, proximity to national grid nodes, avoidance of direct impacts on known cultural heritage assets, access and constructability.

The Project Ireland 2040 National Planning Framework (NPF) identified a range of key future planning and development and place-making policy priorities for the Southern Region that includes:

> *"Harnessing the potential of the region in renewable energy terms across the technological 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."*

3.2.3.1 Grid Connection

The Proposed Project intends to connect to the national grid via a Proposed 110kV Underground Cabling route that predominantly follows the public road corridor from the Proposed Wind Farm to the existing Ballyragget 110kV substation, in the townland of Moatpark, approximately 1km north of the town of Ballyragget, Co. Kilkenny. Details regarding potential alternative grid connection options are considered and presented in Section 3.2.5.6 below.

3.2.3.2 Strategic Site Selection

As the cost of building each MW of electricity generating capacity in a wind farm is in the region of €1.5 million, it is critical that the most suitable site for the Proposed Project is chosen.

As set out in Section 1.3 of this EIAR, the applicant, Killoshulan Renewable Energy Ltd, is a subsidiary of Atlantic Infrastructure Renewables (AIR) which is an Irish-owned Limerick-based company with extensive experience in renewable energy and is responsible for multiple projects throughout Ireland. MKO, on behalf of AIR, undertook a detailed site identification process, through Geographical Information Systems (GIS) software, within multiple counties and has led to the identification of a number of sites which AIR has brought forward into the planning system, and further sites under consideration including the Proposed Project site and others in Co. Galway and Co. Cork.

Site selection for the development of a wind farm must be suitable for consideration under a number of criteria, please see Table 3-2 below for Site-specific Selection Criteria.

Table 3-2: Site-specific Selection Criteria and Basis for Assessment

Criterion	Basis for Assessment	Potential Environmental Effect
Grid Access/ Capacity	Grid Access/Capacity means the potential of the National Grid to accommodate future projects on the network. The proximity of a project to suitable grid nodes (i.e., those with spare capacity) should facilitate the selection of a project for a viable grid connection offer.	**Direct:** Land, Soil and Geology, Water, Biodiversity. **Indirect:** Noise and Vibration, Population and Human Health.
Wind Resource Assessment	The available wind resource (i.e., wind speed) directly translates into how much electrical output is available from the Site.	**Direct:** Air Quality, Climate. **Indirect:** Population Human Health, Air Quality, Climate.
County Development Plans (CDP) and Zoning	County Development Plans typically indicate the areas of a county which are deemed preferred, open to consideration and not suitable for wind farm development.	**Direct:** Landscape and Visual, Cultural Heritage, Biodiversity. **Indirect:** Major Accidents.
Proximity to Houses	Proximity to houses refers to how close the proposed wind turbines are to sensitive receptors. Further detail is provided in Section 3.2.3.2.2 below	**Direct:** Population and Human Health, Noise and Vibration, Shadow Flicker. **Indirect:** Landscape and Visual.
Population Density	Population density refers to the density of housing and population in the surrounding environs to the Site. Further detail is provided in Section 3.2.3.2.2 below	**Direct:** Population and Human Health, Noise and Vibration, Shadow Flicker. **Indirect:** Landscape and Visual.
Environmental Sensitivity	Environmental Sensitivity is the ecological sensitivity of the Site based on proximity to sensitive areas within or around the Site. (Located outside of EU Natura 2000 sites; locations outside of National designations; located outside of Article 17 Annex I Habitats). Further detail is provided in Section 3.2.3.2.1 below	**Direct:** Biodiversity, Ornithology, Land Soils and Geology, Climate. **Indirect:** Water, Major Accidents.
Landscape Capacity/ Cumulative Impact	This refers to the landscape's capacity to absorb wind farm developments.	**Direct:** Landscape and Visual. **Indirect:** Cultural Heritage.

Criterion	Basis for Assessment	Potential Environmental Effect
Site Scale	Sufficient area of unconstrained land that could potentially accommodate a wind farm development and turbine spacing requirements. Further detail is provided in Section 3.2.3.2.3 below	**Direct:** Water Land, Soils and Geology, Biodiversity, Ornithology, Climate, Cultural Heritage, Major Accidents.
Communications Infrastructure	Telecoms masts and signals in the vicinity and across the sites to be considered.	**Direct:** Material Assets (Telecommunications and Electromagnetic Frequency).
Flood Plain Analysis	Flood Plain Analysis assesses the wind farm's location in terms of historical flooding data. It also considers if the site is pumped, or gravity drained.	**Direct:** Water, Major Accidents. **Indirect:** Material Assets (Traffic and Transportation), Major Accidents.
Supporting Infrastructure	Proximity to national and regional road network sites with better road access require less modifications or upgrade to the local infrastructure to facilitate construction or delivery of turbine components to site.	**Direct:** Material Assets (Traffic and Transportation). **Indirect:** Noise and Vibration, Air Quality, and Climate.

3.2.3.2.1 Environmental Sensitivities

The Proposed Wind Farm is not located within any area designated for ecological protection. The Proposed 110kV Underground Cabling route crosses the River Nore Special Protection Area (SPA), and River Barrow and River Nore Special Area of Conservation (SAC) in the townland of Moatpark, Co Kilkenny. At this location, the Proposed 110kV underground cabling route will cross the river via horizontal direction drilling (HDD), with the drilling commencing within the N77 national secondary road verge, and finishing in agricultural land, outside of the European designated sites. The Proposed 110kV Underground Cabling route also crosses the River Nore/Abbeyleix Woods Complex proposed Natural Heritage Area (pNHA) at this location. One of the drilling pits required for HDD is located within the boundary of the pNHA, although it is located within agricultural grassland.

The nearest Natura 2000 site to the Proposed Wind Farm site is the Spahill and Clomantagh Hill SAC, which is located approximately 263m southeast of the Proposed Wind Farm infrastructure at its nearest point. The Spahill and Clomantagh Hill SAC borders the Site and is adjacent to the proposed grassland enhancement area. The Spahill and Clomantagh Hill SAC is a semi-natural dry grasslands and scrubland facies on calcareous substrate. The proposed grassland enhancement area beside the SAC will enhance the extent and connectivity between habitats, this is described further in the proposed BEMP (See Appendix 6-4, for further details).

The closest Natural Heritage Area (NHA) or proposed Natural Heritage Area (pNHA), is Spahill and Clomantagh Hill pNHA, which is located approximately 263m southeast of the Proposed Wind Farm infrastructure at its nearest point.

The Proposed Wind Farm site is located primarily on lands comprising of commercial forestry, agricultural pastural land, mixed forest and transitional woodland-shrub.

3.2.3.2.2 Population Density & Proximity to houses

The Applicant sought to identify an area with a relatively low population density to allow for appropriate setback distances from residential sensitive receptors. Having reviewed the settlement patterns in the vicinity, the study area has emerged as suitable to accommodate the Proposed Wind Farm. The population density of the Population Study Area of the Proposed Wind Farm as described in the Population and Human Health section of this EIAR is 24.6 persons per square kilometre, as described in Chapter 5 of this EIAR. This is significantly lower than the average national population density of 73.3 persons per square kilometre. The proposed turbine positions achieve the recommended setbacks in both the Guidelines (500m) and the draft Guidelines (4 x the proposed turbine tip height). The nearest settlement to the proposed turbines is the village of Johnstown, Co. Kilkenny located approximately 3.8km southwest of T7.

3.2.3.2.3 Site Scale

The Site, covering a total of 796 hectares, with the Proposed Wind Farm site measuring 573 ha comprises a mix of commercial forestry, agricultural pastural land, mixed forest, transitional woodland-shrub and public road corridors. The Proposed Wind Farm site has an elevation range of approximately 300 to 316 meters above ordnance datum (mAOD) at its highest point in the southwest to approximately 120 mAOD at its lowest point at its southeastern boundary of the Proposed Wind Farm site. Land-use in the wider vicinity of the Site comprises a mix of agriculture, commercial and private forestry, low density residential, quarrying, renewable energy, industrial and commercial uses. The Proposed Wind Farm site benefits from existing forestry and agricultural tracks (approximately 10.7km). The Proposed Wind Farm site is easily accessible via a site entrance off the R693 Regional Road along the southern boundary of the Proposed Wind Farm site in the townland of Barna, Co. Kilkenny. As discussed above, the Site comprises habitats of low ecological value and the recommended setback distance to sensitive receptors is achieved.

The constraints and facilitators mapping process is outlined in Section 3.2.5.2.1.

3.2.3.2.4 Summary

From the review of the criteria set out above, the Site is considered a suitable location for the provision of a renewable energy development of the scale proposed. The Proposed Wind Farm is located on agricultural land and commercial forestry which allows the Site to take advantage of the existing access roads (some of which will be upgraded) and highlights the suitability of the Proposed Wind Farm as it can make sustainable use of established items of infrastructure.

The Proposed Wind Farm site is not located within EU or National protected areas. An area of exposed limestone pavement and dry grassland is located southeast of T4. The exposed limestone pavement exhibits an affinity with the Annex I Priority Habitat [8420] and dry grassland an affinity with semi-natural dry grasslands [6210]. Accordingly, owing to its high conservation significance and Priority Annex I status, the habitat has been assessed as being of County Importance. However, the Proposed Project has been designed to completely avoid this habitat and therefore, will have no effect on EU or National protected areas.

The Proposed Wind Farm site is located adjacent to the Spahill and Clomantagh Hill SAC and the Spahill and Clomantagh Hill pNHA. The Proposed Wind Farm site is located primarily on agri-pastoral lands and mixed/commercial forestry, of low ecological value, within a rural setting. Required setbacks from sensitive receptors, as set out above are achievable. The Proposed Grid Connection underground cabling route crosses the River Nore SPA, and the River Barrow and River Nore SAC in the townland of Ballyconra, Co. Kilkenny. At this location, the proposed underground cabling route will cross the river via HDD, with the drilling commencing and finishing in agricultural land, outside of the SAC.

From the review of the criteria set out above, the Proposed Grid Connection was identified for the provision of a connection of the Proposed Wind Farm to the national grid. The Proposed 110kV Underground Cabling route is located primarily within the public road corridor and does not directly interact with any environmental designations. The Proposed 110kV Underground Cabling route overlaps with the River Nore SPA, and the River Barrow and River Nore SAC when crossing the River Nore along its route. However, there are no instream works proposed as part of the Proposed 110kV Underground Cabling route construction, so no significant impacts have been identified.

Factoring all required environmental constraints into the project design, a site of considerable scale, with an estimated installed capacity of approximately 62MW, and potential to power approximately 49,560 Irish households with renewable energy and displace 28,277 tonnes of carbon dioxide per annum (989,687 tonnes over the 35-year operational life), the Site is considered appropriate for wind energy development and represents a positive contribution to National and EU climate action targets.

3.2.4 Alternative Renewable Electricity Technologies

Both onshore and offshore wind energy development and solar energy developments will be required to ensure Ireland reaches the target set in the CAP25 to source 80% of our electricity from renewable energy by 2030. CAP25 has set out the following targets for electricity generation:

- Share of electricity demand generated from renewable sources to up to 80% where achievable and cost effective, without compromising security of electricity supply;
- Onshore Wind Capacity: up to 9GW
- Offshore Wind Capacity: 5GW (minimum)
- Solar PV Capacity: 8GW

When considering alternative renewable energy developments to the Proposed Project, the Applicant considered offshore wind and commercial solar energy production.

3.2.4.1 Offshore Wind

Although the screening exercise was based on identifying lands for onshore wind development; another alternative source of renewable electricity generation would be offshore wind energy.

However, it is considered that due to delays with the regulatory process for offshore development, a combination of both onshore and offshore wind farm development will continue to be required to deliver on the ambitious renewable energy targets set out under CAP25 which include focusing on onshore wind energy developments to reach the 2025/2030 renewable energy targets. As such, the Applicant's primary focus is on onshore wind farms, and the Applicant will continue to explore potential development offshore in tandem with delivering suitable sites onshore such as the Proposed Project.

The Applicant is committed to playing a key role in helping the State achieve its CAP25 objectives while building upon its proven record of generating clean renewable energy to the national grid. As such, the option of an offshore project is not considered to be a reasonable alternative at this time.

3.2.4.2 Solar

Commercial solar energy production is the harnessing and conversion of sunlight into electricity using photovoltaic (PV) arrays (panels).

Please note, the amount of electrical energy output from renewable generation is generally described in terms of capacity factor. The capacity factor relates to the amount of energy that may be achieved from a renewable technology over the period of one calendar year as a percentage of the maximum possible annual output that could be achieved if the facility operated at full capacity every hour of every day throughout the year. Generally solar PV has a lower capacity factor than wind generation. One factor in the energy yield difference is that solar PV does not produce electrical energy at night, but the wind can blow at any time of the day or night. As identified within the Sustainable Energy Authority of Ireland (SEAI) '*Energy in Ireland – 2025 Report*'[1], the capacity factor for wind in this region is 29.2% (0.292). If solar PV was to be deployed on the Proposed Wind Farm, it would be located within the Solar South region of Ireland as delineated by the EirGrid report '*Enduring Connection Policy 2.3 Solar and Wind Constraints Report: Assumptions and Methodology*'[2].. The capacity factor for solar in this region is 13.3% (0.133). In order to achieve an estimated 62MW output using solar PV arrays, there would be a requirement of approximately 99.2ha[3], which represents approximately 17.3% of the Site.

Due to the smaller development footprint of the Proposed Project infrastructure and associated larger MW output, the Proposed Wind Farm was progressed over a proposed solar development. As detailed in Section 1.1.1 in Chapter 1, the Proposed Wind Farm site boundary encompasses an area of approximately 573 hectares and the permanent footprint of the Proposed Wind Farm measures approximately 16.6 hectares, which represents approximately 2.9% of the Proposed Wind Farm site.

A comparison of the potential environmental effects of the development of a solar PV array when compared against the chosen option of developing the Proposed Wind Farm at this site are presented in Table 3-3 below.

