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."*

For the purposes of this EIAR:

- The '**Proposed Wind Farm'** refers to the 9 no. turbines and supporting infrastructure which is the subject of this Section 37E application.
- The '**Proposed Grid Connection'** refers to the 110kV substation and supporting infrastructure which will be the subject of a separate Section 182A application.
- The '**Proposed Project'** comprises the Proposed Wind Farm and the Proposed Grid Connection, all of which are located within the EIAR Study Boundary (the '**Site**') and assessed together within this EIAR.

Please see section 1.1.1 of this EIAR for further details. A detailed description of the Proposed Project is provided in Chapter 4 of this EIAR.

This section of the EIAR contains a description of the reasonable alternatives that were studied by the developer, which are relevant to the Proposed Project and the Site and its specific characteristics, in terms of site location and other renewable energy technologies as well as design layout incorporating size and scale of the Proposed Project, connection to the national grid and transport route options to the Site. It provides an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects. The consideration of alternatives is an effective means of avoiding environmental impacts. As set out in the '*Guidelines on The Information to be Contained in Environmental Impact Assessment Reports' (Environmental Protection Agency, 2022),* the presentation and consideration of reasonable alternatives investigated is an important part of the overall EIA process.

Hierarchy

EIA is concerned with projects. The Environmental Protection Agency (EPA) guidelines state that in some instances neither the applicant nor the competent authority can be realistically expected to examine options that have already been previously determined by a higher authority, such as a national plan or regional programme for infrastructure.

Non-environmental Factors

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

Site-specific Issues

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

3.2 Consideration of Reasonable Alternatives

3.2.1 Methodology

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

- A description of the reasonable alternatives studied; and
- An indication of the main reasons for selecting the chosen option with regards to their environmental impacts.

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

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

The EPA Guidelines (EPA, 2022) state that "*It is generally sufficient to provide a broad description of each main alternative and the key issues associated with each, showing how environmental considerations were taken into account is deciding on the selected option. A detailed assessment (or 'mini-EIA') of each alternative is not required."*

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

- 'Do Nothing' Alternative;
- Alternative Site Locations;
- Alternative Renewable Energy Technologies;
- Alternative Proposed Wind Farm Design Options:
    - Alternative Turbine Number;
    - Alternative Turbine Layout;
    - Alternative Road Layout;
    - Alternative Construction Compound Option;
    - Alternative Borrow Pit Option;
    - Alternative Site Access Points;

- Alternative Turbine Component Delivery Option:
    - Alternative Ports of Entry;
    - Alternative Component Delivery Route;
- Alternative Proposed Grid Connection Design Option:
    - Alternative Substation Location;
    - Alternative National Grid Connection Point;
    - Alternative Grid Connection Option; and
- Alternative Mitigation Measures.

Each of these is addressed in the following sections. When considering a wind farm development, given the intrinsic link between layout and design, the two will be considered together in this chapter.

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

3.2.2 '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 Site would be to leave the Site as it is, with no changes made to the current land-use practices. Pastoral agriculture, small-scale private forestry and public road corridor (approx. 870m for the underground grid connection cable route) would continue. In doing so, the environmental effects in terms of emissions are likely to be neutral.

By implementing this 'Do-Nothing' alternative, however, the opportunity to capture a significant part of the country's renewable energy resource would be lost, as would the opportunity to contribute to meeting Government and EU targets for the production and consumption of electricity from renewable resources and the reduction of greenhouse gas emissions. The opportunity to generate local employment, local authority development contributions, rates and investment in the local area would also be lost. Furthermore, the opportunity to retore a segment of the Eastwood River by improving channel stability, instream habitat and establishing a natural wooded riparian buffer would be lost. Please see Appendix 6-4 Biodiversity Management and Enhancement Plan for details.

As such, on the basis of the positive environmental effects arising from the 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 site are presented in Table 3-1 below.

Table 3-1 Comparison of environmental effects when compared against the chosen option of developing a renewable energy project.

Environmental Consideration	'Do Nothing' Alternative	Chosen option of developing a renewable energy project
Population & Human Health	No increase in local employment and no long-term financial contributions towards the local community. No potential for impacts on residential amenity due to shadow flicker, noise and visual impacts. The opportunity to retore a segment of the Eastwood River by improving channel stability, instream habitat and establishing a natural wooded riparian buffer would be lost. Please see Appendix 6-4 for details. No potential for positive impacts on air quality and climate change targets. No potential to supply an estimated 47,000 homes with clean renewable electricity.	Approximately 100 jobs could be created during the construction, operation, and maintenance phases of the Proposed Project. Based on the assessment and mitigation proposals detailed in Chapter 5 Population & Human Health, there will be no significant effects related to shadow flicker during the operational phase. As detailed in Ch 12, residual effects from Noise and Vibration are predominantly not significant for the short-term construction and decommissioning phases. For the Operational Phase, the residual effects range from not significant to imperceptible on sensitive properties. As detailed in Chapter 14 Landscape & Visual, the residual effect will be significant for some sensitive properties within 1km where 1-3 turbines may appear as having a large vertical extent. However, the proposed turbine locations adhere to the recommended 500m set back distance in the 2006 WEDGs and also the 4 times tip height set-back distance (for non-involved Sensitive Properties) set out for visual amenity purposes, prescribed by the 2019 draft WEDGs. As detailed in the assessment in Chapter 10, the overall impact will be a Long-term Moderate Positive Impact on air quality.
Biodiversity & Ornithology	No habitat loss. No potential for collision risk for birds and bats In addition, the biodiversity net gain proposal detailed in the Biodiversity Enhancement Plan (Appendix 6-4) would not be realised.	As detailed in Chapter 6 Biodiversity, the development has been designed to avoid or mitigate impacts on biodiversity including bats and downstream aquatic receptors. The Proposed Project includes for a biodiversity net gain proposal providing a local boost to biodiversity and water quality. Please see Appendix 6-4 for details. 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/Stability	Neutral	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

Environmental Consideration	'Do Nothing' Alternative	Chosen option of developing a renewable energy project
		subsoil will be relocated within the Site. Geotechnical investigations followed by careful design will lead to no significant environmental impacts.
Hydrology and Hydrogeology	Neutral	Project design specific drainage design removes the potential for significant environmental effects.
Air Quality	Neutral. Will not provide the opportunity for an overall increase in air quality or reduction of greenhouse gasses.	As detailed in Chapter 10, there will be no significant effects on air quality during the construction, and decommissioning phases. There will be a Long-term Moderate Positive Impact on air quality during the operational phase.
Climate	No potential to assist in achieving the renewable energy targets set out in the Climate Action Plan 2023.	As detailed in the assessment in Chapter 11 Climate, over the proposed 30-year lifetime of the Proposed Wind Farm, 58,808 tonnes of carbon dioxide per annum will be displaced from traditional carbon-based electricity generation. Over the proposed 30-year lifetime of the development, therefore, 1,764,240 tonnes of carbon dioxide will be displaced from traditional carbon-based electricity generation. The addition of an estimated 63MW clean energy to the national grid will be a positive contribution to the States renewable energy targets set out in the Climate Action Plan 2023.
Noise & Vibration	No potential for noise and vibration impacts on nearby sensitive properties.	As detailed in Ch 12, residual effects from Noise and Vibration are predominantly not significant for the short-term construction and decommissioning phases. For the Operational Phase, the residual effects range from not significant to imperceptible on sensitive properties.
Cultural Heritage & Archaeology	No potential for impacts on unrecorded, subsurface archaeology.	As detailed in Chapter 13, 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 operation phase, there will be some slight to moderate residual indirect effects on monuments and protected structures. However, in reality the effect will be less severe since the ZTV model does not take natural screening and buildings into consideration which will alleviate if not remove the impact on setting altogether.
Landscape & Visual	No potential for landscape and visual impacts on nearby sensitive properties.	As detailed in the assessment in Chapter 14 Landscape & Visual Impact, the residual effects on the surrounding landscape and designations are not significant, with just a residual effect of moderate significance

Environmental Consideration	'Do Nothing' Alternative	Chosen option of developing a renewable energy project
		being on the Site itself due to the magnitude of change from agriculture to renewable energy and agriculture.
Material Assets	No potential for impacts on traffic volumes and road conditions. No potential for impacts on other material assets.	As detailed in Chapter 15 Material Assets, there will be no significant effects on traffic and transport during the construction and decommissioning phases of the Proposed Project. With the implementation of mitigation measures set out in Chapter 15 Material Assets, there will be no significant effects on non-traffic related material assets described therein, during the construction, operation or decommissioning phases.
Vulnerability to Major Accidents or Natural Disasters	No potential to be impacted 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 proposed Project will be designed and built in line 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 not be significant residual effects associated with the construction, operation and decommissioning of the Proposed Project.

3.2.3 Alternative Site Locations

To ensure that the Levelised Costs of building each Megawatt 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 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 development, 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, siting within areas identified as suitable/preferred for wind energy development under the County Development Plans, suitable wind speeds, adequate setbacks from sensitive properties, proximity to national grid nodes, avoidance of direct impacts on known cultural heritage assets, access and constructability.

3.2.3.1 Site Selection Criteria

As the cost of building each megawatt 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.

Buirios Ltd. is associated with Enerco Energy Ltd., which is an Irish-owned Cork-based company with extensive experience in renewable energy and is responsible for projects throughout Ireland, with projects currently operating or in construction in several counties along the west coast of Ireland. By Q3 2023, Enerco associated companies had over 875 Megawatts (MW) of wind generating capacity in commercial operation or under construction, with a further 500MW of projects at various stages in its portfolio to assist in meeting Ireland's renewable energy targets. Enerco Energy Ltd. invests a significant amount of time and resources identifying and investigating sites for renewable energy proposals throughout the Country.

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

- **Planning Policy:** Compliance with County Development Plan Renewable Energy Strategy for wind energy development;
- **Environmental Sensitivities:** Located outside of EU Natura 2000 sites; locations outside of National designations; located outside of Article 17 Annex I Habitats;
- **Grid Connection**: Proximity to the national grid node;
- **Wind Speed:** Average annual wind speeds conducive to wind energy development;
- **Sensitive Properties**: Capable of complying with required setbacks from sensitive properties.
- **Site Scale:** Sufficient area of unconstrained land that could potentially accommodate a wind farm development and turbine spacing requirements.

