3. CONSIDERATION OF REASONABLE ALTERNATIVES

3.1 INTRODUCTION

This chapter of the Environmental Impact Assessment Report (EIAR) contains a description of the reasonable alternatives that were studied which are relevant to the proposed project and its specific characteristics and provides an indication of the main reasons for the option chosen, taking into account the effects of the proposed project on the environment.

In 2014, Environmental Impact Assessment (EIA) Directive 2011/92/EU was amended by Directive 2014/52/EU (the "EIA Directive"). Article 5, relating to the preparation of an EIAR by the developer, was amended to state the following should be included regarding alternatives:

"…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)(d)).

This is further reinforced in Annex IV (Information Referred to in Article 5(1) (Information for the EIAR) of the **EIA Directive** states that:

"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."

The Environmental Impact Assessment of Projects - Guidance on the preparation of the Environmental Impact Assessment Report (European Union, 2017) states that reasonable alternatives

"must be relevant to the proposed project and its specific characteristics, and resources should only be spent on assessing these alternatives" and 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"*[1].

In addition as noted by the Environmental Protection Agency (EPA) in the Guidelines on the Information to be Contained in EIARs (May 2022) *"Analysis of high-level or sectoral strategic alternatives cannot reasonably be expected within a project level EIAR"* and *"that the amended Directive refers to 'reasonable alternatives… which are relevant to the proposed project and its specific characteristics'*[2]".

The EPA EIAR Guidelines (2022) also stipulates in Section 3.4 (consideration of alternatives) that *'The presentation and consideration of the various alternatives investigated by the developer is an important requirement of the EIA process'.*

The alternatives may include:

- Alternative locations;
- Alternative designs; and

[1] https://ec.europa.eu/environment/eia/pdf/EIA_guidance_EIA_report_final.pdf
[2] https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf

- Alternative processes.

This chapter provides information on the consideration of alternatives, including 'do nothing' / future baseline (Section 3.3.1), alternative locations (Section 3.3.2), alternative design and layout, (Section 3.3.3), and alternative technology (Section 3.3.4), amongst other alternative considerations discussed below.

3.1.1 Statement of Authority

This chapter was prepared John Dillon of TOBIN. John has 18 years of experience in geological assessment for EIS/EIA. John also has experience in the assessment, supervision and project managing of renewable energy projects.

This chapter was reviewed by Orla Fitzpatrick, Technical Director in TOBIN. Orla has twenty years' experience working in the delivery of EIA projects in environmental consultancy. She is a Chartered Environmentalist and has considerable experience as technical approver of environmental deliverables for major infrastructure projects including wind farm projects. She acted as technical approved for such projects as Cloghercor Wind Farm, Scart Mountain Wind Farm and Derryadd Wind Farm.

3.2 METHODOLOGY

3.2.1 Standards and Guidance Documents

The following documents and guidance were reviewed in the preparation of this chapter:

- Environmental Protection Agency (EPA), Guidelines on the Information to be contained in Environmental Impact Assessment Reports (2022);
- Environmental Impact Assessment of Projects - Guidance on the preparation of the Environmental Impact Assessment Report (European Union, 2017);
- Transposition of 2014 EIA Directive in the Land Use Planning and EPA Licencing Systems (DoHPCLG, 2017); and
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (Department of Housing, Planning and Local Government (now referred to as the Department of Housing, Local Government and Heritage), 2018).

Consideration was also given to the following as part of the literature review:

- Best Practice Guidelines for the Irish Wind Energy Industry (IWEA, 2012).

3.3 SITE SELECTION AND ALTERNATIVES CONSIDERED

In accordance with the EIA Directive, taking into account the above standards and guidance documents listed, and in accordance with best practice in our professional experience, including the EPA EIAR Guidelines (2022) this chapter addresses alternatives under the following headings:

- 'Do Nothing/Future Baseline' Option, i.e. without the proposed project proceeding;
- Site Selection;

- Alternative Layouts/ Design;
- Alternative Technology;
- Alternative Mitigation Measures.

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

3.3.1 Do Nothing / 'Future Baseline' Option/Alternative

The "Future Baseline" scenario is not to develop the proposed project and to leave the existing environment as it is, with changes made to the current land-use practices. In such a scenario, the prospect of capturing a valuable renewable energy resource would be lost and as a result the opportunity to contribute to meeting Government and EU targets to produce electricity from renewable resources and the reduction of greenhouse gas emissions would also be lost. Furthermore, the chance to generate additional local employment and investment would not occur, the local economy would remain less diverse and continue to rely primarily on agriculture and forestry as its main source of income.