[1] *SEAI (2025) Energy In Ireland 2025 (https://www.seai.ie/sites/default/files/publications/Energy-in-Ireland-2025.pdf)*
[2] *EirGrid (2024) Enduring Connection Policy 2.3 Solar and Wind Constraints Report: Assumptions and Methodology <https://cms.eirgrid.ie/sites/default/files/publications/ECP-2.3-Solar-and-Wind-Constraints-Report-Assumptions-and-Methodology-v1.1.pdf>*
[3] *Approximately 1.6 - 2 ha are required for each MW of solar panels installed based on approximately 4000 panels per MW (taken from the Sustainable Energy Authority Solar Energy FAQ publication which can be accessed here: https://www.seai.ie/publications/FAQs_on_Solar_PV.pdf). For the purposes of comparison, a minimum value of 1.6 ha has been assumed.*

Table 3-3 Comparison of environmental effects for an alternative technology e.g., solar when compared against the chosen option (wind turbines)

Environmental Consideration	Solar PV Array (approximately 62MW)	Chosen Option (Wind Farm – approximately 62MW)
Population & Human Health (incl. Shadow Flicker)	No potential for shadow flicker to affect sensitive receptors. Potential for glint and glare impacts on local receptors. Lower potential for noise and vibration effects. Lower potential for visual obstructions in the skyline due to solar farms being low-lying structures. Based on the renewable energy outputs associated with solar PV, using solar PV at the Site would have a positive effect on human health due to the production of clean renewable energy and the offsetting of emissions (e.g., nitrogen, sulphur dioxide) which are produced from fossil fuel powered sources of electricity.	Based on the assessment detailed in Chapter 5 and the mitigation measures proposed, there will be no significant effects related to shadow flicker from the Proposed Wind Farm. No potential for glint and glare impacts on sensitive receptors. Based on the assessment included in Chapter 10 and Chapter 11, the Proposed Project will have a long term significant positive effect on air quality and climate due to the production of clean renewable energy and the offsetting of emissions (e.g., nitrogen, sulphur dioxide) which are produced from fossil fuel powered sources of electricity. Based on the assessment in Chapter 10, there will be no significant effects on human health resulting from exhaust and dust emissions during the construction, operation, and decommissioning phases of the Proposed Project. Based on the Assessment in Chapter 12 Noise and Vibration, the Proposed Project will have no significant effects on sensitive receptors. As detailed in Chapter 13 Landscape and Visual, the landscape type and character of the area where the Proposed Turbines are sited comprises a large-scale, human-modified transitional marginal landscape type of 'Low' sensitivity and can effectively accommodate wind energy development. Of the 20 no. viewpoints (VPs) assessed, residual visual effects for 3 no. were deemed not significant, 11 no. were deemed slight, 5 no. were deemed moderate, and 1 no. were deemed significant. The number of receptors experiencing these effects is very low as the landscape surrounding the proposed turbines has a low population density. Visual effects will decrease with distance from the proposed turbines.
Biodiversity & Birds	A larger development footprint would result in greater habitat loss/impact due to the higher level of drainage requirement. Potential for glint and glare impacts on birds.	A smaller development footprint would result in less habitat loss. As detailed in Chapter 6 Biodiversity, the development has been designed to avoid or mitigate impacts on biodiversity including bats and downstream aquatic receptors.

Environmental Consideration	Solar PV Array (approximately 62MW)	Chosen Option (Wind Farm – approximately 62MW)
	No potential for collision risk with birds and bats.	There is no potential for significant negative effects on terrestrial faunal key ecological receptors, with the exception of bats, during the operational phase of the Proposed Project. The Proposed Project maximises the existing infrastructure within the Proposed Wind Farm Site and there will be minimal requirement for operational works along the Proposed Grid Connection Site. The Proposed Project includes for a BEMP (Appendix 6-4) proposal providing a local boost to biodiversity, birds, and water quality. With regard to collision risk, as detailed in the Bat Report in Appendix 6-2 of this EIAR, site-level collision risk for high collision risk bat species with Proposed Turbines was typically Low to Medium. Therefore, there will be no significant effects on bats. With the implementation of the mitigation measures described in Chapter 7 Ornithology, and Appendix 7-6, no significant effects will occur post-mitigation. Furthermore, there will be no impact for glint and glare on birds.
Land, Soils & Geology ***Geotechnical***	Shallower excavations involved in solar PV array developments would result in reduced volume of spoil to be excavated. Greater potential risk of interaction with unmapped karst features due to the larger footprint.	As detailed in the assessment in Chapter 8, there is no loss of topsoil or subsoil as a result of the Proposed Project. Topsoil and subsoil will be relocated within the Proposed Wind Farm. No significant effects on soils and subsoils will occur. Reduced potential risk of interaction with unmapped karst features due to the smaller footprint. The spoil management proposals discussed in Chapter 4 sets out the optimal treatment for spoil excavated/generated on site without creating significant impacts for biodiversity, hydrology, land use, etc.
Hydrology and Hydrogeology	Shallower excavations involved in solar PV array developments would result in reduced volume of spoil to be excavated and stored on site, therefore reducing the potential for silt-laden runoff to enter receiving waterbodies. The larger development footprint would result in a larger area of impermeable surfaces and would result in increased drainage requirements.	Project design specific drainage design removes the potential for significant environmental effects. As detailed in the assessment in Chapter 9, no significant effects on surface water or groundwater quality will occur. The presence of karst features and sensitivity of the underlying groundwater environment were also considered. While the larger footprint of a solar PV development would increase the potential for interaction with previously unmapped karst features, solar PV generally requires shallower excavations. The smaller

Environmental Consideration	Solar PV Array (approximately 62MW)	Chosen Option (Wind Farm – approximately 62MW)
		footprint of the Proposed Wind Farm reduces the area of potential interaction with karst features, with site-specific mitigation measures proposed to manage the identified risks. Refer to Chapter 8: Land, Soils and Geology, Chapter 9: Hydrology and Hydrogeology, and Appendix 8-3 for further details
Air Quality	Increased potential for dust and other noxious emissions due to larger volume of transport movements to and from the Site and larger volume of plant and ground works on site due to the larger footprint. Reduced capacity factor per MW installed of solar PV array technology would result in more reliance on fossil fuels for energy generation and therefore decreased air quality improvements nationally.	Reduced potential for dust and other noxious emissions due to smaller volume of plant and ground works on site due to a smaller footprint. Increased capacity factor of wind energy technology would result in a reduced reliance on fossil fuels for energy generation and therefore increased air quality improvements. As detailed in the assessment in Chapter 10, the Proposed Project will have a long-term, significant, positive effect on air quality during the operational phase.
Climate	Reduced capacity factor of solar PV array technology would result in less carbon offset.	Greater capacity factor resulting in a shorter carbon payback period. As detailed in the assessment in Chapter 11 Climate, over the proposed 35-year lifetime of the Proposed Project, 989,687 tonnes of carbon dioxide will be displaced from traditional carbon-based electricity generation.
Noise & Vibration	Potential for short-term noise and vibration impacts on nearby sensitive receptors during the construction phase. Increased traffic movements and increased plant on site due to the larger footprint could lead to larger noise and vibration output during the construction phase. Less potential for noise and vibration impacts on nearby sensitive receptors during the operational phase.	Based on the assessment detailed in Chapter 12 and the mitigation measures proposed, there will be no significant effects on sensitive receptors due to an increase in noise and vibration levels from the Proposed Project during the construction and operational phase.
Landscape & Visual	Panelling potentially less visible from surrounding area due to the screening by vegetation and topography.	Greater visibility due to the vertical scale of the proposed turbines. As detailed in Chapter 13 Landscape and Visual, the landscape type and character of the area where the Proposed Turbines are sited comprises a large-scale, human-modified transitional marginal landscape type of 'Low'

Environmental Consideration	Solar PV Array (approximately 62MW)	Chosen Option (Wind Farm – approximately 62MW)
		sensitivity and can effectively accommodate wind energy development. Of the 20 no. viewpoints (VPs) assessed, residual visual effects for 3 no. were deemed not significant, 11 no. were deemed slight, 5 no. were deemed moderate, and 1 no. were deemed significant. The number of receptors experiencing these effects is very low as the landscape surrounding the proposed turbines has a low population density. Visual effects will decrease with distance from the proposed turbines.
Cultural Heritage	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.	Smaller development footprint would decrease the potential for impacts on unrecorded, subsurface archaeology. As detailed in Chapter 14, there will be no significant effects on known or unknown archaeology and cultural heritage during the construction, operation and decommissioning phases. Archaeological monitoring under licence will be implemented during the construction phase.
Material Assets	Potential for greater traffic volumes during construction phase due to the number of solar panels required to achieve the same output as wind. Potential for a lesser impact on road capacity due to no required accommodation works for solar panel delivery to the site. Greater potential for impacts on waste management due to increased plant on site giving rise to increase waste materials. No material difference for impacts on gas or water. No potential for impacts on telecommunications.	Positive effect on electricity supply through the generation of indigenous, renewable energy with a provision of an estimated 62MW being exported to the national grid and powering 49,560 Irish households per year No material difference for impacts on gas and water. Buffers implemented on telecommunication links. As detailed in Chapter 15, there will be no significant effects on traffic volumes during the construction phase of the Proposed Project. A detailed Traffic Management Plan (Appendix 15-2) incorporating mitigation measures will be agreed with the roads authority prior to construction works commencing on site.
Major Accidents and Natural Disasters	Decreased vulnerability to major accidents and natural disasters due to low profile design.	As detailed in Chapter 16 the risk of a major accident and/or disaster during the construction of the Proposed Project is considered 'low'. The highest risk scenarios to the Proposed Project (i.e., contamination and fire/explosion) are considered to be unlikely to occur at any phase of the Proposed Project. In relation to the BESS, Appendix 4-4 of the EIAR sets out the Fire Risk Management and Emergency Response Plan for the proposed BESS, detailing mitigation measures, emergency procedures, and actions to protect people,

Environmental Consideration	Solar PV Array (approximately 62MW)	Chosen Option (Wind Farm – approximately 62MW)
		emergency responders, and the environment in the event of a fire. A detailed risk assessment on potential risks relating to major accidents and natural disasters is provided in Section 16.4 of Chapter 16 of this EIAR.

While there are positive and negative environmental aspects of both renewable energy development options, neither is likely to have significant adverse effects. However, given the particular suitability of the Site for wind energy development, i.e., the lesser area of land required and the significant positive impact on climate and air quality, it was considered that wind energy was the most suitable option and most efficient method of electricity production for the Site with the least potential for significant environmental effects.

3.2.5 Alternative Project Design Options

3.2.5.1 Alternative Turbine Numbers and Model

Modern wind turbines have a potential power output in the 4 – 7 megawatt (MW) range. It is proposed to install 10 no. 6.2MW turbines at the Proposed Wind Farm which will have an estimated installed capacity of approximately 62 MW. Such a wind farm could also be achieved on the Proposed Wind Farm site by using smaller turbines (for example 2.5 MW machines). However, this would necessitate the installation of over 25 turbines to achieve a similar output. A larger number of smaller turbines would result in the wind farm occupying a greater footprint within the Proposed Wind Farm site, with a larger amount of supporting infrastructure being required (i.e., roads etc) and increasing the potential for environmental impacts to occur. The proposed number of turbines takes account of all site constraints and the distances to be maintained between turbines and features such as roads and houses, while maximising the wind energy potential of the Proposed Wind Farm. The 10-turbine layout selected for the Proposed Project has the smallest development footprint of the other alternatives considered, while still achieving the optimum output at a more consistent level than would be achievable using different turbines.

The turbine model to be installed on the Proposed Wind Farm will have an overall ground to blade tip height of 185m; a rotor diameter 163m; and a hub height of 103.5 metres. The use of alternative smaller turbines at the Proposed Wind Farm would not be appropriate as they would fail to make the most efficient use of the wind resource passing over the Proposed Wind Farm and would potentially require a larger development footprint. This alternative would potentially lead to additional environmental effects.

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 on the Proposed Wind Farm is presented in Table 3-4 below.

Table 3-4 Comparison of environmental effects between larger quantity of smaller turbines against the chosen option of a 10-no. turbine layout.

Environmental Consideration	Larger number of smaller turbine models	Chosen Option (10-no. turbine layout)
Population & Human Health (incl. Shadow Flicker)	Greater potential for shadow flicker and noise impacts on nearby sensitive receptors due to the increased number of turbines. However, these	Based on the assessment detailed in Chapter 5 and the mitigation measures proposed, there will be no significant effects on population and human health

Environmental Consideration	Larger number of smaller turbine models	Chosen Option (10-no. turbine layout)
	can be curtailed to meet threshold criteria. Smaller turbines would be less visually obstructive in the skyline; however, the larger development footprint would spread further across the landscape potentially occupying a larger portion of a viewpoint.	from shadow flicker and noise and vibration during the construction, operation and decommissioning phases of the Proposed Project. Decreased potential for shadow flicker due to greater setbacks from houses, greater separation between turbines thus reducing aggregated shadow flicker time. Reduced potential for noise impacts on nearby sensitive receptors due to a reduced number of turbines. As stated in Chapter 12 Noise and Vibration, there is no potential for significant noise and vibration effects from the Proposed Turbines and proposed BESS. Furthermore, noise emissions from the proposed turbines can be curtailed to meet threshold criteria. As detailed in Chapter 13 Landscape and Visual, the landscape type and character of the area where the Proposed Turbines are sited comprises a large-scale, human-modified transitional marginal landscape type of 'Low' sensitivity and can effectively accommodate wind energy development. Of the 20 no. viewpoints (VPs) assessed, residual visual effects for 3 no. were deemed not significant, 11 no. were deemed slight, 5 no. were deemed moderate, and 1 no. were deemed significant. The number of receptors experiencing these effects is very low as the landscape surrounding the proposed turbines has a low population density Visual effects will decrease with distance from the proposed turbines.
Biodiversity & Ornithology	Larger development footprint would result in greater potential for habitat loss. Due to the greater number of turbines present there would be a higher risk of collision for bird and bat populations at the Proposed Wind Farm site.	As detailed in Chapter 6 Biodiversity, the Proposed Project has been designed to avoid or mitigate impacts on biodiversity including bats and downstream aquatic receptors. As per Chapter 6 of this EIAR, No significant effects on receptors of International, National, County Importance or Local importance (higher value) were identified. The Proposed Project includes for a BEMP (Appendix 6-4) proposal providing a local boost to biodiversity, including birds, and water quality. With regard to collision risk, as detailed in the Bat Report in Appendix 6-2 of this

Environmental Consideration	Larger number of smaller turbine models	Chosen Option (10-no. turbine layout)
		EIAR, site-level collision risk for high collision risk bat species with Proposed Turbines was typically Low to Medium. Therefore, there will be no significant effects on bats. With the implementation of the mitigation measures described in Chapter 7 Ornithology, the residual effects for collision risk are not significant.
Land, Soils & Geology ***Geotechnical***	Larger development footprint would result in greater volume of spoil to be generated, excavated and sorted. A larger footprint has the potential to increase the likelihood of interacting with previously unmapped Karst features	Smaller footprint would result in smaller volume of soils to be excavated and managed. The spoil management proposals discussed in Chapter 4 sets out the optimal treatment for spoil generated on site without creating significant impacts for biodiversity, hydrology, land use, etc. Smaller footprint reduces the likelihood of interacting with previously unmapped karst features. – geotechnical investigations and a Karst Risk Assessment (Appendix 8-3) were carried out followed by careful design would lead to no significant environmental impacts. As detailed in the assessment in Chapter 8, no significant effects on topsoil, and subsoils will occur.
Hydrology and Hydrogeology	The larger quantity of smaller turbines would be designed to ensure no significant effects on hydrology, however a larger development footprint, would increase the potential for silt-laden runoff to enter receiving waterbodies.	The 10-no. turbine layout has been designed to minimise hydrological impacts. Furthermore, the smaller footprint would result in less potential for silt laden run-off to enter a waterbody. As detailed in the assessment in Chapter 9, no significant effects on surface water or groundwater quality will occur.
Air Quality	Increased potential for vehicle and construction dust emissions due to an increased volume of construction material and turbine component deliveries to the Site, giving rise to a reduced air quality locally for the construction phase.	Decreased potential for vehicle emissions and dust emissions due to a decreased volume of construction material and turbine component deliveries to the Site. As detailed in Chapter 10, the Proposed Project will have a long-term, significant, positive effect on air quality during the operational phase.
Climate	Increased potential for greenhouse gas emissions from the construction phase and a larger loss of carbon storing potential from the larger development footprint.	Decreased potential for vehicle emissions and dust emissions due to a decreased volume of construction material and turbine component deliveries to the Proposed Wind Farm.