3.2.3.2 Planning Policy

3.2.3.2.1 *Tipperary County Development Plan 2022-2028*

The Tipperary County Development Plan 2022-2028 (CDP) is the principal policy instrument used to manage change in land use in the County. The Plan sets out the Planning Authority's strategic land use objectives and policies for the overall development of the County up to 2028. This spatially based strategic framework seeks to manage and coordinate change in land use in the County setting out a clear view ahead in development terms together with clear priorities to drive growth. On the subject of the development of wind energy within the County it is an aim of the CDP to:

"It is the policy of the Council to support, in principle and in appropriate locations, the development of wind energy resources in county Tipperary. The Council recognises that there is a need to promote the development of 'green electricity' resources and to reduce fossil fuel dependency and greenhouse gas emissions in order to address the global issue of climate change, and to comply with European and International policies with regards to renewable and sustainable energy resources."

Tipperary County Development Plan Renewable Energy Strategy

Volume 3 – Appendix 2: Renewable Energy Strategy within the CDP contains the Tipperary Renewable Energy Strategy 2016 which outlines the vision of Tipperary County Council in relation renewable wind energy. In terms of wind speed and consistency, it is perceived that Tipperary is ideally located to support wind energy generation due to its upland areas. The CDP's chapter 10: Renewable Energy and Bioeconomy states it is the express target to maximise appropriate development to support and create a sustainable local renewable energy marketplace as follows:

10-1*: "Support and facilitate new development that will produce energy from local renewable sources such as hydro, bio-energy, wind, solar, geothermal and landfill gas, subject to compliance with normal planning and environmental criteria, in co-operation with statutory and other energy providers. The provisions of the Tipperary Renewable Energy Strategy (and any review thereof) as set out in Volume 3, will apply to new development."*

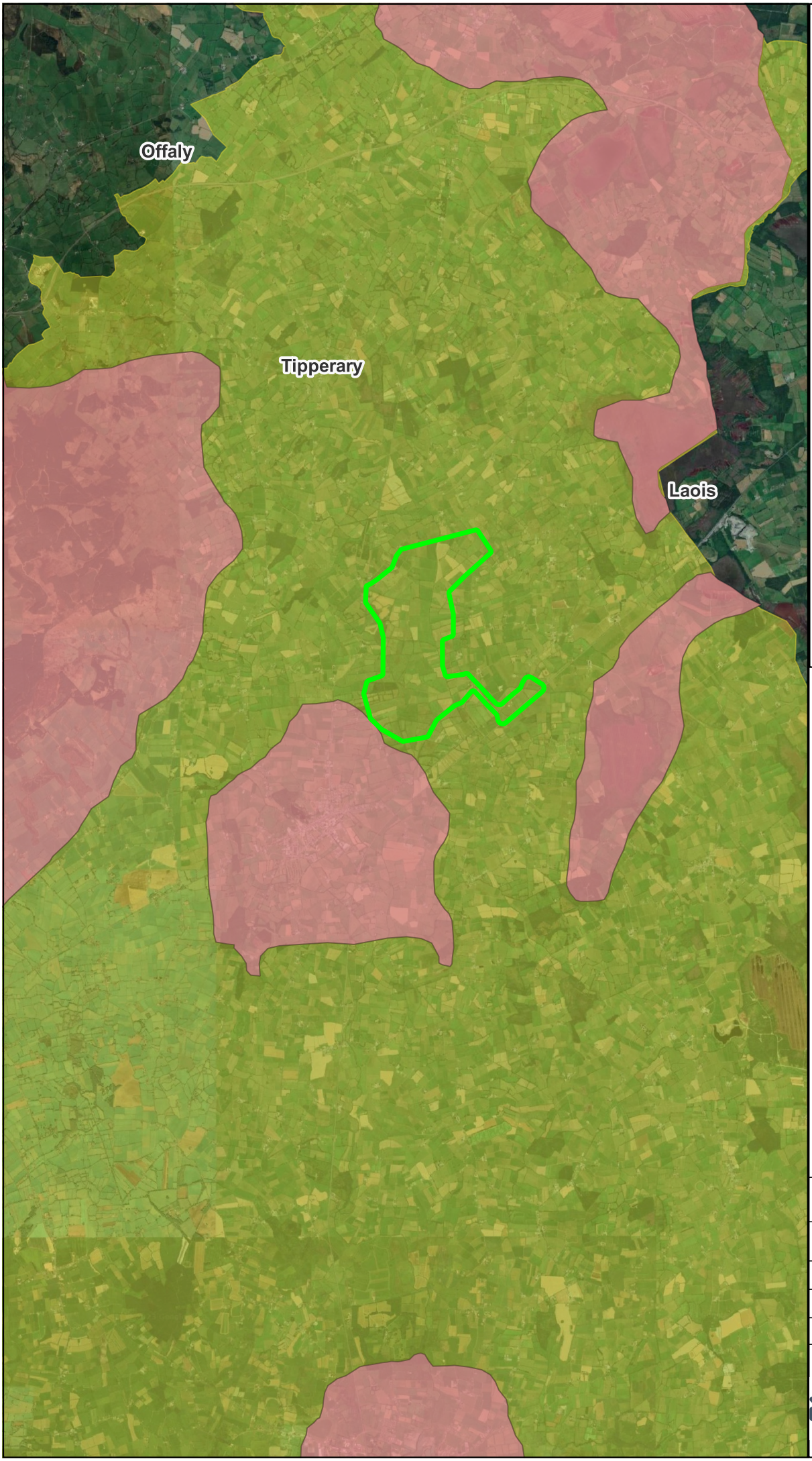
10-A: *"Support the Climate Action Plan (DECC, 2019) as it relates to renewable energy production, having consideration to the strategic importance and potential benefits of renewable energy investment to rural communities."*

10-C: *"To continue to support renewable energy development and to maintain a positive framework for development through the review the Renewable Energy Strategy over the lifetime of the County Development Plan."*

3-6: *"Promote and facilitate renewable energy development, in accordance with the policies and objectives of the Tipperary Renewable Energy Strategy 2016 (and any review thereof), and the Tipperary Climate Adaptation Strategy 2019."*

The CDP Wind Energy Map identifies areas for the development of wind energy projects within the County. Based on Map 11 the entire Site is located within an area that is classified as '**Area Open for Consideration for New Wind Energy Development'**. These areas*:*

'may or may not be appropriate, depending on the character of the landscape and the potential impact of the proposed development. Any impact on the environment must be low and subject to proper planning and sustainable development, and the guidelines set out in this policy document'.



Map Legend

EIAR Study Boundary

Wind Energy Strategy 2022-2028

Areas Open for Consideration for New Wind Energy Development

Areas Unsuitable for New Wind Energy Development

N

Drawing Title	County Tipperary Wind Energy Strategy
Project Title	Borrisbeg Renewable Energy Development
Drawn By: Grainne Griffin	Checked By: Karen Mulryan
Project No.: 220310	Drawing No.: Figure 3-1
Scale: 1:100,000	Date: 06.09.2023

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3.2.3.3 Environmental Sensitivities

3.2.3.3.1 *Environmental Designations*

The Site is not located within or adjacent to any International or Nationally designated sites.

The nearest Natura 2000 site, i.e., Special Area of Conservation (SAC) or Special Protection Area (SPA) is the Kilduff, Devilsbit Mountain SAC which is 4.8km to the west of the study area. The Slieve Bloom Mountains SPA is located approximately 13.5km north of the study area boundary which is the nearest SPA to the Site.

The nearest designated Natural Heritage Area (NHA) is the Nore Valley Bogs NHA which is 6.6km to the north of the study area. The nearest proposed NHA (pNHA) is the Templemore Wood pNHA is located 1.9km to the southwest. The Kilduff, Devilsbit Mountain pNHA is 4.8km to the west of the Site.

3.2.3.3.2 *Article 17 Annex I Habitat*

In addition to the above, there is no Article 17 Annex I habitat recorded within or adjacent to the application site. Comprehensive multi season site surveys have confirmed that there is no Annex I habitat within the Site. Habitats within the Site are predominantly species poor agricultural grassland and wet grasslands and are of a low ecological value. Please see Chapter 6 Biodiversity for further detail s regarding habitats within the Site.

3.2.3.4 Grid Connection

A key driver in identifying a suitable location for a wind farm is grid capacity. The Proposed Project will include an onsite 110kV substation which will connect to the national grid via a c.2km underground cabling route which will run from the proposed onsite 110kV substation through a mix of local roads and private lands (approx. 870m through the L-7039, and approx. 1.2km through private land) to the existing Ikerrin to Thurles 110kV overhead line (OHL) located approximately 1.4km east of the Site as the crow flies. Two proposed end masts (lattice type towers) will be constructed immediately beneath the OHL. The OHL conductor will be terminated at these masts to facilitate a new loop connection into the proposed on-site 110kV substation. The exact final detail and specifications of the grid connection method will ultimately be decided by ESB/EirGrid. The proposed onsite 110kV substation will form part of the national electricity grid once constructed and energised.

3.2.3.5 Wind Speed

The geographical location of County Tipperary, in the Country's midwestern section, gives rise to an excellent wind resource, with very significant wind energy generation potential. In this regard, Tipperary has the potential to play a significant role in Ireland meeting the EU and national renewable energy targets and the current application provides a valuable opportunity to help County Tipperary fulfil this role. On-site monitoring of the wind resource further verifies that with a sufficient turbine height and blade diameter, the wind resource of the Site is commercially viable.

3.2.3.6 Sensitive Properties

The population density of the Population Study Area as described in the Population and Human Health section of this EIAR is 28.06 persons per square kilometre (Census 2022), as described in Chapter 5 of this EIAR. This is significantly lower than the average national population density of 71.47 persons per square kilometre.

The 2006 WEDGs acknowledges that noise and shadow flicker are unlikely to be a significant problem for sensitive properties located greater than 500m away from the nearest turbine. The 2019 draft WEDGs

requires a minimum setback of 4 x the proposed tip height of the wind turbines and includes that there are exceptions to the mandatory minimum setbacks from turbines where the relevant residential receptor provides in writing, an agreement with the developer to the revised setback, subject to an absolute minimum setback of 500m.

The proposed turbine positions achieve the recommended setbacks in both the 2006 WEDGs and the 2019 draft WEDGs. The Climate Action Plan 2023 states that the wind energy guidelines will be rewritten and issued in draft form in 2023 with final guidelines published in 2024.

3.2.3.7 Site Scale

The Site, covering a total of 650 hectares, comprises mix of agri-pastoral land, private forestry and local road and has an elevation range of 105m AOD to 120m AOD. The adjacent landuse predominantly comprises the same. The Site benefits from existing farm roads (approx. 930m) and local roads L-7039 (approx. 870m), L-70391 (approx. 1.1km) and the L7038 (approx. 10m). The Site is easily accessible via farm entrances off the L-3248 to the north (proximate to the N62 to the west), the L-7039 and the L-70391 to the southeast. As discussed above, the Site comprises habitats of low ecological value and the recommended setback distance to sensitive properties is achieved.

As such, with its proximity to grid, accessibility, relatively flat topography, low ecological value habitats and achievable setbacks from sensitive properties, the Site affords a largescale area that is sufficiently unconstrained to accommodate a 9-turbine wind farm development with the required turbine spacing requirements.

3.2.3.7.1 *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 Site is located entirely within an area designated by Tipperary County Council as an *Area Open for Consideration for New Wind Energy Development*.

It is not located within or adjacent to EU or National protected areas, nor does it contain any EU designated Annex I Habitat. The Site is located on agri-pastoral lands, of low ecological value, within a rural setting. It is accessible via local and regional roads and national grid infrastructure is located within 2km. Required setbacks as set out above are achievable and wind speeds in the area are considered commercially viable for wind energy development.

With the location of the existing 110kV Ikerrin to Thurles overhead line, the local road network (L-7039; L-70391; L-7038) all within the southeast of the Site (i.e. the EIAR Study Boundary), designing the proposed onsite substation in the southeast of the Site was the most logical approach. Environmental assessments of the suitability of this area confirmed that this was the optimal location for a proposed onsite substation. Furthermore, the underground electrical cabling route will run through the public road corridor (approx. 870m) and into third party agricultural land of low ecological value.

Factoring all required environmental constraints into the project design, a site of considerable scale, with an estimated installed capacity of 63MW, and potential to power approximately 47,000 Irish households with renewable energy and displace 58,808 tonnes of carbon dioxide per annum (1,764,240 tonnes over the 30-year operational life), the Site is considered appropriate for wind energy development and represents a positive contribution to National and EU climate action targets.

While the outcome of the site selection process has identified the Site a suitable location for a renewable energy development, it does not preclude other sites within the vicinity being brought forward for consideration in the future.

3.2.4 Alternative Renewable Energy Technologies

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.

Enerco Energy Ltd has a keen interest in offshore wind farms and has explored potential offshore sites. 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 under the Climate Action Plan 2023 which include focusing on onshore wind energy developments to reach the 2025/2030 renewable energy targets. As such, Enerco's primary focus remains to be onshore wind farms and they will continue to explore potential development offshore in tandem with delivering suitable sites onshore such as this Site.

The Applicant Buirios is a subsidiary of Enerco Ltd, an Irish owned developer with extensive experience in the design, construction and operation of onshore wind energy developments throughout Ireland, with projects currently operating or in construction in Counties Cork, Kerry, Limerick, Clare, Galway, Mayo and Donegal. By Q4 2023, Enerco and its associated companies had over 875 Megawatts (MW) of onshore wind generating capacity under construction or in commercial operation, with a further 400MW of projects at various stages in its portfolio to assist in meeting Ireland's onshore renewable energy targets. The Applicant is committed to playing a key role in helping the State achieve its CAP 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 Technology

Commercial solar energy production is the harnessing and conversion of sunlight into electricity using photovoltaic arrays (panels). To achieve the same maximum estimated electricity output, as is expected from the Proposed Project (63MW), from solar energy would require a significantly larger development footprint. In this instance, the Proposed Project has a permanent footprint of 8.47 hectares or 1.3% of the Site. A solar PV array of the scale necessary to provide the same electricity output would require a footprint of approx. 100 hectares[1] or 15% of the overall Site. In addition, a solar development of this scale, would have a higher potential environmental effect on Traffic and Transport (construction phase), Air Quality (construction phase) and Biodiversity and Ornithology (habitat loss), a greater potential for direct impacts on unknown subsurface archaeology (construction phase) and glint and glare at the Site (operational phase).

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

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 Project at this Site are presented in Table 3-2 below.

[1] *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 3-2 Comparison of environmental effects when compared against the chosen option (wind turbines)

Environmental Consideration	Solar PV Array (with an estimated 53MW output)	Chosen Option (Wind Turbines)
Population & Human Health	Relatively lower long-term financial contributions towards the local community (i.e., community benefit fund) on a per MWh basis). No potential for shadow flicker to affect sensitive properties. Lower potential for noise and vibration effects. Lower potential for visual obstructions in the skyline due to solar farms being low lying structures. No potential for shadow flicker. Potential for glint and glare impacts on local road users and sensitive properties.	Higher long-term financial contributions towards the local community (i.e., community benefit fund) on a per MWh basis). Greater potential for noise and vibration during construction operational and decommissioning phases. Greater potential for visual effects during operational phase. No material difference between the two options during construction and decommissioning. No potential for glint and glare impacts on sensitive properties.
Biodiversity & Ornithology	Larger development footprint would result in greater habitat loss. It is assumed that a solar project at this site and of such a scale would include a biodiversity enhancement proposal.	Smaller development footprint would result in a smaller habitat loss. The Proposed Project includes for a biodiversity net gain proposal providing a local boost to biodiversity and water quality. Please see Appendix 6-4 for details.
Land, Soils & Geology, Geotechnical/ Stability	Shallower excavations involved in solar PV array developments would result in reduced volume of spoil to be excavated. Geotechnical investigations followed by careful design would lead to no significant environmental impacts.	Larger volume of spoil to manage on site due to deeper excavations.
Hydrology & Hydrogeology	No material difference between the two options. Project design specific drainage design removes the potential for significant environmental effects.	No material difference between the two options. Project design specific drainage design removes the potential for significant environmental effects.
Air Quality	Increased potential for dust and other noxious emissions due to larger volume of transport movements to and from site and larger volume of plant and ground works on site due to the larger footprint. Reduced capacity factor of solar PV array technology would result in a longer carbon payback period.	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 farm technology resulting in a shorter carbon payback period.
Climate	Reduced capacity factor of solar PV array technology would result in a longer carbon payback period.	Greater capacity factor resulting in a shorter carbon payback period.
Noise & Vibration	Potential for short-term noise impacts on nearby sensitive properties during the construction phase.	Potential for reduced noise impacts due to siting of main infrastructure at greater set ack distances from sensitive properties.

Environmental Consideration	Solar PV Array (with an estimated 53MW output)	Chosen Option (Wind Turbines)
	Larger traffic movements and increased plant on site due to the larger footprint/ground disturbance could lead to larger noise and vibration output during the construction phase.	Potential for reduced noise emissions due to fewer plant onsite during the construction phase.
Cultural Heritage & Archaeology	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	Potentially less visible from surrounding area due to screening from forestry and topography.	Greater visibility due to the vertical scale of the proposed turbines.
Material Assets	Potential for greater traffic volumes during construction phase due to the number of solar panels required to achieve the same output. Greater potential for impacts on waste management due to increased plant onsite giving rise to increase in hazardous waste materials. No material difference between the two options for impacts on gas, water, aviation. No potential for impacts on telecommunications.	Lower traffic movements during the construction phase due to the smaller number of components. Smaller potential for impacts on waste management due to fewer plant onsite. No material difference between the two options for impacts on gas, water, aviation. Buffers implemented on telecommunication links.
Vulnerability to Major Accidents Natural Disasters	No material difference between the two options	No material difference between the two options

3.2.5 Alternative Wind Farm Design Options

3.2.5.1 Alternative Turbine Number

The proposed wind turbines will have a potential power output in the 4.5 – 7-megawatt (MW) range. It is proposed to install 9 turbines at the Site which could achieve an estimated generating capacity of 63MW based on a 7MW turbine model. Such a wind farm could also be achieved on the Site by using smaller turbines (for example 3.8 MW machines). However, this would necessitate the installation of approximately 16 turbines to achieve a similar output. Furthermore, the use of smaller turbines would not make as efficient use of the wind resource available at higher elevations above ground level. A larger number of smaller turbines would result in the wind farm occupying a greater footprint within the Site, with a larger amount of supporting infrastructure being required (i.e., roads, steel, etc.) and increasing the potential for negative environmental impacts to occur on biodiversity, hydrology and traffic and transportation. The proposed number of turbines takes account of all Site constraints and the distances to be maintained between turbines and features such as roads and houses, while maximising the wind energy potential of the Site. The 9-turbine layout selected for the Site 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 other alternatives considered included a 10-turbine layout which is discussed in further detail below.

The turbine model to be installed on the Site will have an overall ground-to-blade tip height of 185 metres; blade rotor diameter of 163 metres and hub height of 103.5 metres minimum. The use of alternative smaller turbines at this site would not be appropriate as they would fail to make the most efficient use of the wind resource passing over the Site at higher elevations 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 are presented in Table 3-3 below.