Environmental Consideration	Larger number of smaller turbine models	Chosen Option (10-no. turbine layout)
	Longer carbon saving payback due to increased potential for greenhouse gases identified above.	As detailed in the assessment in Chapter 11 Climate, over the proposed 35-year lifetime of the Proposed Wind Farm, 989,687 tonnes of carbon dioxide will be displaced from traditional carbon-based electricity generation. The addition of an estimated 62MW clean energy to the national grid will be a positive contribution to the State's renewable energy targets set out in CAP25.
Noise & Vibration	Potential for increased noise impacts on nearby sensitive receptors due to reduced separation distance between sensitive receptors and turbine locations and additional turbine generators.	Potential for decreased noise levels at nearby sensitive receptors due to increased separation distance between sensitive receptors and turbine locations. Based on the assessment detailed in Chapter 12, there will be no significant effects on sensitive receptors during the construction operational and decommissioning phases from the Proposed Project.
Landscape & Visual	Neutral - Smaller turbines may be less visually intrusive on the landscape. Equally, a larger number of smaller turbines would be spread over a wider area, taking up a greater portion of a viewpoint.	The Proposed Wind Farm is an appropriately designed and suitably scaled project. As detailed in Chapter 13 Landscape and Visual, the landscape type and character of the area where the Proposed Turbines are sited comprises a large-scale, human-modified transitional marginal landscape type of 'Low' sensitivity and can effectively accommodate wind energy development. Of the 20 no. viewpoints (VPs) assessed, residual visual effects for 3 no. were deemed not significant, 11 no. were deemed slight, 5 no. were deemed moderate, and 1 no. were deemed significant. The number of receptors experiencing these effects is very low as the landscape surrounding the proposed turbines has a low population density. Visual effects will decrease with distance from the proposed turbines.
Cultural Heritage	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.	Smaller development footprint would decrease the potential for impacts on unrecorded, subsurface archaeology. As detailed in the assessment in Chapter 14, there will be no significant direct or indirect effects on known or unknown archaeology and cultural heritage during the construction, operation and decommissioning phases. Archaeological monitoring under licence will be

Environmental Consideration	Larger number of smaller turbine models	Chosen Option (10-no. turbine layout)
		implemented during the construction phase.
Material Assets – Traffic and Transport	Potential for greater traffic volumes during construction phase due to larger development footprint and requirement for more construction materials and turbine components. A higher number of turbines would result in a longer delivery period and hence a longer period of traffic disruptions.	Potential for smaller traffic volumes during construction phase due to smaller development footprint and requirement for fewer construction materials and turbine components.
Material Assets – Utilities, Waste Management, Telecommunications and Aviation	No material difference between the two options for gas, water, waste management, and telecommunications as the larger quantity of smaller turbines would still be designed to minimise impacts on material assets.	No material difference between the two options for gas, water, waste management, and telecommunications as (the 10-no. turbine layout would still be designed to minimise impacts on material assets).
Major Accidents and Natural Disasters	A larger number of turbines could have a greater potential risk relating to major accidents and natural disasters.	As detailed in Chapter 16 the risk of a major accident and/or disaster during the construction of the Proposed Project is considered 'low'. The highest risk scenarios to the Proposed Project (i.e., contamination and fire/explosion) are considered unlikely to occur at any phase of the Proposed Project. A detailed risk assessment on potential risks relating to major accidents and natural disasters is provided in Section 16.4 of Chapter 16 of this EIAR.

For the reasons set out above, the proposal for a 10-no. turbine layout with larger turbines was considered to have a lower overall environmental impact when compared to a larger number of smaller turbines.

3.2.5.2 Alternative Turbine Layout and Design

The design of the Proposed Wind Farm has been an informed and collaborative process from the outset, involving the designers, developers, engineers, landowners, environmental, hydrological, archaeological, traffic specialists, statutory and non-statutory stakeholder and the local communities.

Throughout the preparation of the EIAR, the layout of the Proposed Wind Farm has been revised and refined to take account of the findings of all site investigations and baseline assessments, which have brought the design from its initial layout, through an interim layout to the Proposed Wind Farm layout. The design process has also considered the recommendations and comments of the relevant statutory and non-statutory organisations, the local community and local authorities (as detailed in Chapter 2 of the EIAR: Background to the Proposed Project) while seeking to ensure that a viable project can be constructed and connected to the national grid.

3.2.5.2.1 *Constraints Mapping*

The design and layout of the Proposed Wind Farm follows the recommendations and guidelines set out in the Guidelines (DoEHLG, 2006) and the *'Best Practice Guidelines for the Irish Wind Energy Industry'*[4] (Irish Wind Energy Association, 2012).

The 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 2019 Guidelines (DoHPLG, 2019). A consultation process in relation to the Draft 2019 Guidelines (DoHPLG, 2019) closed on 19th February 2020. The proposed changes presented in the Draft 2019 Guidelines (DoHPLG, 2019) give certain focus on the setback distance from residential properties (four times the proposed maximum tip height), along with shadow flicker and noise requirements relative to sensitive receptors. At time of writing, the Draft 2019 Guidelines (DoHPLG, 2019) 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 issued in 2006. Due to the timelines associated with the planning process for renewable energy projects and the commitment within the CAP 2025 to publish revised wind energy development guidelines for onshore wind by Q1 2025 (refer to Section 1.2.2), it is possible that the Draft 2019 Guidelines (DoHPLG, 2019) will be adopted during the consideration period for the Proposed Project.

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 either using guidance presented in the Draft 2019 Guidelines (DoHPLG, 2019) which is more onerous than the buffer zones as detailed in the current Guidelines (DoEHLG, 2006) or based on industry best practice.

The constraints map for the Site, as shown in Figure 3-1, was produced following a desk study of all site constraints. Figure 3-1 encompasses the following constraints and associated buffers:

- **Sensitive Receptors:** a minimum 740-metre setback from third party sensitive receptors (achieving the 4 x tip height separation distance from third party sensitive receptors in line with the draft Guidelines);
- **Telecommunications**: Setback buffers determined following detailed assessment of telecommunication links that traverse the Proposed Wind Farm site boundary.
- **Designated Sites/Natura 2000:** a minimum 100-metre setback of the Proposed Project infrastructure from Special Areas of Conservation, Special Protected Areas and Proposed Natural Heritage Areas;
- **Hydrology:** Watercourses plus 50m buffer;
- **Archaeology:** Archaeological Sites or Monuments: 50-metre buffer, plus 'Zone of Notification' as required by the National Monuments Service (ROI). Recorded Monuments plus 50m buffer;
- **Transport**: Draft 2019 Guidelines (DoHPLG, 2019) setback from National and Regional roads and railways of a distance equal to turbine tip height plus 10% (i.e., 203.5m). To note, for the purposes of identifying the greatest setback buffer from national and regional roads and railway, a tip height of 185m has been utilised;

Facilitators at the Proposed Wind Farm refer to those aspects which build on the existing advantages and include the following:

- Available lands for development;
- Acceptable wind resource;
- Opportunity to win construction materials on site, minimising the potential for additional traffic (and associated environmental impacts) and cost generation by acquiring all materials offsite;

[4] https://windenergyireland.com/images/files/9660bdfb5a4f1d276f41ae9ab54e991bb600b7.pdf

- Existing access points and general accessibility of all areas of the Proposed Wind Farm 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 wind farm layout was then developed to take account of all the constraints mentioned above and their associated buffer zones and the separation distances required. Following the mapping of all known constraints, detailed site investigations were carried out, see Section 4.3.1.1.2 of Chapter 4 for detail on site investigative works completed to date.

The ecological assessment of the Proposed Wind Farm encompassed habitat mapping and extensive surveying of birds, bats and other fauna. This assessment, as described in Chapter 6 and 7 of this EIAR on Biodiversity and Ornithology, 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 at the Proposed Wind Farm examined the proposed locations for turbines, roads and other components of the Proposed Project, such as the Proposed Grid Connection infrastructure. 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 by constraints. In other specific areas, infrastructure elements under consideration were omitted from the final Proposed Wind Farm layout to eliminate the potential for significant environmental impacts within the Balief Zone of Contribution.

Archaeological investigations, comprising a desktop study and detailed field surveys, identified all recorded National Monuments and Recorded Monuments within the vicinity of, and within, the Proposed Wind Farm site. Key constraints and appropriate buffer distances were established to inform both the landscape and visual assessment and the design evolution of the Proposed Project. Please see Chapter 13 Landscape and Visual Impact Assessment (LVIA) and 14 Cultural Heritage for further details.

The turbine layout for the Proposed Wind Farm has also been informed by wind data, the results of noise assessments, shadow flicker and the separation distance to be maintained between turbines. Thus, the baseline environmental assessment of the Proposed Wind Farm site and wind farm design 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.

As the Proposed Wind Farm design was refined, the biodiversity and ornithology mitigation and enhancement measures, detailed in the BEMP included as Appendix 6-4, for the Proposed Project were also refined through an iterative design process. This process is outlined in Section 3.2.5.2.2 below.

Map Legend

Hydrology & Hydrogeology

- Watercourses
- 50m Watercourse Buffer

Ecology

- Annex I habitat
- Biodiversity Exclusion Zone

Transport

- 203.5m Regional Road Buffer

Telecommunications

- Setback Buffers on Telecommunications Links

Dwellings

- Sensitive Receptors
- 740m Sensitive Receptor Buffer

Map Legend

- EIAR Site Boundary
- AIP Killoshulan Viable A

Designated Sites/ Natura 2000

- 100m Proposed Natural Heritage Area (pNHA) Setback
- 100m Special Areas of Conservation (SAC) Setback

Archaeological Sites /Monuments and Protected (NIAH) Structures

- National Monuments
- 50m National Monuments Buffer

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Drawing Title
Environmental Constraints

Project Title
Killoshulan Wind Farm

Drawn By	Checked By
ER	EMC
Project No.	Drawing No.
260172	Figure 3-1
Scale	Date
1:15,000	2026-10-14

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3.2.5.2.2 Alternative Proposed Wind Farm Design Iterations

The final design of the Proposed Wind Farm takes account of all identified constraints and the distances that is to be maintained between turbines and the constraints such as houses, roads, etc. The layout is based on the results of all site investigations that have been carried out during the EIAR process and the EIA scoping process with statutory and non-statutory consultees. As information regarding the Proposed Project was compiled and assessed, the number of turbines and the proposed layout have been revised and amended to take account of the physical constraints of the Proposed Wind Farm and the requirement for buffer zones and other areas which should be avoided. The selection of the number of turbines and layout has also had regard to wind-take and the separation distance to be maintained between turbines, as well as landscape and visual, cultural heritage, noise and shadow flicker elements. The EIAR and Proposed Project 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 Wind Farm layout has evolved following feedback from the various studies and assessments carried out as well as ongoing negotiations and discussions with landowners, the local community, and statutory consultees.

There were a number of reviews by the wind farm design team of the specific locations of turbines during the optimisation of the Proposed Wind Farm site layout. The initial constraints study identified a significant viable area within the overall study area of the Proposed Wind Farm site. Please refer to Figure 3-2, Figure 3-3 and Figure 3-4 to see the evolution of the turbine layout for the Proposed Wind Farm.

Proposed Wind Farm Layout Iteration No. 1

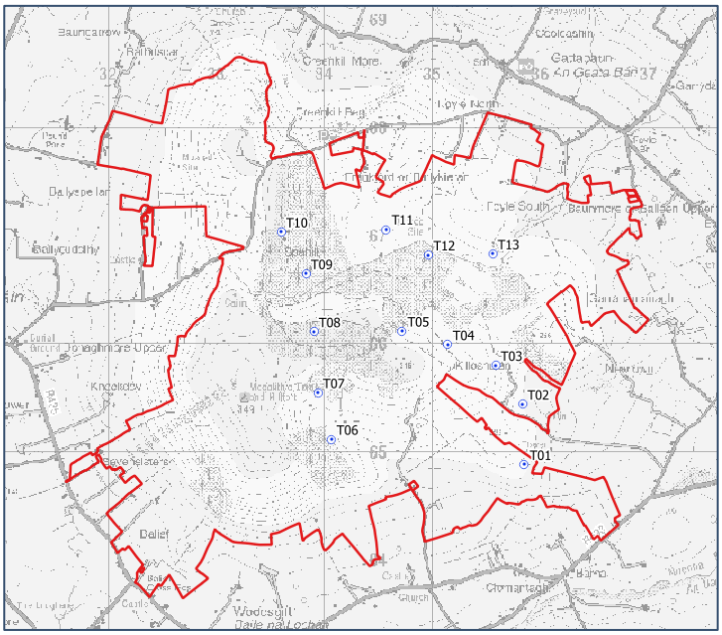


Figure 3-2 Proposed Wind Farm Layout Iteration No. 1

Iteration No. 1 which is presented in Figure 3-2 is the initial turbine layout which was based on a preliminary constraints mapping exercise and identification of a viable area for turbine siting. The initial desktop constraints study, based on available lands within the study area at that time, identified a viable area sufficient to accommodate 13 no. turbines. A turbine blade-tip height of 185m was considered at this early stage in the design process. Layout Iteration No. 1 was presented to the project team for desktop constraints review and early-stage assessment.