Table 3-3 Comparison of environmental effects when compared against the chosen option (9 wind turbines, higher MW output)

Environmental Consideration	Larger number of smaller turbines	Chosen option of a 9-no. turbine layout
Population & Human Health	Greater potential for shadow flicker and noise impacts on nearby sensitive properties due to the increased number of turbines. However, these 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. No material difference between the two options on air quality	Decreased potential for shadow flicker due to greater setbacks from houses, greater separation between turbines thus reducing aggregated shadow flicker time. Potential for decreased noise levels at nearby sensitive properties due to increased separation distance between sensitive properties and turbine locations. Fewer but larger turbine models would be more visually obstructive in the skyline but may occupy a narrower portion of the viewpoint. No material difference between the two options on air quality
Biodiversity & Ornithology	Larger development footprint would result in greater habitat loss.	Smaller development will result in a smaller habitat loss. The Proposed Project has been designed to avoid or mitigate impacts on biodiversity including bats and downstream aquatic receptors. The Proposed Project includes for a biodiversity net gain proposal providing a local boost to biodiversity and water quality. Please see Appendix 6-4 for details.
Land, Soils & Geology	Larger development footprint would result in greater volumes of spoil to be excavated and managed. Geotechnical investigations: No material difference between the two options	Smaller development footprint would result in smaller volumes of spoil to be excavated and managed. Geotechnical investigations: No material difference between the two options
Hydrology and Hydrogeology	No material difference between the two options	No material difference between the two options

Environmental Consideration	Larger number of smaller turbines	Chosen option of a 9-no. turbine layout
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.
Climate	There would be an increased potential for vehicle emissions and dust emissions due to an increased volume of construction material and turbine component deliveries to the site.	Decreased potential for vehicle emissions and dust emissions due to a decreased volume of construction material and turbine component deliveries to the Site.
Noise & Vibration	Potential for increased noise levels at nearby sensitive properties due to reduced separation distance between sensitive properties and turbine locations and additional turbine generators.	Potential for decreased noise levels at nearby sensitive properties due to increased separation distance between sensitive properties and turbine locations.
Cultural Heritage & Archaeology	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology. No material difference between the two options for indirect effects on monuments	Smaller development footprint would decrease the potential for impacts on unrecorded, subsurface archaeology. No material difference between the two options for indirect effects on monuments
Landscape & Visual	Smaller turbines may be less visually intrusive on the landscape. Equally, a higher number of smaller turbines would be spread over a wider area, taking up a greater portion of a viewpoint	Fewer but larger turbine models would be more visually obstructive in the skyline but may occupy a narrower portion of the viewpoint.
Material Assets- Traffic and Transport *Material Assets- Utilities, Waste Management, Telecommunications and Aviation*	Potential for greater traffic volumes during construction phase due to larger development footprint and requirement for more construction materials and turbine components. No material difference between the two options for gas, water, Waste Management, Telecommunications and Aviation.	Potential for smaller traffic volumes during construction phase due to smaller development footprint and requirement for fewer construction materials and turbine components. No material difference between the two options for gas, water, Waste Management, Telecommunications and Aviation
Vulnerability to Major Accidents Natural Disasters	No material difference between the two options	No material difference between the two options

3.2.5.2 Alternative Turbine Layout

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, geotechnical, archaeological, and traffic specialists.

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 first initial layout to the Proposed Wind Farm layout. The design process has also taken account of the recommendations and comments of the relevant statutory and non-statutory organisations, the local community and local authorities as detailed in Chapter 2 Background to the Proposed Project.

3.2.5.2.1 *Constraints and Facilitators Mapping*

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

The 2006 WEDGs were the subject of a targeted review. The proposed changes to the assessment of impacts associated with onshore wind energy developments were outlined in the document 2019 draft WEDGs.) A consultation process in relation to the 2019 draft WEDGs closed on 19th February 2020. The proposed changes presented in the 2019 draft WEDGs give certain focus on the setback distance from residential properties (four times the proposed maximum tip height), along with shadow flicker and noise requirements. At time of writing, the Draft Guidelines have not yet been adopted and the Climate Action Plan 2023 states that new draft wind energy guidelines will be published in 2023 with final guidelines adopted in 2024.

The constraints mapping process involves the placing of buffers around different types of constraints so as to clearly identify the areas within which no development works will take place. The size of the buffer zone for each constraint has been assigned using guidance presented 2006 WEDGs. Should the 2019 draft WEDGs be adopted in advance of a planning decision being made on Borrisbeg Renewable Energy Development, the Proposed Project will be capable of achieving the requirements of the 2019 draft WEDGs as currently proposed.

A constraints map for the Site was produced following a desk study of all site constraints. Figure 3-2 encompasses the following constraints and associated buffers:

- **Sensitive properties:** The Proposed Wind Farm design achieves a setback of greater than 750m from non-involved sensitive properties and a setback minimum of 610m from involved sensitive properties. The 2006 WEDGs acknowledge that shadow flicker and noise impacts are unlikely for residential properties locate greater than 500m from a proposed turbine. The 2019 draft WEDGs recommend a minimum set back of 4x tip height from the nearest residential receptor (in this instance this would equate to a 740m minimum set back), except where agreements with involved landowners are in place which are subject to a mandatory 500m setback:

  '*With the exception of applications where reduced setback requirements have been agreed with relevant owner(s) as outlined at 6.18.2 below, planning authorities and An Bord Pleanála (where relevant), shall, in undertaking their development planning and development management functions, ensure that a setback distance for visual amenity purposes of 4 times the tip height of the relevant wind turbine shall apply between each wind turbine and the nearest point of the curtilage of any residential property in the vicinity of the proposed development, subject to a mandatory minimum setback of 500 metres from that residential property'*

- **Telecommunication:** Telecommunication links plus the operator specific buffer;
- **Hydrology:** Watercourses plus 50-metre buffer. Given the flat topography of the Site, a 10-metre buffer on field drains is not required.
- **Flood Risk:** Site Specific Flood Modelling for 100-yr and 1000-yr events.
- **Archaeology:** Archaeological Sites or Monuments: 'Zone of Notification' as required by the National Monuments Service (ROI). There is one redundant record within the EIAR site boundary which will not be included in the next revision of the Sites and Monuments Record. However, it has been buffered by 150m. An unrecorded cropmark is located approx. 20m

northeast of the proposed borrow pit. one potential fosse located north of the proposed borrow pit. A buffer of 20m has been implemented and it will be fenced off with appropriate signage from construction activities.

- **Habitats and Biodiversity**: badger setts, minimum 30m setback, increased to 50m during the breeding season, increased to 150m if blasting and breaking is required during the breeding season..

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

- Policy- Located entirely within an Area Open for Consideration for Renewable Energy Development;
- Available lands for development;
- Wind resource;
- Proximity to national grid node;
- 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;
- Existing access points and general accessibility of all areas of the Site due to existing road infrastructure; and
- Limited extent of constraints.

The inclusion of the constraints on a map of the study area allows for a viable area to be identified. An initial wind farm layout is then developed to take account of all the constraints mentioned above and their associated buffer zones and the separation distance required. Following the mapping of all known constraints, detailed site investigations were carried out.

The ecological assessment of the Site encompassed habitat mapping and extensive surveying of birds and other fauna. This assessment, as described in Chapter 6 of this EIAR on Biodiversity, optimised the decision on the siting of turbines and the carrying out of any development works, such as the construction of roads.

The hydrological and geotechnical investigations of the Site examined the proposed locations for turbines, roads and other components of the Proposed Project, such as the construction compound. 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.

The turbine layout for the Proposed Wind Farm has also been informed by the results of noise assessments, flood modelling and the separation distance to be maintained between turbines. Thus, the baseline environmental assessment of the 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.

Map Legend

- EIAR Study Boundary
- 50m Watercourse buffer
- 10m Drain buffer
- 1/100 Flood Zone
- 1/1000 Flood Zone
- National Monument- redundant record
- Transmission link buffer
- Transmission link buffer- passes over site
- Minimum 500m Set Back from Residential Receptors
- Unrecorded cropmark

N

Drawing Title	Constraints
Project Title	Borrisbeg Renewable Energy Development
Drawn By: Grainne Griffin	Checked By: Karen Mulryan
Project No.: 220310	Drawing No.: Figure 3-2
Scale: 1:22,500	Date: 06.09.2023

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3.2.5.2.2 *Alternative Turbine Layout Iterations*

The final proposed turbine layout takes account of all site constraints and the distances to be maintained between turbines and from houses, roads, etc. The layout is based on a combination of the results of all site investigations and surveys that have been carried out during the EIAR process and the EIA scoping process with statutory and non-statutory consultees. With any new turbine layout, the publicly available project website (with contact details) was updated accompanied by a design leaflet drop to the local community to keep them informed of the design evolution.

As information regarding the Site was compiled and assessed, the layout was revised and amended to take account of the physical constraints of the Site, the required buffer zones, areas where no turbines could be located, availability of land, and cumulative impacts.

The selection of turbine numbers and layout has also had regard to wind-take, noise and shadow flicker impacts and the separation distance to be maintained between turbines. The EIAR and wind farm design process was an iterative process, where findings at each stage of the assessment were used to further refine the turbine layout, always with the intention of minimising the potential for environmental impacts.

There were a number of reviews by the wind farm design team of the specific locations of turbines during the optimisation of the Site layout. The initial constraints study identified a significant viable area within the overall study area. Please refer to Figure 3-3, Figure 3-4, and Figure 3-5 to see the evolution of the turbine layout for the Proposed Wind Farm.

Proposed Layout Iteration No. 1: 10 Turbine Layout

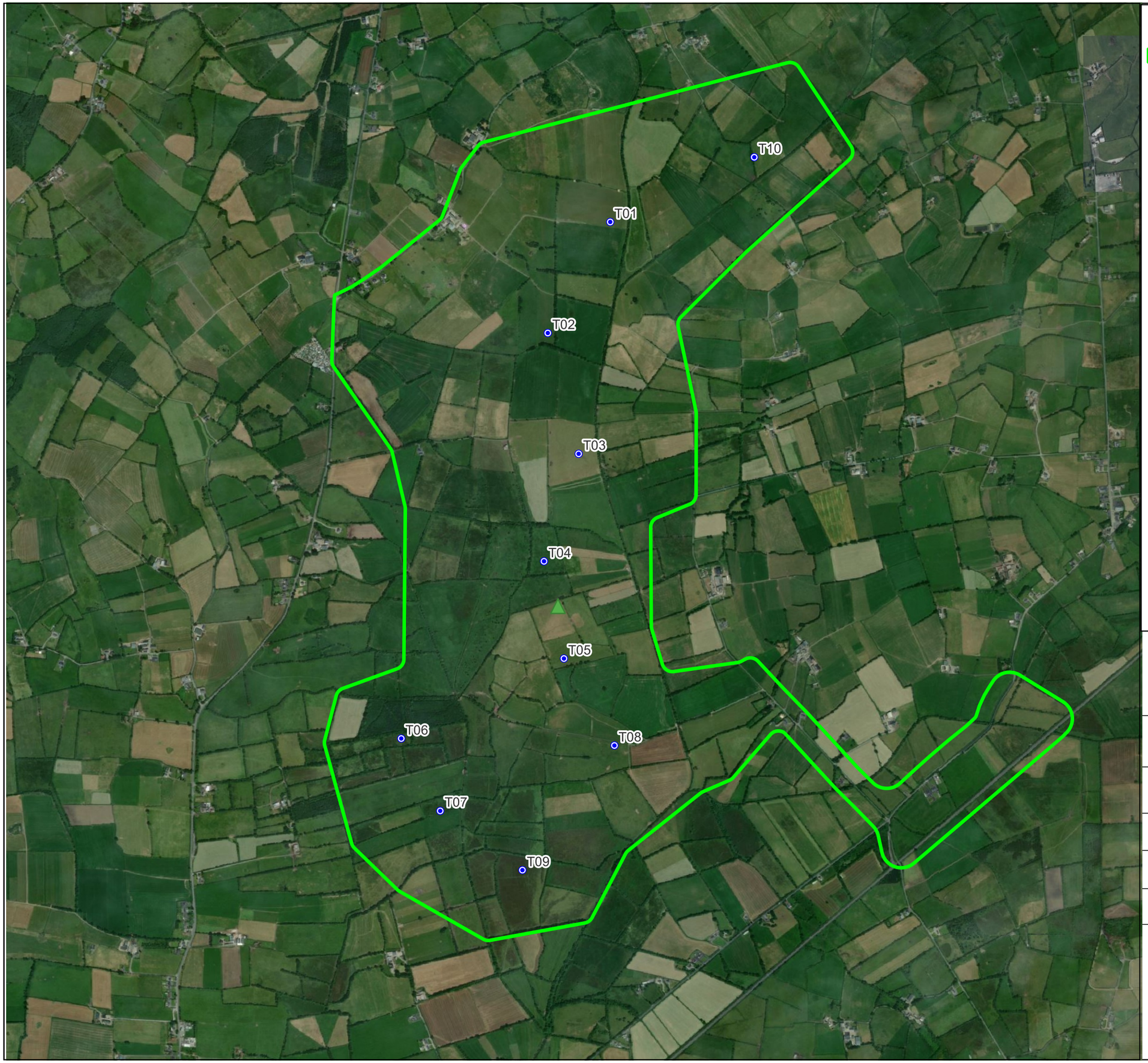
Iteration No. 1 which is presented in Figure 3-3 is the initial turbine layout and met mast location which was based on a preliminary constraint mapping exercise and identification of a viable area for turbine siting. A larger viable area for the 10-no. turbine layout was identified within the overall study area during the constraints mapping process. However, due to the requirement for a new clear span bridge across the River Suir solely for Turbine no.10 and difficulties acquiring landowner agreements for this area, Turbine no.10 was removed from the wind farm design.

Proposed Layout Iteration No. 2: 9 Turbine Layout

Iteration No. 2 which is presented in Figure 3-4 comprised of 9 No. turbines and the met mast location. The layout in Iteration No. 2 was presented to the project team for detailed investigations and assessment. These investigations included habitat mapping, ecological surveying, hydrological and geotechnical investigations of the Site. Detailed hydrological monitoring also commenced for the Site for the purposes of site-specific flood modelling.

Final Optimised 9 Turbine Layout:

Following feedback from telecoms operators and the project hydrogeologist, the 9 -turbine design was refined further by small movements of turbines and roads. Please refer to Figure 3-5 for the final turbine and met mast locations. The final proposed turbine layout takes account of all site constraints (e.g., ecology, ornithology, hydrology, telecommunications, etc.) and design constraints (e.g., setback distance from houses and third-party lands/infrastructure and distances between turbines on-site, etc.). The layout also takes account of the results of all site investigations and baseline assessments that have been carried out during the EIAR process.



Map Legend

- EIAR Study Boundary
- Turbine Layout
- Met Mast

Drawing Title
Proposed Layout Iteration No.1: 10 Turbine Layout

Project Title
Borrisbeg Renewable Energy Development

Drawn By	Checked By
NS	KM
Project No. 220310	Drawing No. Figure 3-3
Scale 1:17,500	Date 2023-11-17

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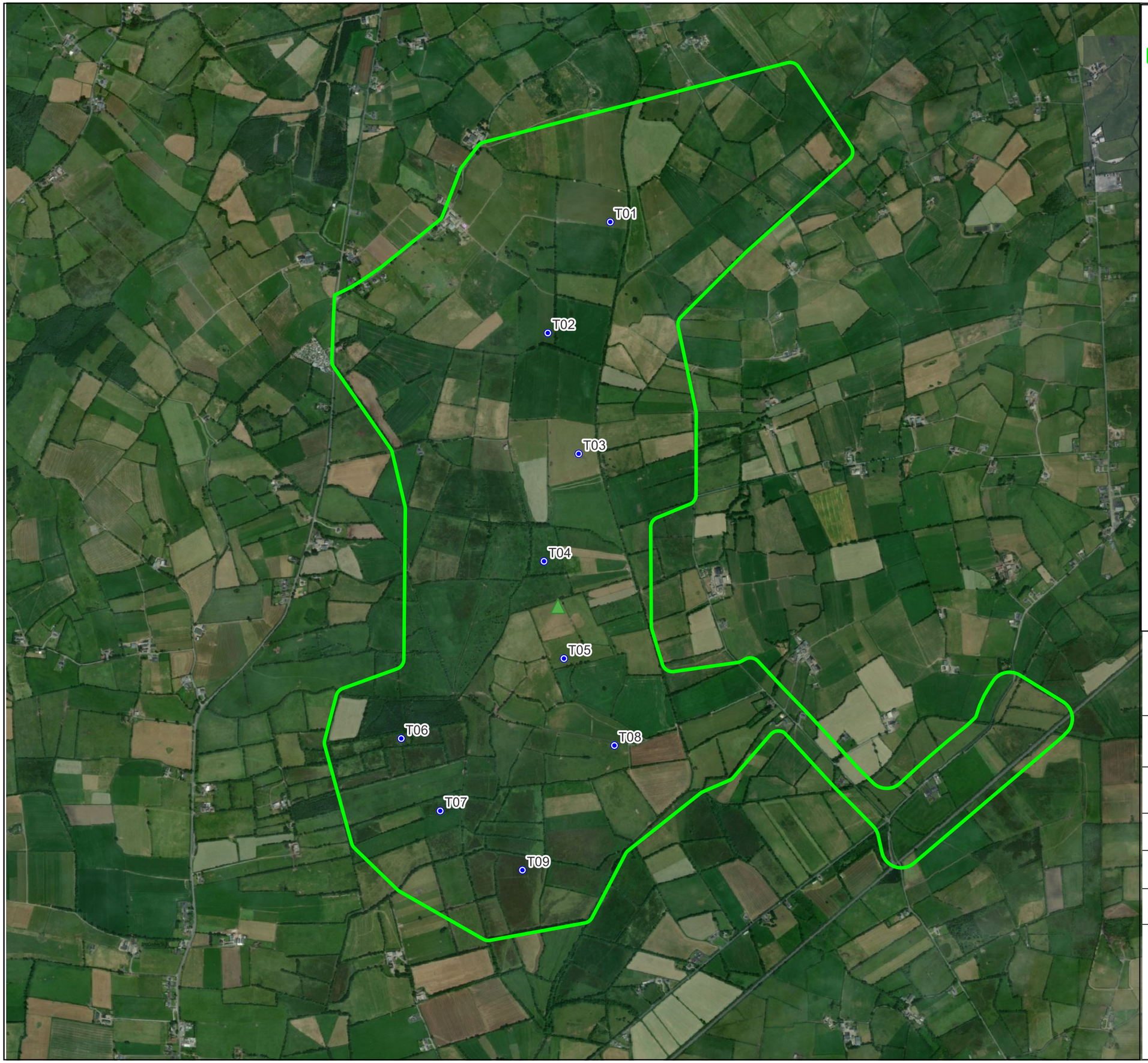

Map Legend

- EIAR Study Boundary
- Turbine Layout
- Met Mast

N

Drawing Title
Proposed Layout Iteration No.2: 9 Turbine Layout

Project Title
Borrisbeg Renewable Energy Development

Drawn By	Checked By
NS	KM
Project No. 220310	Drawing No. Figure 3-4
Scale 1:17,500	Date 2023-11-17