Proposed Wind Farm Layout Iteration No. 2

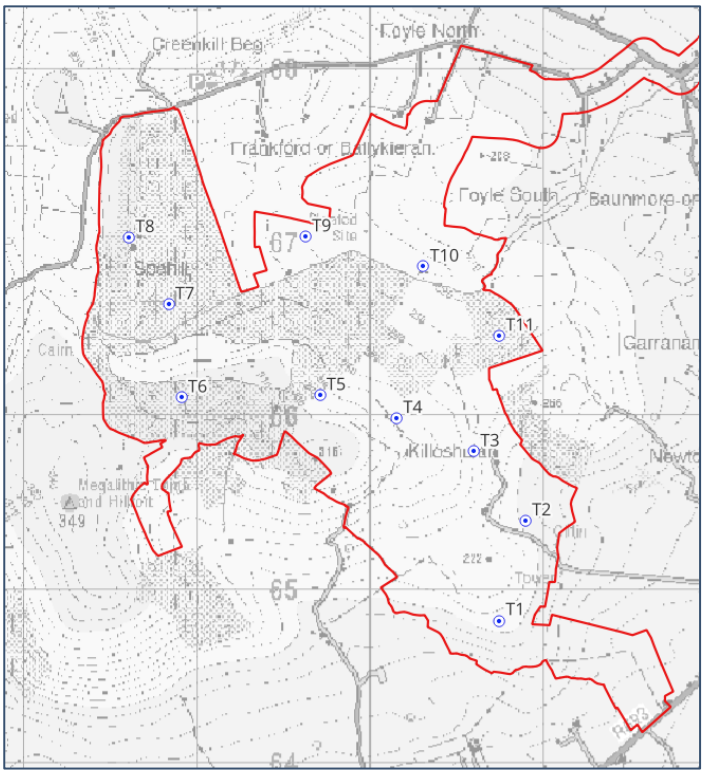


Figure 3-3 Proposed Wind Farm Layout Iteration No. 2

Iteration No. 2 is presented in Figure 3-3 above and represents the reduced 13 no. turbine to 11 no. turbine layout for the Proposed Wind Farm. Following continued discussions with landowners located in proximity to the Site, less land was available to the Applicant, which limited the amount of viable area under consideration within the Site. Additionally, due to the existing landscape setting and potential visual impacts on the Clomantagh Hillfort and the peak of Spahill, features of cultural heritage significance, 2 no. turbines in the southwest of the Proposed Wind Farm were removed from the layout.

With the contraction of available lands, it was decided to improve the economic viability of the project whilst having regard to the physical and environmental constraints previously identified. Iteration No. 2, comprised of 11 no. turbines, is a refined turbine layout which was based on updated designs, following desktop review by the design team. Layout Iteration No. 2 was presented to the project team for detailed investigations and assessment. These investigations included detailed habitat mapping, ecological surveying, hydrological and geotechnical investigations of the Proposed Wind Farm.

Proposed Wind Farm Layout Iteration No. 3– Final Proposed Project Layout

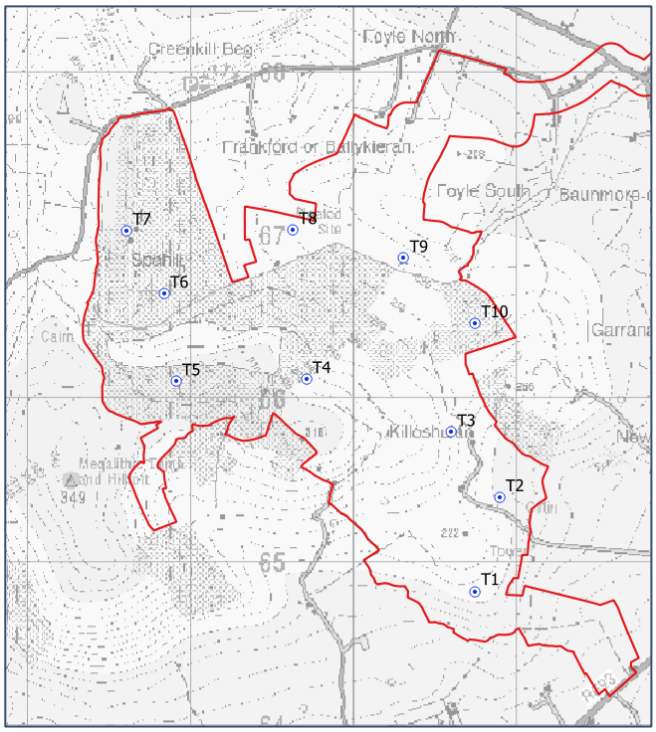


Figure 3-4 Proposed Wind Farm Layout Iteration No. 3

Iteration No. 3 is presented in Figure 3-4 above and represents the reduced 11 no. turbine to 10 no. turbine final layout for the Proposed Wind Farm. From the detailed hydrological and geotechnical investigations carried out on Iteration No. 2, karst features were identified underneath a proposed turbine location, which required relocation in order to mitigate potential effects on sub-surface geologic features and groundwater.. It was decided the proposed turbine would therefore no longer be brought forward following the site investigation results to prevent any potential sub-surface hydrological and geological effects as a result of the Proposed Project.

Further assessments were carried out as this layout was presented to the EIAR team for further detailed investigations and assessment. These included additional detailed archaeological investigations, habitat mapping, ecological surveying, and hydrological and geotechnical investigations of the Proposed Wind Farm. Further geotechnical investigations led to the relocation of T2 by approximately 50m in order to reduce the potential risk of impacts on identified karst features on the Site.

As part of the final design iteration, enhancement of grassland and hedgerow replanting/bolstering measures were developed in order to ensure that the Proposed Project had a positive effect on local biodiversity. Measures such as hedgerow replanting and bolstering have been proposed as part of the Proposed Wind Farm, with further details being available in Appendix 6-4 BEMP.

The revisions to the layout were found to have a positive effect on the environmental and ecological elements of the Proposed Wind Farm when compared to the other options considered.

A comparison of the potential environmental effects of initial iterations of the turbine layout as compared against the final turbine layout are presented in Table 3-5 below.

Table 3-5 Comparison of environmental effects of previous design iterations when compared against the final 10 no. turbine layout.

Environmental Consideration	Previous design iterations	Chosen Option of the Final 10. No Turbine Layout and all associated infrastructure
Population & Human Health (incl. Shadow Flicker)	Likely potential for increased shadow flicker impacts on nearby sensitive receptors due to the increased number of turbines in Proposed Wind Farm Layout Iteration No. 1 (13 no. turbine layout) and Proposed Wind Farm Layout Iteration No. 2 (11 no. turbine layout). Likely potential for increased noise impacts due to the increased number of turbines in Proposed Wind Farm Layout Iteration No. 1 (13 no. turbine layout) and Proposed Wind Farm Layout Iteration No. 2 (11 no. turbine layout)	There is no potential for significant shadow flicker effects from the proposed turbines. Shadow flicker effects can be mitigated to meet threshold criteria. Potential for reduced shadow flicker impacts on nearby sensitive receptors due to the reduced number of turbines and greater setbacks from houses, As detailed in Chapter 13 Landscape and Visual, the landscape type and character of the area where the Proposed Turbines are sited comprises a large-scale, human-modified transitional marginal landscape type of 'Low' sensitivity and can effectively accommodate wind energy development. Of the 20 no. viewpoints (VPs) assessed, residual visual effects for 3 no. were deemed not significant, 11 no. were deemed slight, 5 no. were deemed moderate, and 1 no. were deemed significant. The number of receptors experiencing these effects is very low as the landscape surrounding the proposed turbines has a low population density. Visual effects will decrease with distance from the proposed turbines. Based on the assessment detailed in Chapter 5 and Chapter 13, and the mitigation measures proposed, there will be no significant effects on population and human health from shadow flicker and noise and vibration during the construction, operation and decommissioning phases of the Proposed Project.
Biodiversity & Ornithology	Larger development footprint would result in greater potential habitat loss in Proposed Wind Farm Layout Iteration No. 1 (13 no. turbine layout) and Proposed Wind Farm Layout Iteration No. 2 (11 no. turbine layout). Greater number of turbines in Proposed Wind Farm Layout Iteration No. 1 and Proposed Wind Farm Layout Iteration No. 2 would lead to a greater collision risk for bird and bat species on the Proposed Wind Farm site.	As detailed above and further in Chapter 6, the Proposed Wind Farm has been designed to avoid or mitigate impacts on biodiversity. The Proposed Project includes for a BEMP, providing a local boost to biodiversity and ornithology. Please see Appendix 6-4 for details. With regard to collision risk, s detailed in the Bat Report in Appendix 6-2 of

Environmental Consideration	Previous design iterations	Chosen Option of the Final 10. No Turbine Layout and all associated infrastructure
		this EIAR, site-level collision risk for high collision risk bat species with Proposed Turbines was typically Low to Medium. Therefore, there will be no significant residual effects on bats. As detailed in Chapter 7 Ornithology, the Proposed Project has been designed to avoid or mitigate impacts on ornithological receptors. As detailed in the Collision Risk Assessment (CRA) in Appendix 7-6. No significant effects will occur post-mitigation.
Land, Soils & Geology ***Geotechnical***	Larger development footprint would have resulted in larger volume of spoil to be excavated and crushed stone to be extracted for construction in Proposed Wind Farm Layout Iteration No. 1 (13 no. turbine layout) and Proposed Wind Farm Layout Iteration No. 2 (11 no. turbine layout). The larger development footprint of Proposed Wind Farm Layout Iteration No. 1 (13 no. turbine layout) and Proposed Wind Farm Layout Iteration No. 2 (11 no. turbine layout increases potential risk for interacting with previously unmapped karst features	As detailed in the assessment in Chapter 8, topsoil and subsoil excavation volumes will be managed within the Proposed Wind Farm site, and therefore there will be no significant effects on topsoil and subsoil. Geotechnical investigations followed by careful design will lead to no significant environmental impacts. Smaller development footprint leads to a smaller volume of spoil to be excavated and would require less crushed stone to be extracted for construction. The spoil management proposals discussed in Chapter 4 sets out the optimal treatment for spoil excavated/generated on site without creating significant impacts for biodiversity, hydrology, land use, etc. Smaller development footprint reduces potential risk for interacting with previously unmapped karst features. As detailed in the karst risk assessment included as Appendix 8-3 karst features are present within the southern portion of the Site (covering the site entrance road and T1 to T4). Excavation of the existing soils and replacement with engineered fill and geogrid reinforcement over a suspected or identified karst feature is recommended The presence of a geotechnical engineer or engineering geologist and geotechnical investigations followed by careful design will lead to no significant environmental impacts.
Water	Larger footprint would result in a greater potential for silt-laden runoff to enter natural	As detailed in the assessment in Chapter 9, no significant effects on

Environmental Consideration	Previous design iterations	Chosen Option of the Final 10. No Turbine Layout and all associated infrastructure
	watercourses within and around the Proposed Wind Farm. For Proposed Wind Farm Layout Iteration No. 1 (13 no. turbine layout) and Proposed Wind Farm Layout Iteration No. 2 (11 no. turbine layout) Increased potential for impacts on groundwater schemes due to the location of infrastructure. Project design specific drainage design would remove the potential for significant environmental effects.	surface water or groundwater quality will occur.
Air Quality	More turbines increase the potential to maximise the use of the site wind resource and the opportunity to further reduce the country's dependence on fossil fuels. However, there would be an increased potential for impacts on air quality due to increased vehicle emissions and dust emissions as a result of increased volumes of material and turbine component deliveries required to facilitate the construction of the Proposed Wind Farm Layout Iteration No. 1 (13 no. turbine layout) and Proposed Wind Farm Layout Iteration No. 2 (11 no. turbine layout)	As detailed in Chapter 10, there will be no significant effects on air quality. The nature of the Proposed Project is such that, once operational, it will have a long-term, moderate, positive impact on the air quality and reduce dependency on fossil fuels, thereby resulting in a reduction in harmful emissions that is damaging to human health and the environment.
Climate	A larger number of turbines could result in a greater amount of exhaust emissions from construction vehicles and plant and the transport of materials and workers to/from the site of Proposed Wind Farm Layout Iteration No. 1 (13 no. turbine layout) and Proposed Wind Farm Layout Iteration No. 2 (11 no. turbine layout) A larger number of turbines could result in a higher MW output in the operational phase which would result in a greater amount of carbon savings for Proposed Wind Farm Layout Iteration No. 1 (13 no. turbine layout) and Proposed Wind Farm Layout Iteration No. 2 (11 no. turbine layout)	As detailed in the assessment in Chapter 11, over the proposed 35-year lifetime of the Proposed Wind Farm, 989,687 tonnes of carbon dioxide will be displaced from traditional carbon-based electricity generation. The addition of an estimated 62MW clean energy to the national grid will be a positive contribution to the State's renewable energy targets set out in CAP25.
Noise & Vibration	A larger number of turbines could have a greater noise impact for Proposed Wind Farm Layout Iteration No. 1 (13 no. turbine layout) and Proposed Wind Farm Layout Iteration No. 2 (11 no. turbine layout)	Based on the assessment detailed in Chapter 12 and the mitigation measures proposed, there will be no significant effects on sensitive receptors due to an increase in noise levels from the Proposed Wind Farm during the construction and operational phase.
Landscape & Visual	A larger number of turbines could have a greater visual impact for Proposed Wind	The smaller number of proposed turbines ensures a setback exceeding

Environmental Consideration	Previous design iterations	Chosen Option of the Final 10. No Turbine Layout and all associated infrastructure
	Farm Layout Iteration No. 1 (13 no. turbine layout) and Proposed Wind Farm Layout Iteration No. 2 (11 no. turbine layout)	that required in the Draft 2019 Guidelines (DoHPLG, 2019). As detailed in Chapter 13 Landscape and Visual, the landscape type and character of the area where the Proposed Turbines are sited comprises a large-scale, human-modified transitional marginal landscape type of 'Low' sensitivity and can effectively accommodate wind energy development. Of the 20 no. viewpoints (VPs) assessed, residual visual effects for 3 no. were deemed not significant, 11 no. were deemed slight, 5 no. were deemed moderate, and 1 no. were deemed significant. The number of receptors experiencing these effects is very low as the landscape surrounding the proposed turbines has a low population density. Visual effects will decrease with distance from the proposed turbines.
Cultural Heritage	A larger number of turbines and associated infrastructure could have a greater impact on unrecorded subsurface archaeology for Proposed Wind Farm Layout Iteration No. 1 (13 no. turbine layout) and Proposed Wind Farm Layout Iteration No. 2 (11 no. turbine layout)	As detailed in the assessment in Chapter 14, there will be no significant effects on known or unknown archaeology and cultural heritage during the construction, operation and decommissioning phases.
Material Assets – Traffic and Transport	Potential for greater traffic volumes during construction phase due to larger development footprint and requirement for more construction materials and turbine components for Proposed Wind Farm Layout Iteration No. 1 (13 no. turbine layout) and Proposed Wind Farm Layout Iteration No. 2 (11 no. turbine layout)	As detailed in Chapter 15, there will be no significant effects on traffic volumes during the construction phase of the Proposed Project. A detailed Traffic Management Plan (Appendix 15-2) incorporating all the mitigation measures will be agreed with the roads authority prior to construction works commencing onsite.
Material Assets – Utilities, Waste Management, and Telecommunications	No material difference between the Proposed Wind Farm Layout Iteration no. 1 and 2 for gas, water, waste management, and telecommunications.	No material difference between the Proposed Wind Farm Layout Iteration no. 1, 2 and 3 for gas, water, waste management, and telecommunications.
Major Accidents and Natural Disasters	A larger number of turbines could have a greater potential risk relating to major accidents and natural disasters for the Proposed Wind Farm Layout Iteration No. 1 (13 no. turbine layout) and Proposed Wind Farm Layout Iteration No. 2 (11 no. turbine layout) due to increased land disturbance and larger excavation footprint.	As detailed in Chapter 16 the risk of a major accident and/or disaster during the construction of the Proposed Project is considered 'low'. The highest risk scenarios to the Proposed Project (i.e., contamination and fire/explosion are considered unlikely to occur at any phase of the Proposed Project.