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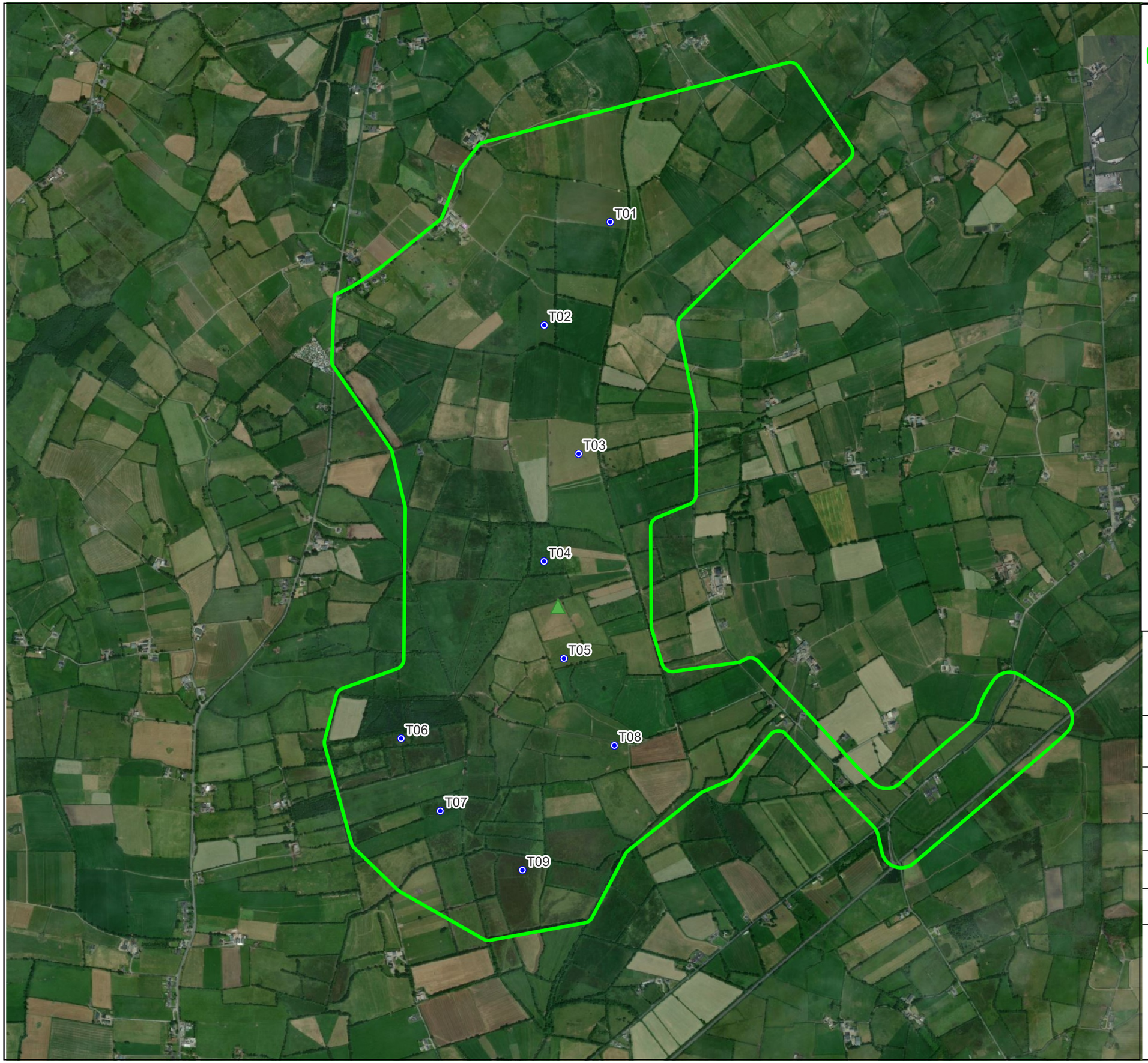

Map Legend

- EIAR Study Boundary
- Turbine Layout
- Met Mast

Drawing Title
Proposed Layout Iteration No.3: 9 Turbine Layout

Project Title
Borrisbeg Renewable Energy Development

Drawn By	Checked By
NS	KM
Project No. 220310	Drawing No. Figure 3-5
Scale 1:17,500	Date 2023-11-17

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A comparison of the potential environmental effects of initial and final iteration of the turbine layout is presented in Table 3-4 below.

Table 3-4 Comparison of the potential environmental effects of initial and final iteration of the turbine layout i

Environmental Consideration	Initial Layout (10 no. turbines)	Final Layout (Optimised 9 no. turbines)
Population & Human Health (incl. Shadow Flicker)	No material environmental difference for population or human health. Potential for increased shadow flicker duration at nearby sensitive properties.	No material environmental difference for population or human health. Reduced potential for shadow flicker duration for sensitive properties located in the northeast of the Site. As detailed in Chapter 14 Landscape & Visual, the residual effect will be significant for some sensitive properties within 1km where 1-3 turbines may appear as having a large vertical extent. However, the proposed turbine locations adhere to the recommended 500m set back distance in the 2006 WEDGs and also the 4 times tip height set-back distance (for non-involved Sensitive Properties) set out for visual amenity purposes, prescribed by the 2019 draft WEDGs.
Biodiversity & Ornithology	Larger development footprint, therefore, increase overall habitat loss; however, habitat enhancement and replacement would mitigate against this.	Smaller development footprint, therefore reduced overall habitat loss. Nonetheless, the proposed habitat management and enhancement will mitigate against this. The Proposed Project includes for a biodiversity net gain proposal providing a local boost to biodiversity and water quality. Please see Appendix 6-4 for details.
Land, Soils & Geology. Geotechnical/ Stability	No material difference between the two options	No material difference between the two options.
Hydrology and Hydrogeology	No material difference between the two options	No material difference between the two options
Air Quality	No material difference between the two options	No material difference between the two options.
Climate	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.	Fewer turbines reduced the potential to maximise the use of the Site wind resource and the opportunity to further reduce the country's dependence on fossil fuels.

Environmental Consideration	Initial Layout (10 no. turbines)	Final Layout (Optimised 9 no. turbines)
Noise & Vibration	Potential for greater noise impacts due to greater number of turbines. However, noise emissions can be curtailed.	Fewer turbines will generate reduced noise levels; fewer turbines sited 4x tip height from sensitive properties.
Cultural Heritage & Archaeology	Neutral- Larger development footprint may result in a marginally greater potential for impacts on unknown subsurface archaeology	Neutral- smaller development footprint has a marginally reduced potential for impacts on unknown subsurface archaeology
Landscape & Visual	Potential for greater visual impacts due to the wider visual extent of the proposed turbines.	Reduced visual impacts due to the reduced visual extent of the proposed turbines. The strategic siting of infrastructure will mitigate any potential for significant landscape and visual effects.
Material Assets	No material difference between the two options	No material difference between the two options
Vulnerability to Major Accidents Natural Disasters	No material difference between the two options	No material difference between the two options

3.2.5.3 Alternative Road Layout

Access tracks are required onsite to enable transport of infrastructure and construction materials within the Site. Such tracks must be of a gradient and width sufficient to allow safe movement of equipment and vehicles. Approximately 7km of new internal tracks are required for the Proposed Project along with approximately 780m of existing farm tracks used by the landowners in their daily farming activities. These tracks will be upgraded to facilitate the movement of construction traffic and delivery of turbine components through the Site. In addition to this, approx. 2.1km of local road runs through the Site which will be resurfaced by the Developer.

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 Site and 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 the internal roads.

An alternative option to making maximum use of the existing road network (farm tracks and local roads) within the Site would be to construct a new road network, having no regard to existing tracks or roads. This approach was not favoured, as it would require unnecessary disturbance to the Site and create the potential for additional environmental impacts to occur. It would also result in an unnecessary requirement for additional cut and fill material to be used in the construction of new roads. Please see Table 3-5 for a Comparison of environmental effects when compared against the chosen option.

Table 3-5 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 a smaller habitat loss. The Proposed Project includes for a biodiversity net gain proposal providing a local boost to biodiversity and water quality. Please see Appendix 6-4 for details.
Land, Soils & Geology ***Geotechnical/Stability***	Larger development footprint would result in greater volumes of spoil to be excavated and stored. Larger volume of stone required for road construction. No material difference between the two options for geotechnical/Stability	Smaller development footprint which leads to a reduction in spoil volumes to be excavated. No material difference between the two options for geotechnical/Stability
Hydrology and Hydrogeology	No material difference between the two options	No material difference between the two options
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 due to fewer plant on site and shorter construction phase
Climate	No material difference between the two options	No material difference between the two options
Noise & Vibration	Potential for increased noise impacts on nearby sensitive properties during the construction of the new roads.	Potential for less noise impacts on nearby sensitive properties during the construction of the road upgrades.
Cultural Heritage & Archaeology	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 properties due to the presence of additional plant on site during the construction phase to excavate and construct a new road layout.	There will be a slight reduction in potential for visual impacts during the construction phase due to the decreased presence of plant on site.
Material Assets	Potential for greater traffic movements on site during construction phase due to larger development footprint	Smaller development footprint results in a reduced construction traffic movements

Environmental Consideration	New Road Network	Use and Upgrade/Resurface of Existing Site Tracks/Local Roads
	Greater potential for impacts on waste management due to increased plant on site giving rise to increase in hazardous waste materials. No material difference between the two options in potential for impact on gas, water, telecommunications aviation assets.	on site due to smaller development footprint. No material difference between the two options in potential for impact on gas, water, telecommunications aviation assets.
Vulnerability to Major Accidents Natural Disasters	No material difference between the two options	No material difference between the two options

3.2.5.4 Alternative Construction Compound Option

One temporary construction compound will be used for the storage of all construction materials staff facilities and car-parking areas for staff for the Proposed Wind Farm. The temporary compound is located in the northwest of the Site near the temporary abnormal load entrance and general construction entrance. This will result in shorter distances for traffic movements within the Site during construction. As a result, vehicle emissions and the potential for dust arising will be reduced. A second temporary construction compound is proposed adjacent to the onsite substation. Please see section 3.2.6 for details on the Proposed Grid Connection.

The temporary construction compound is located in an agricultural field of low ecological value, screened from sensitive properties to the north by a hawthorn hedgerow, also of low ecological value. Earlier design iterations included siting this compound in an adjacent field to the to the north of this final location. However, there was potential for greater visual impact on sensitive properties to the northwest. Due to the low environmental sensitivities of the area, all other comparative factors with the earlier and final temporary compound locations are assessed as the same, i.e., no material difference when compared with each other. A comparison of the potential environmental effects of constructing one larger compound when compared against the use of two compounds is presented in Table 3-6 below.

Table 3-6 Comparison of environmental effects when compared against the initial and final temporary compound location.

Environmental Consideration	Initial temporary compound location	Final temporary compound location
Population & Human Health	Potential for increased impact on residential amenity due to increased visibility of construction compound during the construction phase	Reduced potential for impact on residential amenity due to screening of final temporary compound location by a hawthorn hedgerow to the north.
Biodiversity & Ornithology	No Material difference between the two options	No Material difference between the two options
Land, Soils & Geology ***Geotechnical/Stability***	No Material difference between the two options	No Material difference between the two options

Environmental Consideration	Initial temporary compound location	Final temporary compound location
Hydrology and Hydrogeology	No Material difference between the two options	No Material difference between the two options
Air Quality	No Material difference between the two options	No Material difference between the two options
Climate	No Material difference between the two options	No Material difference between the two options
Noise & Vibration	Slight potential for increased noise impacts on sensitive properties due to lack of vegetation screening. Overall, no significant environmental difference between the two options.	Slight temporary reduction in noise emissions due to screening provide by hedgerow to the north of the compound. Overall, no material environmental difference between the two options.
Cultural Heritage & Archaeology	No Material difference between the two options	No Material difference between the two options
Landscape & Visual	Slight potential for increased visual impacts during the construction phase due to open views from nearby sensitive properties to the temporary construction compound. Overall, no material environmental difference between the two options.	Slight potential for decreased visual impacts during the construction phase due to closed views from sensitive properties to the temporary construction compound due to the presence of vegetation screening between the houses and the compound. Overall, no material environmental difference between the two options.
Material Assets	No Material difference between the two options	No Material difference between the two options
Vulnerability to Major Accidents Natural Disasters	No Material difference between the two options	No Material difference between the two options

3.2.5.5 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 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 geotechnical experts, Hydro Environmental Services and Danu Energy Consulting Ltd. 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 properties.

Arising from this process, 2 no. test pit locations were selected near T1 and T2 in the northern portion of the Site. Trial pits were undertaken at these locations followed by borehole drilling at 1 no. location to determine a potential suitable location for a borrow pit. The findings of the geological site investigations concluded in the identification of 1 no. borrow pit (24,351m^2) within the Site with a potential of providing

71,567m^3 of construction stone material for the Proposed Project. Please see Figure 4-1 for borrow pit location and Figure 4-17 and Figure 4-18 for cross section details. The extraction of material from the borrow pit will be during the construction phase of the Proposed Project only and will be a temporary operation carried out over a short period of time. Rock breaking and blasting are potential methods of 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 estimated maximum volume to be extracted from the borrow pit for the Proposed Wind Farm is up to 70,000m^3 with an additional 20,000m^3 to come from licenced quarries within 20km (please see Figure 4-19 for details). 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 (approx. 20,000m^3). The materials required for the Proposed Grid Connection will also be imported from licenced quarries (approx. 17,700m^3). There are approx. 15 no. licenced quarries located within 20 km of the Site which have been selected for the purposes of assessment throughout this EIAR. The locations of these quarries are shown in Figure 4-19.

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 Site. The movement of the volume of material required for the construction of 9 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 an 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 of sourcing all materials off site when compared against the chosen option – onsite borrow pit and offsite quarries.

Environmental Consideration	Sourcing all stone from local, off-site quarries	Use of onsite borrow pit along with offsite quarries
Population & Human Health (incl. Shadow Flicker)	Potential for increased vehicular, noise and dust emissions from increased traffic movements, 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 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 properties, 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 Biodiversity chapter, this is habitat of low ecological value which is comprises the majoring of the site and surrounding landscape. Furthermore, the borrow pit will be left to naturally revegetate post construction. The Proposed Project includes for a biodiversity net gain proposal providing a local boost to biodiversity and water quality. Please see Appendix 6-4 for details.

Environmental Consideration	Sourcing all stone from local, off-site quarries	Use of onsite borrow pit along with offsite quarries
Land, Soils & Geology Geotechnical/Stability	Slight reduction in spoil to be excavated, however, additional spoil placement areas would be required as an on-site borrow pit would not be available for the placement of excavated spoil. No Material difference between the two options in relation to geotechnical and stability concerns. Geotechnical investigations followed by careful design would lead to no significant environmental impacts.	Reduction in requirement for spoil placement areas. No Material difference between the two options in relation to geotechnical and stability concerns. Geotechnical investigations followed by careful design would lead to no significant environmental impacts.
Hydrology and Hydrogeology	No Material difference between the two options	No Material difference between the two options
Air Quality	Potential for increased vehicular and dust emissions from increased traffic movements within the site, due to the volume of rock to be excavated.	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	There is no material difference on climate between either option.	There is no material difference between either option.
Noise & Vibration	Increased potential for noise and vibration effects on local sensitive properties due to arrival and departure of heavy goods vehicles during the construction phase and reduced potential for noise and vibration effects on local sensitive properties due to no breaking or crushing of materials won from onsite borrow pit.	Potential for less noise impacts on nearby sensitive properties during the construction of the road upgrades.
Landscape & Visual	Reduced landscape and visual effects temporarily as no open rock face would be visible from certain viewpoints. Increased visual impact due to frequent arrival and departure of HGVs to and from the Site.	Potential for increased landscape and visual effects temporarily due to open rock face which may be visible from certain viewpoints. However, there would be a reduced HGV presence on site and on the local road network as a portion of the materials will be won onsite. Furthermore, the borrow pit will be reinstated onsite once exhausted.
Cultural Heritage & Archaeology	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.
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.	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

Environmental Consideration	Sourcing all stone from local, off-site quarries	Use of onsite borrow pit along with offsite quarries
	No material difference between the two options in potential for impact on waste management, telecoms, aviation, electricity, water or gas.	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.
Vulnerability to Major Accidents Natural Disasters	No Material difference between the two options	No Material difference between the two options

3.2.5.6 Alternative Turbine Component Delivery Option

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.

3.2.5.6.1 *Alternative Ports of Entry*

The ports considered for the port of entry of wind turbine components into Ireland for the Proposed Wind Farm include Dublin, Shannon-Foynes Port, County Limerick, Cork and the Port of Galway. Shannon Foynes Port is the principal deepwater facility on the Shannon Estuary and caters for dry bulk, break bulk, liquid, and project cargoes. The Port of Galway also offers a roll-on roll-off procedure to facilitate import of wind turbine components. 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 four ports utilising the motorway network to the proposed haul route to the site. Regardless of which port is chosen, the components will approach the Site via the M7 to the north (including Cork via the M8 to avoid travelling through Thurles), given the Site's proximity to the M7 and the N62 which runs along its western boundary. For the purpose of this EIAR, the port of Dublin was selected as the port of entry for the proposed turbines and has been assessed in detail in Chapter 15 of this EIAR.

3.2.5.6.2 *Alternative Component Delivery Route*

The Site is located approx. 9.4km south of the M7/N62 junction and the N62 runs north-south along its western boundary, as such, turbine components have a relatively direct route from Dublin Port to Site via motorways and a national road without the need for regional or smaller local roads. Therefore, the Dublin Port-M7 -N62 route was put forward for further investigation at the commencement of the Site selection process. After review by the Traffic Consultant and subsequent autotrack assessment, it was concluded that this route will require minimal accommodating works, avoids towns, villages and third party landtake to facilitate the delivery of abnormal loads to the Site. Furthermore, it has a low potential for traffic disruption and prolonged noise or emissions. Therefore, the optimal delivery route is one that utilises the M7 and N62 and consequently, alternative component delivery routes from the motorway to the site were not investigated further.

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 15.2 Material Assets- Traffic and Transport for further details.

3.2.5.6.3 *Alternative Site Access Points*

Abnormal Load Entrances

Following discussion with Tipperary County Council, it was concluded that a separate entrance for abnormal loads would be constructed at the Site with all other Heavy Goods Vehicles (HGVs) and construction phase vehicles using a separate entrance. The abnormal load entrance will be temporary in nature and will be reinstated once all turbine components are delivered. This is to ensure no impacts occur on traffic flow on the adjacent N62. Given the Site's proximity to the M7 and the N62 adjacent to the west, the most logical access point for abnormal loads is considered to be the along the western boundary of the Site. An autotrack assessment confirmed the suitability of the northwestern boundary for abnormal load entry with minimal landtake requirements and minimal environmental impacts. An alternative to this was to take the abnormal loads up the L-3428 into existing farm entrances located approximately 50m and 700m from the N62, or via a new general construction access point. However, due to the necessary land take requirements, inadequate sightlines and the potential for noise, dust and traffic impacts on sensitive properties, this option was ruled out. Another alternative was to insert a new abnormal load entrance on the N62; however, in order to comply with TII requirements, a new temporary entrance was not inserted on the national road.

General Construction and Operation

There are a number of existing access points to the Site. These comprise private farm access points off the N62, the L-3248, the L-7039 and the L-70391. An initial review of these existing locations was carried out to identify the most suitable locations for wind farm construction and operation site entrances.

The existing entrances off the L-3248 approximately 50m from the N62 was deemed unsuitable due to the lack of adequate sightlines.

The existing farm entrance on the L-3248 approximately 700m from the N62 was ruled out due to the requirement to bring traffic past several residential properties giving rise to potential dust, noise and traffic impacts.

Therefore a new site entrance off the L-3248 approximately 70m from the N62 which has achieved the necessary sightlines is proposed for both general construction and operation, adjacent to an existing farm entrance. An alternative to was to insert a new entrance on the N62; however, in order to comply with TII requirements, a new entrance, temporary or permanent, was not inserted on the national road.

The existing site entrance at the L-70391 was considered suitable for construction traffic and as an operational entrance for maintenance staff, Eirgrid (for substation access) and for continued farm access.

3.2.6 Alternative Grid Connection Design Options

3.2.6.1 Alternative Substation Location

Two proposed substation locations were investigated for the Proposed Project, one in the northwest of the Site and an alternative option in the southwest. The northwest substation option (with temporary construction compound) was located approx. 400m in from the proposed general construction/operation entrance off the L-3248. The second location option was in the field immediately north of the L70391 in the southeast of the Site.

The northwestern substation option was located within a 50m watercourse buffer, 3.4km northwest of the existing 110kV overhead line. The southeastern substation option is not located within a watercourse buffer and is approx. 1.4km from the existing 110kV line (as the crow flies), therefore requiring a considerably shorter underground cabling grid route connection. Furthermore, it was not located within a watercourse buffer. As such, the southeastern substation location was considered the optimal location. Please see Table 3-8 for a comparison of effects between the northwestern substation location option and the selected southeastern substation location option.

Table 3-8 Comparison of environmental effects locating the proposed Substation in the northwest against the chosen option of locating it in the southeast.