Environmental Consideration	Previous design iterations	Chosen Option of the Final 10. No Turbine Layout and all associated infrastructure
		A detailed risk assessment on potential risks relating to major accidents and natural disasters is provided in Section 16.4 of Chapter 16 of this EIAR.

3.2.5.2.3 Alternative Internal Road Layout

Access tracks are required onsite in order to enable transport of infrastructure and construction materials within the Proposed Wind Farm. Such tracks must be of a gradient and width sufficient to allow safe movement of equipment and vehicles. Approximately 9.1km of new internal tracks are required for the Proposed Project along with approximately 4.5km of existing roads and access tracks, which is currently used by the landowners in their daily activities. These tracks will be utilised where possible; however, some require upgrading/widening to facilitate the movement of abnormal loads through the Proposed Wind Farm site.

As the turbine layout was finalised, the most suitable routes between each component of the Proposed Project were identified, taking into account the shortest routes and existing farm tracks and filtering out the physical and environmental constraints of the Proposed Wind Farm site and the associated buffers, and utilising the most direct route between turbines in order to minimise the footprint. Additionally, turning areas were designed and sited for minimum environmental effect along internal roads.

An alternative option to making maximum use of the existing road network within the Proposed Wind Farm would be to construct a new road network, having no regard to existing roads or tracks. This approach was not favoured, as it would require unnecessary disturbance to the Site and create the potential for additional cut and fill material to be used in the construction of new road networks. Please see Table 3-6 for a comparison of environmental effects when compared against the chosen option.

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	Use and Upgrade/Resurface of Existing Site Tracks/Local Roads
Population & Human Health	Potential for increased impacts on residential amenity due to increased disturbance during the construction stage.	The road upgrades will have potentially less of an impact on population and human health.
Biodiversity & Ornithology	Larger development footprint would result in greater habitat loss compared to the chosen option.	Smaller development footprint will result in less habitat loss.
Land, Soils & Geology	Larger development footprint would result in greater volumes of spoil to be excavated and stored. Larger volume of stone required for road construction. Increased material volume from borrow pit.	Smaller development footprint which leads to a reduction in spoil volumes to be excavated and a smaller volume of stone required for road construction. Reduced material volume from borrow pit.
Hydrology and Hydrogeology	Larger new development footprint would result in greater volumes of	Smaller new development footprint would result in smaller volumes of spoil to be

Environmental Consideration	New Road Network	Use and Upgrade/Resurface of Existing Site Tracks/Local Roads
	spoil to be excavated and greater potential for silt-laden runoff from works area.	excavated and lower potential for silt-laden runoff from works area.
Air Quality	More ground disturbance, potential for greater emissions due to more plant on site and longer construction phase would result in increased dust and other emissions.	Less ground disturbance therefore potential for fewer emissions and dust generation due to fewer plant on site and shorter construction phase.
Climate	Larger development footprint requires more construction materials leading to increased vehicle movements and associated vehicular emissions. Greater amounts of on-site felling with a greater footprint resulting in less carbon sequestration across the Proposed Wind Farm site.	Smaller development footprint requires less construction materials leading to decreased vehicle movements and associated vehicular emissions. Reduced amounts of on-site felling resulting in more carbon sequestration across the Proposed Wind Farm site.
Noise & Vibration	Potential for increased noise impacts on nearby sensitive receptors during the construction of the new roads.	Potential for less noise impacts on nearby sensitive receptors during the construction of the road upgrades.
Cultural Heritage	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.	Smaller development footprint would decrease the potential for impacts on unrecorded, subsurface archaeology.
Landscape & Visual	There is potential for increased temporary visual impacts for sensitive receptors due to the presence of additional plant on site during the construction phase to excavate and construct a new road layout. Reduced natural screening associated with greater on-site felling.	There will be a slight reduction in potential for visual impacts during the construction phase due to the decreased presence of plant on site. Increased natural screening with less on-site felling.
Material Assets	Potential for greater traffic movements on site during construction phase due to larger development footprint. No material difference between the two options in potential for impact on gas, water, telecommunications and aviation assets.	Smaller development footprint results in a reduced construction traffic movements on site due to smaller development footprint. No material difference between the two options in potential for impact on gas, water, telecommunications and aviation assets.

Environmental Consideration	New Road Network	Use and Upgrade/Resurface of Existing Site Tracks/Local Roads
Major Accidents and Natural Disasters	No material difference between the two options.	No material difference between the two options.

3.2.5.3 Alternative Borrow Pit Option

The use of an onsite borrow pit represents an efficient use of existing onsite resources and reduces the need to transport large volumes of construction stone materials along the local public road network to the Proposed Wind Farm site. The use of an onsite resource, that would only be developed for the Proposed Wind Farm, reduces the use of off-site existing quarry material assets.

A review of potential construction phase borrow pit locations was carried out by hydrological experts Hydro-Environmental Services and the project geo-technical consultants Fehily Timoney. Site surveys were undertaken and existing GIS data and environmental constraints were also considered, namely aerial photography, soil and subsoil cover, biodiversity (habitats), on site drainage, proximity to the existing and proposed internal road network, and proximity to sensitive receptors.

Trial pits were undertaken to determine potential suitable locations for borrow pits. The findings of the geological site investigations concluded the identification of a borrow pit within the Proposed Wind Farm site, northwest of T4, measuring approximately 19,015m^2 with a potential of providing the majority of construction stone material for the Proposed Project. The location of the proposed borrow pit is shown on Figure 4-2 and cross section details are shown on Figure 4-14. The extraction of material from the borrow pit will be during the construction phase of the Proposed Wind Farm only and will be a temporary operation carried out over a short period of time. Rock breaking will be used for extracting material from the borrow pit. Processing and crushing of stone material will also be required at the borrow pit to achieve the grading requirements for use in construction. The final volumes to be removed from the borrow pit will be confirmed at the time of construction and following detailed pre-construction site investigation works. In addition to the material to be extracted from the borrow pit, it is anticipated that engineering fill and higher quality, surfacing granular fill and sand will be sourced from local, authorised quarries (approximately 30,000m^3). Licenced quarries located within 20 km of the Proposed Wind Farm site which could provide some construction material for the construction of the Proposed Wind Farm are shown in Chapter, Figure 4-32, of this EIAR.

An alternative to using an on-site borrow pit was the option of sourcing all stone and materials from a licensed quarry or quarries in the vicinity of the Proposed Wind Farm site. The movement of the volume of material required for the construction of a 10-no. turbine wind farm would result in a significant increase in construction traffic and heavy loads, in combination with a potential for an increase in noise and dust emissions along the haul routes and was therefore considered a less preferable option. The cost of importing the required volume of crushed stone was also a factor in choosing to obtain stone from the on-site borrow pit.

A comparison of the potential environmental effects when comparing the sourcing of all stone from local, off-site quarries against the chosen option (majority from on-site borrow pit) is presented in Table 3-7 below.

Table 3-7 Comparison of environmental effects when compared against the chosen option (Deliveries of Materials from Nearby Quarries)

Environmental Consideration	Sourcing all stone from local, off-site quarries	Use of onsite borrow pit along with offsite quarries
Population & Human Health	Potential for increased vehicular, noise and dust emissions from increased traffic movements, along construction haul routes due to the volume of rock to be transported to the site along the public road network, which could be a nuisance to local residents along the haul route.	Lower dust and noise emissions, and traffic volumes along construction haul routes due to reduced requirement for daily HGV presence on site during the construction phase. Temporary dust and noise emissions related to borrow pit extraction however, due to vegetation screening and distance from sensitive receptors, the residual effects are not significant.
Biodiversity & Ornithology	Reduced habitat loss and ground disturbance for flora, fauna and birds.	Increase in habitat loss due to borrow pit footprint however, as assessed in the Chapter 6 Biodiversity, this is habitat of low ecological value which is comprises the majoring of the site and surrounding landscape. Furthermore, the borrow pit will be reinstated with excavated spoil and will be reseeded post construction.
Land, Soils & Geology	Reduction in volume of spoil to be excavated however, additional large spoil placement areas would be required as an on-site borrow pit would not be available for the placement of excavated spoil.	Increased volume of spoil to be excavated and managed in order to access usable rock. The on-site borrow pit will be used for spoil management, reducing the requirement for management elsewhere on the Proposed Wind Farm site
Hydrology and Hydrogeology	Less potential for effects on groundwater quality.	Greater potential for effects on ground water quality due to extraction of bedrock from borrow pit area.
Air Quality	Potential for increased vehicular and dust emissions from increased traffic movements to and from the Proposed Wind Farm site, due to the volume of rock to be imported.	More ground disturbance due to onsite borrow pit which can give rise to dust emissions however, lower traffic volumes arriving and departing site per day and reduced onsite traffic volumes therefore reducing dust and noxious emissions overall.
Climate	Potential for increased greenhouse gas emissions from quarry trucks	Potential for decrease in greenhouse gas emissions from quarry trucks if

Environmental Consideration	Sourcing all stone from local, off-site quarries	Use of onsite borrow pit along with offsite quarries
	due to an increased number of vehicular movements to and from the Site.	all stone was sourced onsite compared to delivery of stone to the Site.
Noise & Vibration	Increased potential for noise and vibration effects on local sensitive receptors along construction haul routes due to arrival and departure of heavy goods vehicles during the construction phase and reduced potential for noise and vibration effects on local sensitive receptors due to no breaking or crushing of materials won from onsite borrow pit.	Potential for increased noise and vibration effects on some residential receptors due to the extraction of bedrock from the borrow pit area. Mitigation measures presented in Chapter 12 of this EIAR will ensure that no significant effects occur.
Cultural Heritage	Slightly smaller development footprint would reduce the potential for impacts on unrecorded, subsurface archaeology.	Slightly larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.
Landscape & Visual	Potentially reduced landscape and visual effects temporarily as no open rock face would be visible from certain viewpoints during the construction phase.	Potential for increased landscape and visual effects temporarily due to open rock face which may be visible from certain viewpoints during the construction phase. However, excavated soil and subsoil will be used to reinstate the borrow pit area at the end of the construction phase.
Material Assets	Significantly higher HGV traffic volumes on the public road network during construction phase due to the volume of crushed stone required to be transported to the site and empty HGVs leaving the site. No material difference between the two options in potential for impact on waste management, telecoms, aviation, electricity, water or gas.	Reduced volume of HGVs traffic volumes on the public road network during construction as a considerable portion of materials will be won on site. Decreased potential for noise, dust and emissions due to the reduced volumes of HGV traffic on the roads. No material difference between the two options in potential for impact on waste management, telecoms, aviation, electricity, water or gas.
Major Accidents and Natural Disasters	No material difference between the two options.	No material difference between the two options.

3.2.5.4 Alternative Turbine Delivery Route

With regard to the selection of a transport or haul route to the Site, alternatives were considered in relation to ports of entry, turbine components, general construction-related traffic, and site access locations.

3.2.5.4.1 *Alternative Ports of Entry*

The ports considered for the port of entry of wind turbine components into Ireland for the Proposed Wind Farm include Belview Port, County Waterford, Dublin Port, Shannon-Foynes Port, County Limerick, Cork and the Port of Galway. All of the aforementioned ports have been used for the importing of turbine components. As stated, all ports mentioned above have a proven track record in the handling and subsequent transport of large turbine components. The final selection will be driven by commercial, availability and scheduling considerations. There are clear access routes for all five ports utilising the motorway network to the proposed haul route to the site.

3.2.5.4.2 *Alternative Component Delivery Route*

The alternative delivery route considered the Shannon-Foynes Port and would approach the Proposed Wind Farm site via the M7 to the northwest. The Proposed Wind Farm site is located approximately 24.8km southeast of the M7/R435 junction (Junction 21, Borris in Ossory). From the Junction 21, this delivery route is approximately 32.1km in length.

The alternative delivery route considered removing the barriers and crossing the M7 motorway, exiting Junction 21 (Borris in Ossory) on the M7, then traveling approximately 9.2km southeast along the R435 regional road towards Rathdowney town, Co. Laois. The vehicles would join the R433 regional road in Rathdowney town and travel approximately 1km east through the villages of Donaghmore toward the centre of Rathdowney town. The vehicles will join the R435 regional road and travel approximately 13km south towards Johnstown, Co. Kilkenny. The vehicles will travel east through Johnstown before turning south and travelling approximately 3.9km to join the R693 regional road in the townland of Balief Upper, Co. Kilkenny. The vehicles will join the R693 regional road and travel for approximately 5km to the proposed site entrance, turning north into the Proposed Wind Farm site in the townland of Barna, Co. Kilkenny. The total length of the alternative route is 32.1 km. Please refer to Figure 3-5 to see the alternative turbine delivery route for the Proposed Project.

After review by the Traffic Consultant and subsequent autotrack assessment, it was concluded that this route would require substantial accommodating works along the route at 14 no. locations to facilitate the delivery of abnormal loads to the Site. The alternative route would therefore require a larger amount of accommodation works and robust Traffic Management Plan facilitate component deliveries along regional roads to the Site.

Therefore, the optimal delivery route is considered as the one that utilises the M8/ R639 junction (Junction 7) which has been subject to autotrack assessment and shows that limited accommodation works are required along the delivery route itself.

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

The delivery of turbine components including blades, tower sections and nacelles is a specialist operation owing to the oversized loads involved. As detailed in Section 15.1 of this EIAR, turbine blades will be delivered to site using a Super Wing Carrier. When considering turbines transport routes, alternative modes of transport were also considered. Depending on the selected turbine delivery route and the turbine manufacturer, a blade adapter or blade transporter may also be used, if deemed appropriate, for delivery of turbines to the Proposed Wind Farm site.

It should be noted that all component deliveries (abnormal loads) will be undertaken as described in the Traffic Management Plan which will be submitted and agreed with the local authorities and roads authorities upon consent of this application. All component deliveries will be subject to garda escort. All manoeuvres around junctions and into site entrances will be supervised by a qualified team of turbine delivery experts. The abnormal load entrance will be temporary in nature, over a short period of the construction phase only. The abnormal load entrance will be reinstated after all abnormal loads have been delivered to site. However, should replacement components be required, this entrance will be temporarily reopened to facilitate such works. Please see Section 15.1 Material Assets- Traffic and Transport for further details.

County Offaly

M7 Junction 21

Donaghmore

Rathdowney

County Laois

County Tipperary

Johnstown

Urlingford

County Kilkenny

Kilkenny

M8 Junction 7

Map Legend

- EIAR Site Boundary
- Proposed Site Entrance
- Proposed Turbine Delivery Route
- Alternative Turbine Delivery Route
- County Boundary

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Drawing Title: Alternative Turbine Delivery Route

Project Title: Killoshulan Wind Farm

Drawn By	Checked By
ER	EMC
Project No.	Drawing No.
260172	Figure 3-5
Scale	Date
1:160,000	2026-10-28

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3.2.5.5 Alternative Design of Ancillary Structures

The ancillary structures required for the Proposed Project include temporary construction compounds, underground electrical cabling and an on-site meteorological mast.