Environmental Consideration	Northwest Substation Location	Southeast Substation Location
Population & Human Health	No material difference between the two options	No material difference between the two options
Biodiversity & Ornithology	No material difference between the two options	No material difference between the two options The Proposed Project includes for a biodiversity net gain proposal providing a local boost to biodiversity and water quality. Please see Appendix 6-4 for details.
Land, Soils & Geology ***Geotechnical/Stability***	Excavation for cabling route to substation would be considerably longer, requiring more spoil management. No material difference between the two options in terms of geotechnical/Stability concerns	Less ground disturbance due to shorter cabling route, therefore smaller spoil management requirements, No material difference between the two options in terms of geotechnical/Stability concerns
Hydrology and Hydrogeology	No material difference between the two options	No material difference between the two options
Air Quality	Potential for increased dust emissions due to additional ground disturbance with the longer cable route to substation	Reduced potential for emissions due to shorter grid connection route.
Climate	There is no material difference on climate between either option.	There is no material environmental effect difference between either option.
Noise & Vibration	Potential for increased noise impacts on nearby sensitive properties during the excavation of the longer cable route	Potential for less noise impacts on nearby sensitive properties during the shorter excavation of the internal grid route. There will be no significant effects on sensitive properties during the construction and operation of the Proposed Grid Connection.
Cultural Heritage & Archaeology	Longer cable route requires more excavation works. Increased the potential for impacts on unrecorded, subsurface archaeology.	Smaller development footprint would decrease the potential for impacts on unrecorded, subsurface archaeology.

Environmental Consideration	Northwest Substation Location	Southeast Substation Location
Landscape & Visual	Longer cable route may result in plant being on site for a longer period which may impact on residential amenity but overall, no material difference on Landscape & Visual between either option	There is no material environmental effect difference between both options considered.
Material Assets	Potential for greater traffic volumes during construction phase due to larger development footprint. No material difference between the two options in potential for impact on utilities waste management, telecoms, aviation.	Smaller grid connection route results in a reduced requirement for plant onsite therefore reduced traffic volume and traffic impact across a greater extent of the public road network. Smaller development footprint would require less aggregate material to be brought in from surrounding quarries during construction and less spoil to be moved around the Site. No material difference between the two options in potential for impact on utilities waste management, telecoms, aviation.
Vulnerability to Major Accidents Natural Disasters	No Material difference between the two options	No Material difference between the two options

3.2.6.2 Alternative National Grid Connection Point

The Megawatt (MW) output of the Site is such that it needs to connect to the grid at 110kV. The nearest 110kV infrastructure is the 110kV Ikerrin to Thurles overhead line which connects into the Ikerrin substation 8.6km (as the crow flies) to the north and the Thurles substation 14km (as the crow flies) to the south, respectively.

An alternative to connecting to the 110kV Ikerrin to Thurles overhead line approximately 1.4km east of the Site, would be to connect to either of the aforementioned substations via underground cabling or overhead line.

A review of an underground grid connection cable route or overhead grid connection cable route to these two substations concluded that there would be disturbance to traffic and transport (20km in national, regional and local roads for a connection to Ikerrin 110kV substation and 32km in national, regional and local roads for a connection to Thurles 110kV substation), and as a consequence, residential amenity, and/or the potential for bird collision risk and visual impacts from overhead lines, combined with the need for considerable costs and materials.

The Tipperary Renewable Energy Strategy 2022-2028 acknowledges that '*the transport of energy from the turbines to a substation, which connects to the grid, will usually require the establishment of ancillary infrastructure which may create additional visual impact. Generally, however, the connection of the wind*

turbines to the substation (and sometimes from the substation to the grid) now typically is done via underground cable (where feasible), thus minimising the visual impact of overhead lines.'[2]

Furthermore, consultation with Tipperary County Council indicated that their preferred option is to not utilise the road network for grid connection cable routes if an alternative, namely third-party land is available. Due to the considerable number of landowners that would be required to provide land for a 20km or 32km underground grid connection cable route, it was not possible to secure agreements with all landowners. As such, underground grid connection cable routes to the Ikerrin and Thurles 110kV substations were not considered further.

Therefore, most logical and optimal national grid connection point is via the existing 110kV line located 1.4km to the east of the Proposed Wind Farm in private land for which agreements are in place. This option requires just 870m of underground cabling route through a local road and 1.2km through private agricultural land. While segments of this road will be closed during the cable laying activities, it will not significantly impact on local residences along this road as there is an alternative route for access/egress to their properties.

3.2.6.3 Alternative Connection to Existing 110kV Overhead Line

A key consideration in determining the grid connection method for a proposed wind energy development is whether the cabling is undergrounded or run as an overhead line. As discussed above, it is proposed to construct an underground cable route connection between the Site and the existing 110kV Ikerrin to Thurles overhead line. The grid connection cable route from the proposed onsite substation to the national grid will be via a c.2km underground cabling route which will run through a mix of local road (L-7039) and agricultural land. This underground cabling route connection requires crossing 2 no. watercourses, one within the L7039 which will be crossed via a Directional Drilling method and the second crossing will be crossed within private agricultural land via a clear span culvert i.e., no instream works are proposed In addition, 3 no. field drains will require culverts. Please see chapter 4 for watercourse crossing methodologies. The existing overhead line will be broken with 2 no. new end masts (lattice-type towers) to facilitate the connection to the proposed onsite substation via the underground electricity cabling route. The two proposed end masts will be located adjacent to existing masts and therefore, no new landform will be introduced. Once constructed, electricity on the Ikerrin-Thurles 110kV overhead line will be transmitted through the proposed substation, hence the 'loop-in/loop-out' nature of the proposed substation.

An alternative to the c.2km underground cabling route would be to construct an approx. 1.4km overhead line from the proposed onsite substation to the existing Ikerrin to Thurles 110kV overhead line. While overhead lines 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. Furthermore, as discussed above, the preference for underground cabling connection between wind farms and the national grid is referenced in the 2006 WEDGs and the 2019 draft WEDGs and the Tipperary Renewable Energy Strategy 2022-2028.

The chosen underground electrical cabling route will follow a mix of existing public roads and new track across private land, thereby minimising the use of public roads, and will have a reduced permanent visual impact due to the placement of the cable route underground, with just 2 no. masts erected above ground adjacent to existing masts, forming part of the existing overhead line.

[2] *Tipperary County Development Plan 2022 – 2028 Appendix 2 Renewable Energy Strategy, p. 25.*

Table 3-9 Comparison of environmental impacts for overhead line verses the chosen option- 870m underground cable connection route through local roads and 1.2km in third party land.

Environmental Consideration	1.4km Overhead Grid Connection Line	2km Underground Cable Connection Route
Population & Human Health	Potential for permanent visual impacts due to overhead line and tower masts required. Potential for temporary visual impact from presentence of plant machinery onsite during the construction period. Potential for temporary noise and dust impacts from plant machinery onsite during construction phase	No potential for permanent visual impacts from 2km grid route as it will all be contained underground. Potential for temporary visual impact from presentence of plant machinery onsite during the construction period. Potential for temporary noise and dust impacts from plant machinery onsite during construction phase
Biodiversity & Ornithology	Potential for collision risk due to presence of permanent overhead lines. Additional habitat loss with footprint of masts required to hold up lines.	Reduced potential for collision risk The Proposed Project includes for a biodiversity net gain proposal providing a local boost to biodiversity and water quality. Please see Appendix 6-4 for details.
Land, Soils & Geology ***Geotechnical/Stability***	Reduced ground disturbance as just excavations for masts only will be required. Geotechnical investigations followed by careful design would lead to no significant environmental impacts	Increased ground disturbance however, grid route excavations will be backfilled.
Hydrology and Hydrogeology	No material difference between the two options	No material difference between the two options
Air Quality	Onsite plant and ground disturbance during construction phase during excavation will lead to dust emissions. Potential for reduced dust emissions due to reduced ground disturbance	Increased potential for temporary emissions due to ground disturbance for the underground grid connection route.
Climate	No material difference between the two options	No material difference between the two options.
Noise & Vibration	Potential for decreased noise impacts on nearby sensitive properties during the excavation of mast foundations in comparison to the excavation of the grid route.	Potential for increase noise impacts on nearby sensitive properties during the excavation of the grid connecting route.
Cultural Heritage & Archaeology	Less ground disturbance, therefore, decreased potential for impacts on unrecorded, subsurface archaeology.	More ground disturbance due to 1.2km of the grid route in third party land.
Landscape & Visual	Increased potential for permanent landscape and visual impact due to the	No potential for permanent visual impacts from overhead lines or several permanent

Environmental Consideration	1.4km Overhead Grid Connection Line	2km Underground Cable Connection Route
	presence of overhead lines and several supporting tower masts.	masts along its route. There will be just 2 proposed end masts adjacent to the existing overhead line and masts.
Material Assets	Reduced potential for traffic impacts as grid route will not be placed in roadbed. No material difference between the two options in potential for impact on utilities, waste management, telecoms, aviation.	Increased potential for traffic impacts due to laying of grid cables in road. No material difference between the two options in potential for impact on utilities, waste management, telecoms, aviation.
Vulnerability to Major Accidents Natural Disasters	No material difference between the two options	No material difference between the two options

3.2.7 Alternative Mitigation Measures

Mitigation by avoidance has been a key aspect of the Proposed Project's evolution through the selection and design process. Avoidance of the ecologically sensitive areas of 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, this has been mitigated with habitat replacement and enhancement proposals.

It is proposed to replant approximately 1.8 hectares of natural woodland within the Site along a segment of the Eastwood River. This replanting of natural woodland is considerably more than its habitat loss and will be retained for the lifetime of the Proposed Wind Farm as a Woodland Conservation Area. This replanting will have a **long-term slight positive effect** on biodiversity. Approximately 2.42 hectares of felled conifer will be replanted at greater than 10km from the Site and also outside the hydrological catchment within which the Site is located.

Approximately, 5.17km of hedgerow will be planted within the Site, greater than the required removal length to accommodate the development footprint. This will have a **long-term slight positive effect** on bat foraging habitats and biodiversity. The alternative to the above proposals is to encroach on the environmentally sensitive areas of the Site and accept the potential environmental effects and risk associated with this.

In addition to the above, the Applicant has committed to restore the pattern, profile and dimensions of a 340m segment of the Eastwood River. This will also have a **long-term slight positive effect** on water quality aquatic species locally. Please see Chapter 6 Biodiversity and Appendix 6-4 Biodiversity Management and Enhancement Plan for details on habitat enhancement and biodiversity net gain associated with the Proposed Project.

The best practice design and mitigation measures set out in this EIAR will contribute to reducing any environmental 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 are sustainable.