3.2.5.5.1 *Temporary Construction Compounds*

The temporary construction compounds will be used for the storage of all construction materials, plant and turbine components. The temporary construction compounds are interspersed at 2 no. separate locations throughout the Proposed Wind Farm and are accessed via the internal site roads that will be constructed. The use of 2 no. temporary construction compounds was deemed preferable to the alternative of a single large compound in the centre of the Proposed Wind Farm for a number of reasons. Principally, it will facilitate more efficient construction practices and will result in shorter distances for traffic movements within the Proposed Wind Farm during construction. As a result, vehicle emissions and the potential for dust arisings will be reduced by making use of 2 no. construction compounds rather than one larger construction compound.

3.2.5.5.2 *Alternative Internal Site Cabling Route*

The internal 33kV site cabling will follow the internal road network throughout the Proposed Wind Farm site, connecting all 10 no. turbines to the Proposed 110kV Substation. While this means that a longer cable route will be needed, it was considered the more environmentally prudent option. The alternative to this would be to lay the cables 'as the crow flies' between the turbines and the Proposed 110kV Substation, however, this would lead to a greater environmental disturbance and a greater volume of spoil created.

3.2.5.5.3 *Alternative Meteorological Mast Location*

The meteorological mast is located in the northwest of the Proposed Wind Farm site, adjacent to an area of new road. A proposed new road will be used to access the proposed met mast location. The proposed met mast is located in forestry. The proposed met mast location was also constraints and facilitators led in its design, where an appropriate setback distance from the proposed turbines was incorporated during the design process.

While other locations to situate the proposed met mast within the Proposed Wind Farm site were examined, the above location was deemed to be most suitable due to its proximity to existing roadways and the low ecological value of the habitat.

3.2.5.6 Alternative Grid Connection Cabling Route Options

3.2.5.6.1 *Alternative Substation Location*

The Proposed 110kV Substation is located in the north of the Proposed Wind Farm site and is sited within an agricultural grassland field. This grassland is of low ecological value. Given its location relative to the proposed turbines, the Proposed 110kV Substation is in a suitable position for the collection of the internal electrical cabling from the turbines. The Proposed 110kV Substation is located an appropriate distance from the nearest proposed turbine (twice the 185m Tip Height)[5] and is located close to the public road network along which the Proposed 110kV Underground Cabling will run for approximately 12.6km.

[5] https://www.eirgrid.ie/sites/default/files/publications/6-110-220-400-kV-Substation-General-Requirements.pdf

This location was deemed to be suitable due to the habitats it is located on, its position within the overall Proposed Wind Farm site and relative to the public road network.

3.2.5.6.2 *Proposed Substation Alternatives*

The location of the Proposed 110kV Substation was reviewed after identifying the most appropriate Proposed 110kV Underground Cabling route. The following section outlines the methodology in relation to the siting of the Proposed 110kV Substation.

Proposed 110kV Substation

The footprint of the Proposed 110kV Substation compound measures approximately 23,665 m^2 in area and will include 2 no. control buildings and the electrical substation components necessary to consolidate the electrical energy generated by each wind turbine and export that electricity from the Proposed 110kV Substation to the national grid.

Site Selection

Following determination of the Proposed 110kV Underground Cabling route (see Section 3.2.5.6.3 below), potential locations for the Proposed 110kV Substation were considered, having regard to landscape and visual sensitivity, proximity to residential receptors, and review of all potential environmental constraints.

Of the locations considered, the northern portion of the Proposed Wind Farm was identified as the most suitable location for the Proposed 110kV Substation.

Constraints

The siting of the Proposed 110kV Substation infrastructure was determined through the application of known environmental constraints, informed by detailed ecological, ornithological, and landscape and visual surveys, together with the Proposed 110kV Underground Cabling route feasibility assessment described above.

The Proposed 110kV Substation is sited within agricultural fields currently in use as grazing pasture. This is considered to be a working agricultural landscape that has been extensively modified through agricultural activity, is not subject to any landscape designation, and is not considered to be of particular scenic or aesthetic value. A small number of residential properties are located to the north of the Proposed 110kV Substation.

It was determined that the location of the Proposed 110kV Substation will achieve appropriate separation distances from sensitive receptors while remaining suitably positioned to connect the Proposed Wind Farm to the national grid.

It is noted that, while the operational lifespan of the Proposed Wind Farm is expected to be 35 years (following which the Proposed Turbines may be repowered or decommissioned), the Proposed 110kV Substation, the Proposed 110kV Underground Cabling route and all the associated transmission infrastructure i.e. underground cables, etc will form part of the national grid infrastructure.

3.2.5.6.3 *Alternative Grid Connection Cabling Route Options*

The Proposed Wind Farm will connect to the national grid via underground electrical cabling, located primarily within the public road corridor, with some small sections passing through private agricultural land. Underground electrical cables will transmit the power output from each wind turbine to the Proposed 110kV Substation, and from there to the existing Ballyragget 110kV substation, via an underground electrical cabling route, measuring approximately 12.6km in length.

A key consideration in determining the grid connection method for a proposed wind energy development is whether the cabling is underground or run as an overhead line (OHL). An alternative to the approximately 12.6km Proposed 110kV Underground Cabling would be to construct an OHL from the Proposed 110kV Substation to the existing 110kV Ballyragget substation following a similar route to that of the Proposed 110kV underground cabling route. While OHL are less expensive and allow for easier repairs when required, underground cabling will have no visual impact. For this reason, it was considered that underground cabling would be a preferable alternative to overhead lines. The Guidelines (DoEHLG, 2006) also indicate that underground cables are the preferred option for connection of a wind energy development to the national grid. The Proposed 110kV underground cabling will follow the route of existing public road insofar as possible in order to minimise the amount of ground disturbance required.

An entirely off-road grid connection route alternative was considered at an early stage of the design process, however, this was discounted due to requirement to construct significant lengths of access and maintenance tracks to access joint bays along the route, increasing the potential for environmental effects compared to a route that predominantly follows existing roads. In addition, the requirement for a significant number of landowner agreements along the length of the route would have significantly increased the time required to confirm the final proposed, design of the Proposed Project and driven up the overall costs associated with the project.

Existing substations located within 20km of the Proposed Wind Farm site were considered, 3 no. existing electricity substation were assessed for the Proposed Wind Farm to connect to the national grid, the electricity substations included:

- Ballyragget 110kV Substation
- Thurles 110kV Substation
- Tirlán facility 38kV Substation

The Proposed 110kV Underground Cabling to Ballyragget 110kV substation has been revised and refined to take account of the findings of the site investigations and baseline assessments, which have informed the Proposed Grid Connection design as presented in Figure 3-6. The alternative options considered are shown Figures 3-7 to Figure 3-10.

Grid Connection Option A to Thurles 110kV Substation

Grid Connection Option A, utilising the maximum length of the primary road network, as presented in Figure 3-6 below, is an underground grid connection cabling route, connecting the Proposed 110kV Substation to the existing Thurles 110kV substation in the townland of Ballygammane, Co. Tipperary. The grid connection cabling route utilises the local and regional road network. The cabling route measures approximately 27.2km in length. Of the cable route that is located within the public road network, 73% (19.8km) is located in the local road network and 27% (7.4km) is located within the regional road network. The option was disregarded from further consideration due to the length of the route.

County Laois

County Tipperary

County Kilkenny

Map Legend

- EIAR Site Boundary
- 110kV Onsite Substation Location
- Thurles 110kV Substation
- Potential Grid Route - Option A
- County Boundaries

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Drawing Title
Proposed Grid Connection - Option A

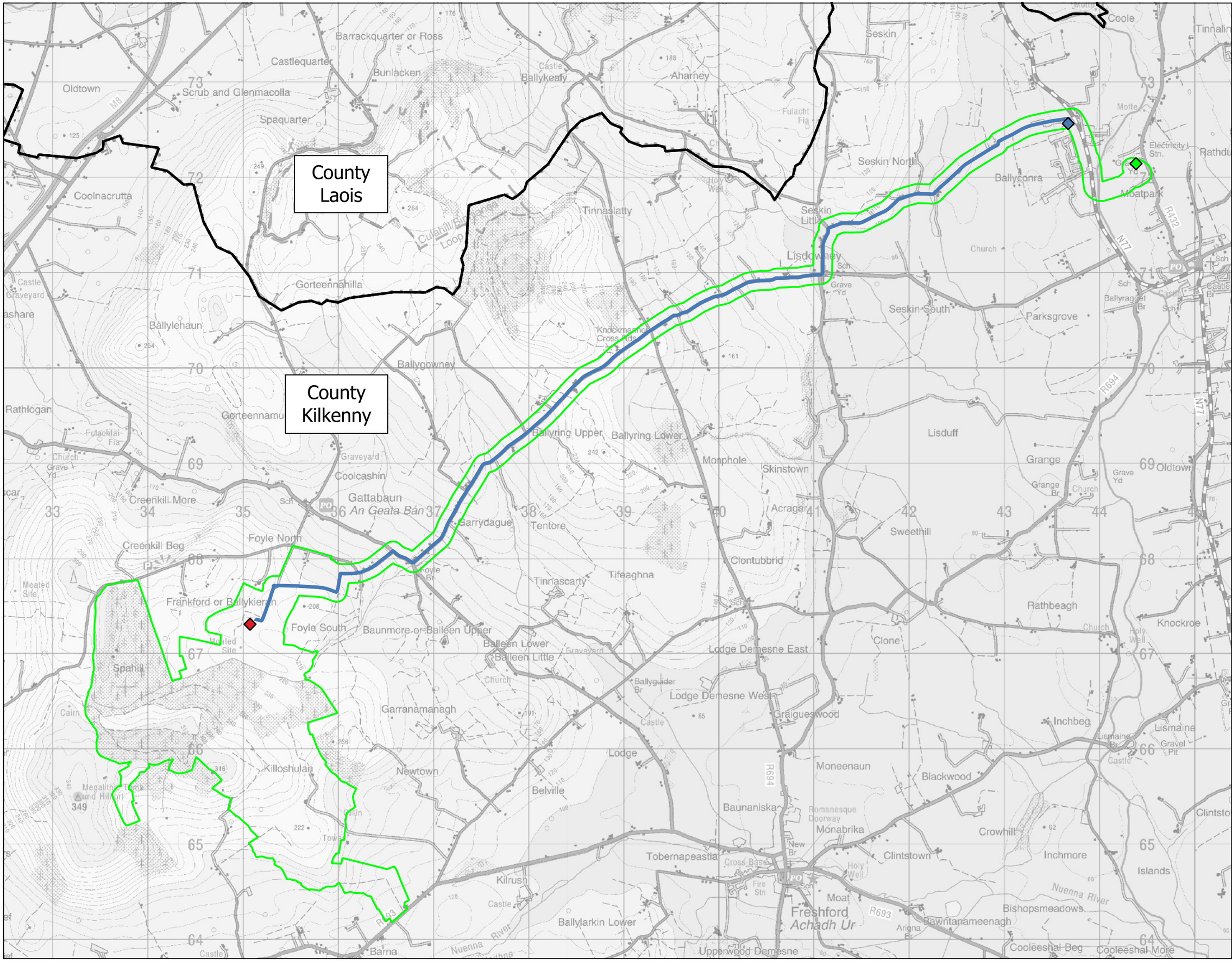
Project Title
Killoshulan Wind Farm

Drawn By	Checked By
ER	EMC
Project No.	Drawing No.
260172	Figure 3-6
Scale	Date
1:60,000	2026-10-15

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Grid Connection Option B to Tirlán facility 38kV Substation

Grid Connection Option B, as presented in Figure 3-7 below, is an underground grid connection cabling route, connecting the Proposed 110kV Substation to the existing Tirlán 38kV substation in the townland of Ballyconra, Co. Kilkenny. The Tirlán 38kV substation is approximately 10 kilometres (km) to the northeast of the Proposed Wind Farm site. The grid connection cabling route utilises the local road network. The cabling route measures approximately 11.1km in length. The Proposed Wind Farm will have an estimated installed capacity of approximately 62 MW, the initial grid capacity undertaken by the applicant confirmed that the Tirlán 38kV Substation does not have the available capacity to accommodate the electricity generated by the Proposed Wind Farm, nor it is likely to have in the future, that would allow the Proposed Wind Farm to export its maximum electricity output to the national grid.



Map Legend

- EIAR Site Boundary
- 110kV Onsite Substation Location
- Tirlan 38kV Substation
- Ballyragget 110kV Substation
- Potential Grid Route - Option B
- County Boundary

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Drawing Title: Proposed Grid Connection - Option B

Project Title: Killoshulan Wind Farm

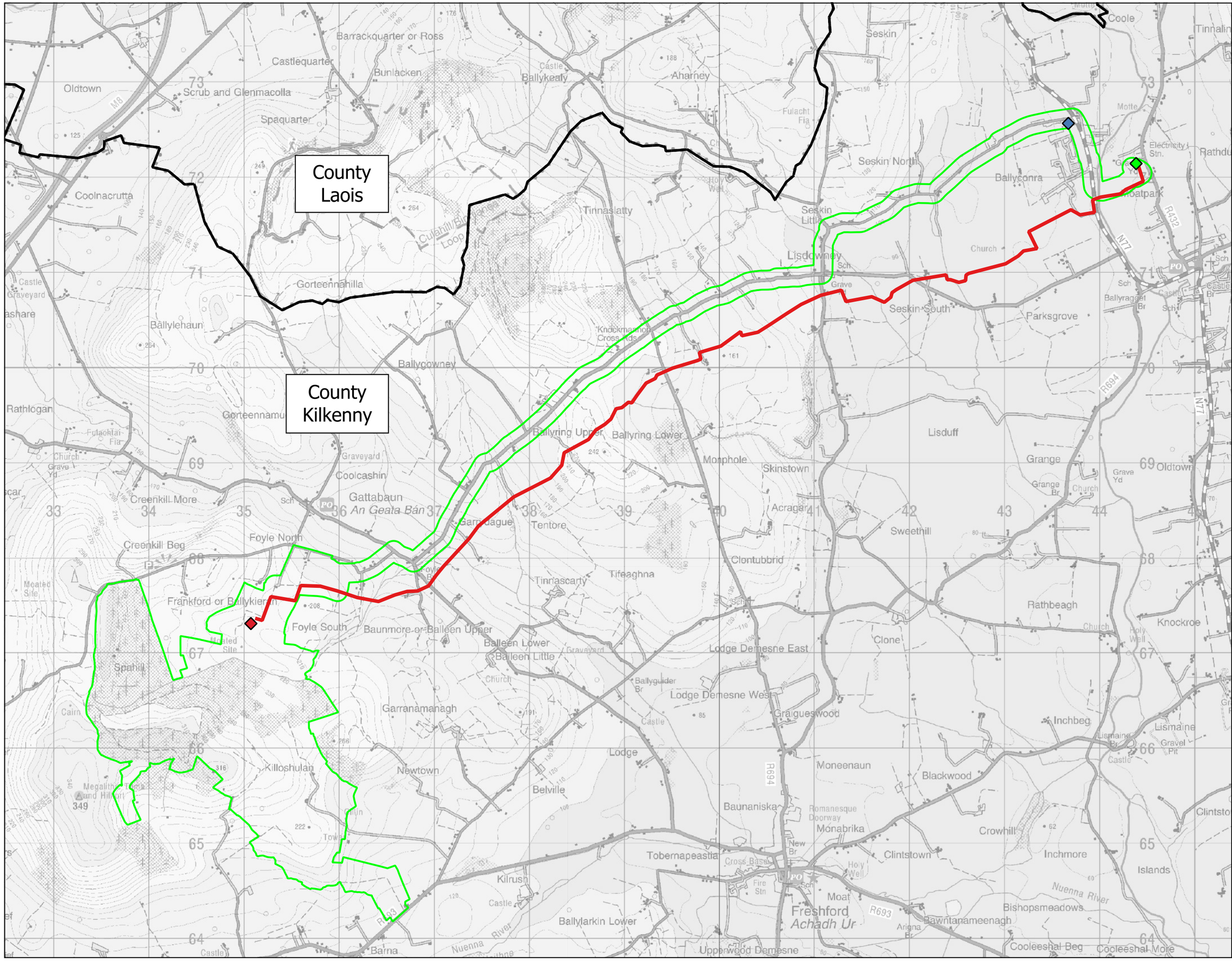
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Project No.	Drawing No.
260172	Figure 3-7
Scale	Date
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Grid Connection Option C to Off-Road Connection Route – Either Underground or Overhead

Grid Connection Option C, as presented in Figure 3-8 below, is either an OHL or an underground grid connection cabling route, connecting the Proposed 110kV Substation to the existing Ballyragget 110kV substation. As mentioned above the Tirlán 38kV substation does not have the connection capacity, nor it is likely to have in the future, that would allow the Proposed Project to export its maximum electricity output to the national grid. It was therefore not the chosen option for connection to the national grid. The existing Ballyragget 110kV substation in the townland of Moatpark, Co. Kilkenny has the capacity to allow the Proposed Project to export its maximum electricity output to the national grid. The Ballyragget substation is 10.3km to the northeast of the Proposed 110kV Substation. Option C is an entirely off-road grid connection route to Ballyragget. The cable route is approximately 12.1km in length running through private agricultural lands. Over 44 no. landholdings would be crossed requiring individual agreements to be entered into with each landowner. Statutory Undertakers, such as ESB or EirGrid, would normally negotiate with the landowners but would employ their compulsory purchase powers, as a Statutory Undertaker in cases where it was unable to reach agreements. Private developers do not have such powers, making cross-country routes impossible.

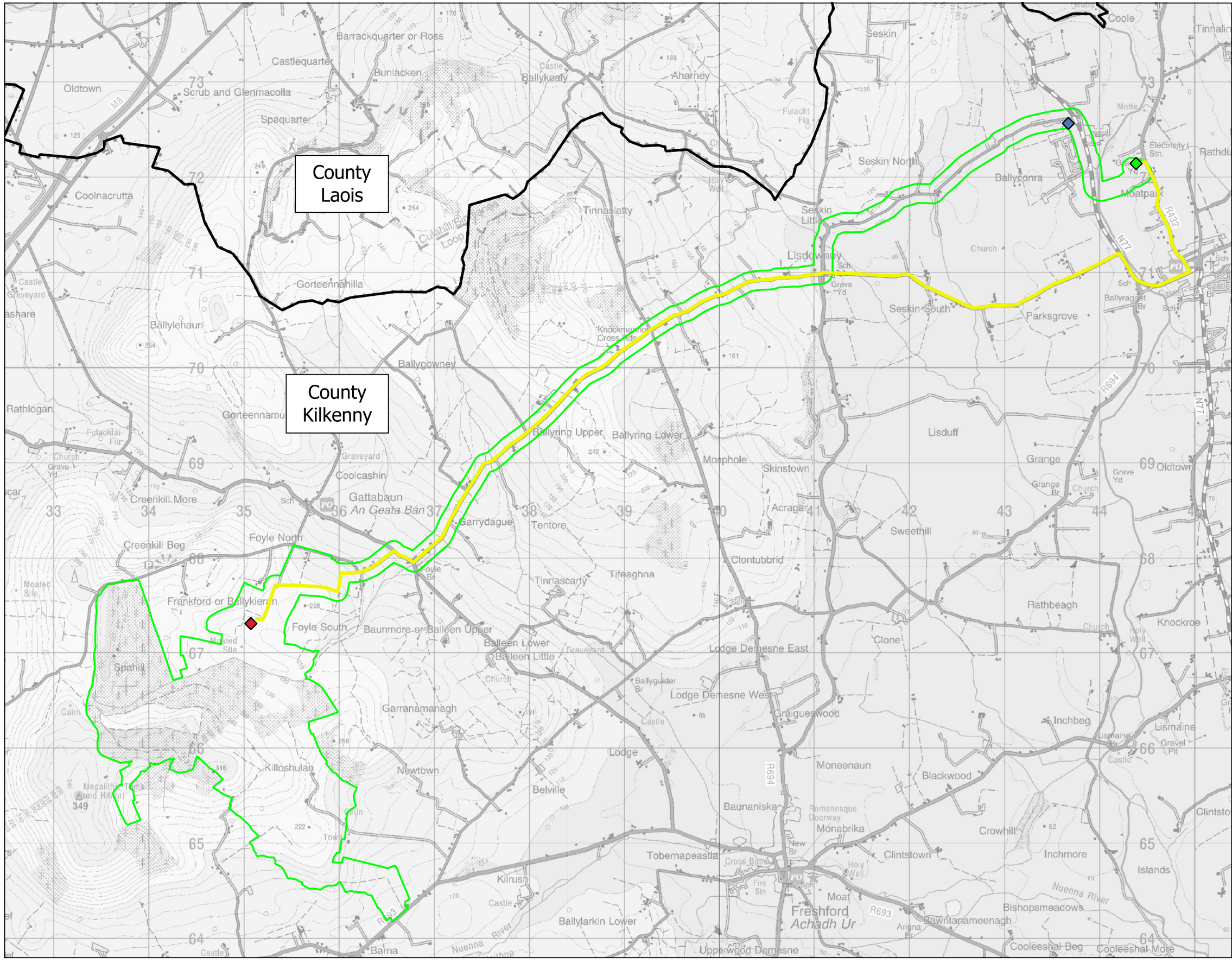
The Draft 2019 Guidelines (DoHPLG, 2019) also indicate that underground cables along the public road corridor are the preferred option for connection of a wind energy development to the national grid.


County Laois
County Kilkenny
Barrackquarter or Ross
Castlequarter
Bunlacken
Ballykealy
Aharney
Seskin
Coole
Tinnalin
Oldtown
Scrub and Glenmacolla
Spaquarter
Motte
Seskin North
Ballyconra
Electricity Stn.
Coolnacrutta
Tinnaslatty
Seskin Little
Boatpark
R432
N77
Church
Lisdowney
Gorteennahilla
Seskin South
Parksgrove
Ballylehaun
Knockmannon Cross Rds
Ballycowney
Rathlogan
Gorteennamu
Ballyring Upper
Ballyring Lower
Lisduff
R694
Monphole
Skinstown
Grange
Coolcashin
Creenkill More
Gattabaun
An Geata Bán
Garrdague
Tentore
Acragar
Sweethill
Creenkill Beg
Foyle North
Clontubbrid
Tifeaghna
Tinnascarty
Rathbeagh
Knockroe
Frankford or Ballykieran
Foyle South
Baunmore or Balleen Upper
Balleen Lower
Balleen Little
Lodge Demesne East
Clone
Spahill
Garranamanagh
Ballyguider Br
Lodge Demesne West
Graigueswood
Inchbeg
Lismaine
Gravel Pit
Killoshulan
Newtown
Lodge
Belville
Moneenaun
Blackwood
Megalithic Tomb and Historic
Baunaniska
Romanesque Doorway
Monabrika
Crowhill
Tobernapeastia
Cross Base
New Br
Clintstown
Inchmore
Islands
Kilrush
Fire Stn
Moat
Freshford
Achadh Úr
R693
Bawntanameenagh
Bishopsmeadows
Ballylarkin Lower
Nuenna River
Upperwood Demesne
Cooleeshal Beg
Cooleeshal More
Barna
Map Legend
EIAR Site Boundary
110kV Onsite Substation Location
Tirlan 38kV Substation
Ballyragget 110kV Substation
Potential Grid Route - Option C
County Boundary
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Proposed Grid Connection - Option C
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Grid Connection Option D to Ballyragget 110kV Substation

Grid Connection Option D, as presented in Figure 3-9 below, is an underground grid connection cabling route, connecting the Proposed 110kV Substation to the existing Ballyragget 110kV substation in the townland of Moatpark, Co. Kilkenny. The Ballyragget substation is approximately 10.3 kilometres (km) to the northeast of the Proposed 110kV Substation. The grid connection cabling route utilises the local and national secondary road network and off-road private lands. The cabling route is approximately 13.3km in length. Of the cable route within the public road network, 71% (10.8km) is located within the local road network, 10% (1.3km) is located within the R432 Regional Road and 11% (1.5km) is located within the N77 National Secondary Road. The remaining 7% (1km) is located in private lands.

This option was not the preferred option due to the longer extent of this route, the greater potential for effects on local road users, residents within the town of Ballyragget and the technical difficulties relating to crossing the bridge over the River Nore on the N77.



Drawing Title
Proposed Grid Connection - Option D

Project Title
Killoshulan Wind Farm

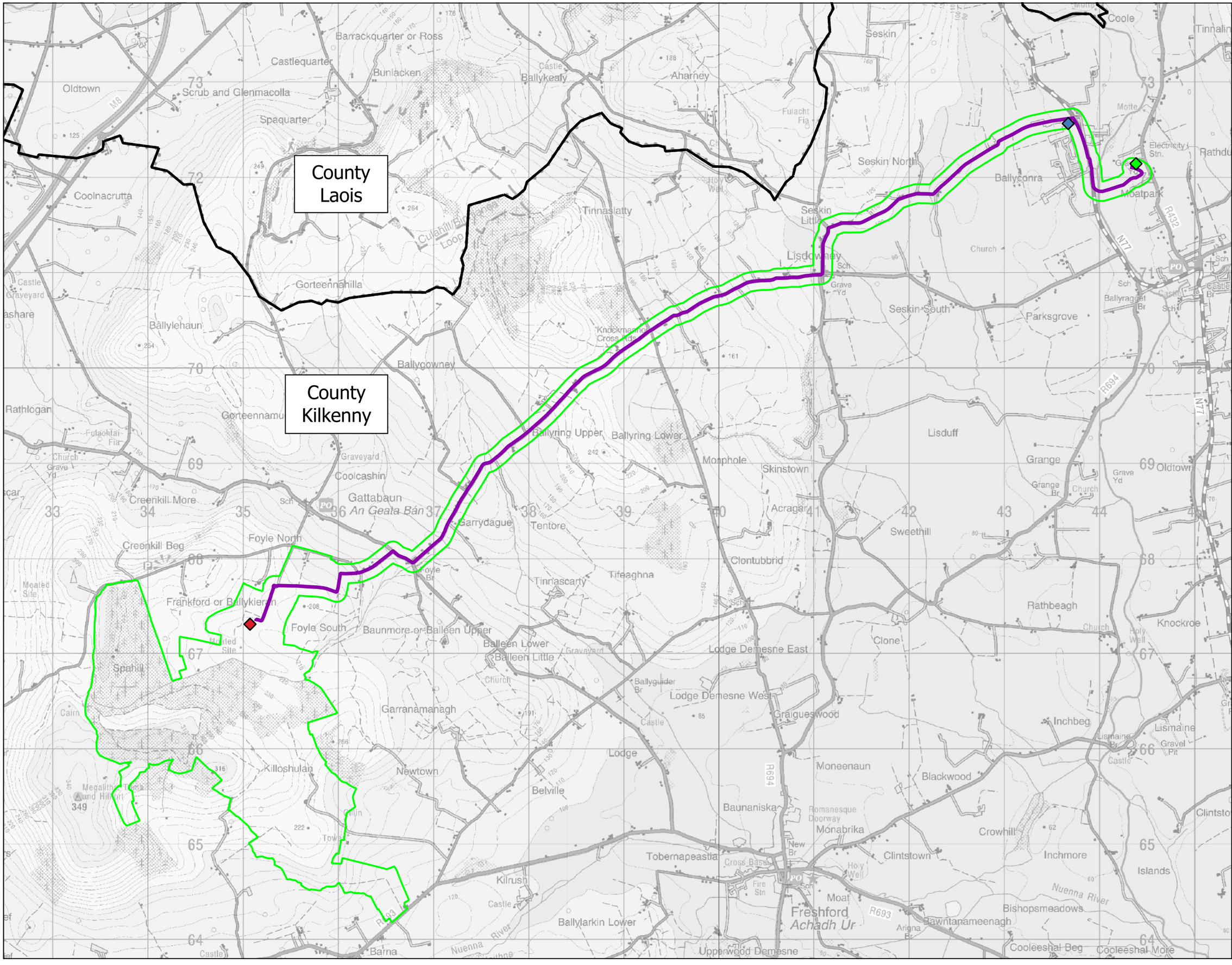
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Project No.	Drawing No.
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Scale	Date
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Grid Connection Option E– Chosen Grid Connection

Grid Connection Option E, as presented in Figure 3-10 below, is an underground grid connection cabling route, connecting the Proposed 110kV Substation to the existing Ballyragget 110kV substation. Option E is a grid cabling route that utilises the local road network and off-road private lands. The cabling route is 12.6km in length. Of the cable route within the public road network, 76% (9.6km) is located within the local road network and 6% (0.8km) is located along the corridor of the N77 National Secondary Road. The remaining 18% (2.2km) is located in private lands.

As part of the detailed design process, every effort has been made to locate the grid connection cabling trench off the existing road carriageway and within the hard shoulder or soft margin/grass verges. The exact location of the grid connection cabling within the curtilage of the public road network may be subject minor modification following confirmatory site investigations, to be undertaken prior to construction of the proposed wind farm development as part of the Road Opening Licence process. However, it is acknowledged that detailed surveys will be required to ground-truth the information provided by the service providers mentioned above and to identify any other existing services such and underground gas, telecommunications and private water supply. It is considered that Option E is a good balance in terms of optimum grid length and secondary roads and limiting the use of national secondary road.



Drawing Title
Proposed Grid Connection - Option E

Project Title
Killoshulan Wind Farm

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Project No.	Drawing No.
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Environmental Consideration	Option A – Thurles 110kV Substation (27.2km)	Option B – Tirlán 38kV Substation (11.1km)	Option C – Ballyragget 110kV Substation. Off-Road Connection Route – Either Underground or OHL (12.1km)	Option D - Ballyragget 110kV Substation (13.3km)	Option E – Chosen Grid Connection (12.6km)
Population & Human Health	Potential for temporary visual impact over a longer construction phase considering the longer route, from presence of plant machinery onsite during the construction period. Greater potential for temporary noise and dust impacts for a longer construction phase considering the longer route, from plant machinery onsite during construction phase. This route passes by a greater number of sensitive receptors compared to Option E given that it runs through the town of Johnstown, Co. Kilkenny.	Potential for temporary visual impact but over a shorter construction phase considering the shorter route, from presence of plant machinery onsite during the construction period. Potential for temporary noise and dust impacts but over a shorter construction phase considering the shorter route, from plant machinery onsite during construction phase compared to Option E.	Potential for temporary visual impact over a longer construction phase considering the longer route, from presence of plant machinery onsite during the construction period. Potential for a permanent visual impact if an OHL option was proposed Potential for temporary noise and dust impacts but over a shorter construction phase considering the shorter route, from plant machinery onsite during construction phase compared to Option E.	Potential for temporary visual impact over a longer construction phase considering the longer route, from presence of plant machinery onsite during the construction period. Greater potential for temporary noise and dust impacts for a longer construction phase considering the longer route, from plant machinery onsite during construction phase. This route passes by a greater number of sensitive receptors compared to Option E given that it runs through the town of Ballyragget, Co. Kilkenny.	Potential for temporary visual impact for a longer construction phase considering the longer route, from presence of plant machinery onsite during the construction period. Potential for temporary noise and dust impacts for a longer construction phase considering the longer route, from plant machinery onsite during construction phase.
Biodiversity (including Birds)	Low potential for impact on sensitive ecological receptors during the construction phase. The	Low potential for impact on sensitive ecological receptors during the construction	High potential for impact on sensitive ecological receptors during the construction	Low potential for impact on sensitive ecological receptors during the construction phase. As	Low potential for impact on sensitive ecological receptors during the construction

Environmental Consideration	Option A – Thurles 110kV Substation (27.2km)	Option B – Tirlán 38kV Substation (11.1km)	Option C – Ballyragget 110kV Substation. Off-Road Connection Route – Either Underground or OHL (12.1km)	Option D - Ballyragget 110kV Substation (13.3km)	Option E – Chosen Grid Connection (12.6km)
	Proposed Grid Connection underground cabling route doesn't pass through any designated sites. No instream works are proposed as part of the crossing methodology along this route so no adverse impacts on any designated site are anticipated.	phase. The Proposed Grid Connection underground cabling route doesn't pass through any designated sites. No instream works are proposed as part of the crossing methodology along this route so no adverse impacts on any designated site are anticipated.	phase due to proposed underground cabling route option crossing private lands. As detailed in Chapter 6, the Proposed Grid Connection underground cabling route passes through 1 no. mapped SAC (River Barrow and River Nore SAC) and 1 no. mapped SPA (River Nore SPA) in the townland of Ballyconra, Co. Kilkenny. However, no instream works are proposed as part of the crossing methodology for the SAC or SPA. Therefore, as detailed in Chapter 6 no adverse impacts on the SAC or SPA are anticipated	detailed in Chapter 6, the Proposed Grid Connection underground cabling route passes through 1 no. mapped SAC (River Barrow and River Nore SAC) and 1 no. mapped SPA (River Nore SPA) in the townland of Ballyconra, Co. Kilkenny. However, no instream works are proposed as part of the crossing methodology for the SAC or SPA. Therefore, as detailed in the Chapter 6 no adverse impacts on the SAC or SPA are anticipated	phase. As detailed in Chapter 6, the Proposed Grid Connection underground cabling route passes through 1 no. mapped SAC (River Barrow and River Nore SAC) and 1 no. mapped SPA (River Nore SPA) in the townland of Ballyconra, Co. Kilkenny. However, no instream works are proposed as part of the crossing methodology for the SAC or SPA. Therefore, as detailed in the Chapter 6 no adverse impacts on the SAC or SPA are anticipated
Land, Soils, & Geology	Greater volume of earthworks required due	Lowest volume of earthworks required	Greatest volume of earthworks required as	Greater volume of earthworks required due to	Greater volume of earthworks required

Environmental Consideration	Option A – Thurles 110kV Substation (27.2km)	Option B – Tirlán 38kV Substation (11.1km)	Option C – Ballyragget 110kV Substation. Off-Road Connection Route – Either Underground or OHL (12.1km)	Option D - Ballyragget 110kV Substation (13.3km)	Option E – Chosen Grid Connection (12.6km)
	to longer route as compared to Option E. This underground cabling route option is proposed to be located primarily within the public road corridor, with an approximately 1.5km stretch passing through private agricultural land before connecting with the Thurles 110kV substation	due to shorter route as compared to Option E. The Proposed Grid Connection underground cabling route will be primarily located within the public road corridor, with approximately 1.5km passing through private agricultural land.	compared to Option E for offroad route. The proposed underground cabling route option crosses private lands and construction of access tracks will required, before connecting with the Ballyragget 110kV substation	longer route as compared to Option E. This underground cabling route option is proposed to be located primarily within the public road corridor, with an approximately 1.5km stretch passing through private agricultural land before connecting with the Ballyragget 110kV substation	due to longer route. This underground cabling route option is proposed to be located primarily within the public road corridor, with an approximately 2.2km stretch passing through private agricultural land before connecting with the Ballyragget 110kV substation
Water	Option A has 6 no. EPA mapped watercourse crossing. There are no instream works proposed as part of the crossing methodologies for the watercourse crossing.	Option B has 4 no. EPA mapped watercourse crossing. There are no instream works proposed as part of the crossing methodologies for the watercourse crossing.	Option C has 7 no. EPA mapped watercourse crossing. There are no instream works proposed as part of the crossing methodologies for the watercourse crossing.	Option D has 5 no. EPA mapped watercourse crossing. There are no instream works proposed as part of the crossing methodologies for the watercourse crossing.	Option E has 5 no. EPA mapped watercourse crossing. There are no instream works proposed as part of the crossing methodologies for the watercourse crossing.
Air Quality	This option would result in increased potential for effects from dust, and vehicle emissions during construction given the longer route	This option would result in reduced potential for effects from dust, and vehicle emissions during	This option would result in increased , potential for effects from dust, and vehicle emissions during construction given the	This option would result in increased potential for effects from dust, and vehicle emissions during construction given the longer route	As a result of the longer route, this option has a greater potential for effects from dust, and vehicle emissions during

Environmental Consideration	Option A – Thurles 110kV Substation (27.2km)	Option B – Tirlán 38kV Substation (11.1km)	Option C – Ballyragget 110kV Substation. Off-Road Connection Route – Either Underground or OHL (12.1km)	Option D - Ballyragget 110kV Substation (13.3km)	Option E – Chosen Grid Connection (12.6km)
		construction compared to Option E.	route is entirely off the public road. Reduced potential for effects from dust and vehicle emissions with OHL option.		construction given the longer route
Climate	This option would result in increased vehicle emissions during construction given that it is the longest route	This option would result in reduced vehicle emissions, compared to the other options during construction given the reduced length	This option would result in increased vehicle emissions during construction given it's off road route. Reduced potential for effects from dust and vehicle emissions with OHL option.	This option would result in increased vehicle emissions during construction given the longer route	This option would result in increased vehicle emissions during construction given the longer route
Noise & Vibration	Given the maximum potential length of Option A is 27.2km and is approximately 14.6km longer than Option E, there is potential for greater noise impacts associated with Option A This option does pass through the town of Johnstown, Co. Kilkenny	Given the maximum potential length of Option B is 11.1km and is approximately 1.5 km shorter than Option E, there is potential for reduced noise impacts associated with Option B This option will pass through no village or	Given the maximum potential length of Option C is 12.1km and is approximately 0.5 km shorter than Option E, there is potential for reduced noise impacts associated with Option C	Given the maximum potential length of Option D is 13.3km and is approximately 0.7km longer than Option E, there is potential for greater noise impacts associated with Option D However, this option does pass through the town of Ballyragget, Co. Kilkenny	Given the maximum length of Option E is 12.6km, there is potential for greater noise impacts than Options B and C and reduced potential for noise impacts than Options A and D. However, this option will pass through no

Environmental Consideration	Option A – Thurles 110kV Substation (27.2km)	Option B – Tirlán 38kV Substation (11.1km)	Option C – Ballyragget 110kV Substation. Off-Road Connection Route – Either Underground or OHL (12.1km)	Option D - Ballyragget 110kV Substation (13.3km)	Option E – Chosen Grid Connection (12.6km)
	therefore would potentially impact a greater number of sensitive receptors when compared to Option E.	settlement and therefore would impact on fewer sensitive receptors when compared to Option E	However, this option is travelling off road for a longer length than Option E and therefore would potentially impact a lower number of sensitive receptors when compared to Option E.	and therefore would potentially impact a greater number of sensitive receptors when compared to Option E.	village or settlement and therefore would impact on fewer sensitive receptors
Landscape and Visual	Neutral – once constructed, there is no material difference of environmental effect between all options considered.	Neutral – once constructed, there is no material difference of environmental effect between all options considered.	Neutral for underground option – once constructed, there is no material difference of environmental effect between all options considered. Potential permanent negative visual effect on surrounding area from OHLs	Neutral – once constructed, there is no material difference of environmental effect between all options considered.	Neutral – once constructed, there is no material difference of environmental effect between all options considered.
Archaeological, Architectural & Cultural Heritage	Low potential for impacts on unrecorded, sub-surface archaeology given that this option is located almost exclusively within existing roads.	Lower potential for impacts on unrecorded, sub-surface archaeology given that this option is located almost	Greater potential for impacts on unrecorded, sub-surface archaeology for underground grid connection given the length of this route that	Lower potential for impacts on unrecorded, sub-surface archaeology given that this option is located almost exclusively within existing roads.	Lower potential for impacts on unrecorded, sub-surface archaeology given that this option is located almost

Environmental Consideration	Option A – Thurles 110kV Substation (27.2km)	Option B – Tirlán 38kV Substation (11.1km)	Option C – Ballyragget 110kV Substation. Off-Road Connection Route – Either Underground or OHL (12.1km)	Option D - Ballyragget 110kV Substation (13.3km)	Option E – Chosen Grid Connection (12.6km)
		exclusively within existing roads.	passes through agricultural land. Lower potential for impacts on unrecorded, sub-surface archaeology given that the OHL option has a smaller development footprint .		exclusively within existing roads.
Material Assets - Traffic	Given the maximum potential length of Option A is 27.2km and is approximately 14.6km longer than Option E, there is potential for greater impact on road infrastructure due to narrow road carriage ways and associated road closure requirements. Greater potential for traffic impacts given that this option passes through the town of Johnstown, Co. Kilkenny. Road closures are proposed during the construction of	Given the maximum potential length of Option B is 11.1km and is approximately 1.5 km shorter than Option E, there is potential for reduced impact on road infrastructure due to narrow road carriage ways and associated road closure requirements.	Reduced potential for impact on road infrastructure due to off-road route	Given the maximum potential length of Option D is 13.3km and is approximately 0.7km longer than Option E, there is potential for greater impact on road infrastructure due to narrow road carriage ways and associated road closure requirements. Greater potential for traffic impacts given that this option passes through the town of Ballyragget, Co. Kilkenny.	Given the maximum length of Option E is 12.6km, there is potential for greater impact on road infrastructure and traffic than Options B and C and reduced potential for noise impacts than Options A and D.

Environmental Consideration	Option A – Thurles 110kV Substation (27.2km)	Option B – Tirlán 38kV Substation (11.1km)	Option C – Ballyragget 110kV Substation. Off-Road Connection Route – Either Underground or OHL (12.1km)	Option D - Ballyragget 110kV Substation (13.3km)	Option E – Chosen Grid Connection (12.6km)
Material Assets- Utilities, Waste Management, and Telecommunications	this grid connection route given the width of the Regional (R435 and R502) and the local road corridors. Therefore, it would result in traffic impacts Greater potential for impact on gas, water, given the longer length of the route No material difference between the options in potential for impact on telecommunications.	No material difference between the options in potential for impact on gas, water, or telecommunications.	No material difference between the options in potential for impact on water or telecommunications. Greater potential for impact on gas network as underground proposed route crosses gas line in the townland of Parksgrove, Co. Kilkenny.	No material difference between the options in potential for impact on water or telecommunications. Greater potential for impact on gas network as proposed route crosses gas line in the townland of Parksgrove, Co. Kilkenny	No material difference between the options in potential for impact on gas, water, or telecommunications.
Major Accidents and Natural Disasters	Required excavations for 27.2km of underground cabling could have a greater potential risk relating to major	Required excavations for 11.1km of underground cabling could have a lower potential risk relating to	Required excavations for 12.1 km of underground cabling could have a lower potential risk relating to	Required excavations for 13.3 km of underground cabling could have a greater potential risk relating to major accidents and natural	As detailed in Chapter 16 the risk of a major accident and/or disaster during the construction of the Proposed Project

Environmental Consideration	Option A – Thurles 110kV Substation (27.2km)	Option B – Tirlán 38kV Substation (11.1km)	Option C – Ballyragget 110kV Substation. Off-Road Connection Route – Either Underground or OHL (12.1km)	Option D - Ballyragget 110kV Substation (13.3km)	Option E – Chosen Grid Connection (12.6km)
	accidents and natural disasters for Option A due to increased land disturbance.	major accidents and natural disasters than Option E due to it being a shorter route.	major accidents and natural disasters than Option E due to it being a shorter route, .	disasters than Option E due to increased land disturbance.	is considered 'low'. The highest risk scenarios to the Proposed Project (i.e., contamination and fire/explosion) are considered to be unlikely to occur at any phase of the Proposed Project.

3.2.6 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 environmental constraints within the Site limits the potential for environmental effects. As noted above, the Proposed Project layout aims to avoid any environmentally sensitive areas. Where loss of habitat occurs in the Site, dedicated enhancement and mitigation have been proposed, the design of which has been refined through the constraints led iterative design process.

It is proposed to replant approximately 225m of new hedgerow within the Site in order to replace the hedgerow which is proposed to be removed in order to facilitate the Proposed Project. The replanting of hedgerow was deemed necessary in order to replace the habitat which is being lost, however additional bolstering measures have been put in place to ensure a net gain of biodiversity on the Site. It is proposed to bolster approximately 3.4km of existing hedgerow within the Site. These replanting and enhancement measures will have a long-term slight positive effect on biodiversity.

It is proposed to manage grasslands within the Proposed Wind Farm site to encourage increased biodiversity and potentially create the priority Annex I habitat Semi-natural dry grasslands and scrubland facies on calcareous substrates. Suitable areas of the Site have been identified for grassland management to the west of the Proposed Wind Farm site, adjacent to the Spahill and Clomantagh Hill SAC.

Further detail on this biodiversity enhancement can be found in Chapter 6 of this EIAR.

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.