The 2009 EU Renewable Energy Directive (2009/28/ EC) set Ireland a legally binding target to meet 16% of our energy requirements from renewable sources by 2020. In 2018, the Directive was recast (2018/2001/EU) to move the legal framework to 2030 targets, setting a new binding target of at least 32% with a clause for a possible upwards revision by 2023. At that time Ireland was committed to meeting 40% of electricity demand from renewable sources, with 10% for transport and 12% for heat. It is now established that Ireland has not met the 2020 renewable energy targets. Under the 'Future Baseline scenario', there will be no opportunity to provide additional renewable energy into the electricity grid.

Under the 2025 Climate Action Plan, which is discussed further in Chapter 4 of this EIAR (Policy Planning and Development), the following targets have been set out:

- Increase electricity generated from renewable sources to 80% by 2030, indicatively comprised of:
    - At least 5 GW of offshore renewable energy;
    - Up to 8 GW of solar photovoltaic (PV) energy; and
    - Up to 9 GW of onshore wind capacity.

Under the "Future Baseline" scenario, the proposed project would not go ahead, the development of Wind Turbine Generators (WTGs) would not be pursued, and all lands associated with the proposed project would continue current uses primarily agriculture, forestry and turbary (turf cutting). The prospect of creating sustainable energy would be lost at the proposed wind farm site. The nation's ability to produce sustainable energy and reduce greenhouse gas emissions to meet EU targets and targets set out in the Climate Action Plan (2025) would be reduced.

Over the 35-year life of the proposed wind farm it is anticipated that 1.75 million tonnes of carbon will be offset in the production of electricity, which would otherwise be released to the atmosphere through the burning of fossil fuels in the "Future Baseline" scenario. Importation and use of fossil fuels would continue, and Ireland's energy security would remain vulnerable.

According to EirGrid Group's All-island Generation Capacity Statement 2021 – 2030, the growth in energy demand for the next ten years will be between 18% (low demand scenario) and 43% (high demand scenario). In addition, the proposed project will provide employment both in the local area and to the wider economy through the construction and operational phases as described in Chapter 5 (Population and Human Health). It will also provide investment in the local community in terms of community benefit fund. Under the 'Future Baseline' scenario, the socio-economic benefits associated with the proposed project will be lost.

In the scenario where the proposed project does not proceed, 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 would be lost.

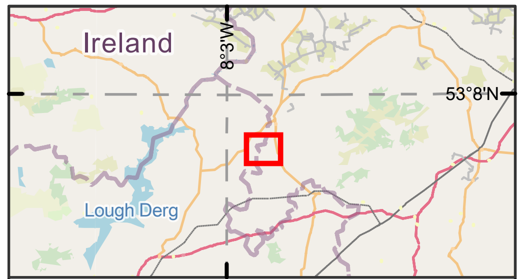
Table 3-1 Residual Effects of the proposd project in a Future Baseline scenario

Environmental Consideration	Do Nothing Alternative
Human Health and Population	No increase in employment as a result of the project. No long-term investment in sustainability in the locality. No long-term provision of a community benefit fund locally. No potential for construction, operation and decommissioning phase effects
Biodiversity	Agriculture would continue to be practiced as it currently is, with continued high levels of pressure on the potentially valuable habitats on the wind farm site. Forestry would continue to be clear-felled / managed as part of the ongoing forestry growth cycle. Due to the more extreme nature of current weather patterns, it is also likely that drought and heavy rainfall will continue to increase erosion. No potential for construction, operation or decommissioning phase effects associated with the wind farm and associated infrastructure. Continued turbary cutting at T4 and loss of degraded raised bog.
Ornithology	The existing environment of cutover bog, raised bog, scrub, improved agricultural land, commercial forestry and natural woodlands would continue to be managed as they are. The presence of bird species within and surrounding the proposed wind farm site would likely remain as they currently are.
Land, Soils and Geology	Forestry, turf cutting and agricultural works will be carried out. No potential for construction, operation or decommissioning phase effects. Continued turbary cutting at T4 and loss of degraded raised bog.
Hydrology and Hydrogeology	Forestry and agricultural works will be carried out as required. No potential for construction, operation or decommissioning phase effects.

Environmental Consideration	Do Nothing Alternative
Shadow Flicker	No potential for shadow flicker, however, the Applicant has committed to near zero shadow flicker by adopting mitigation measures using control software subject to the time it takes for the turbine rotor to come to a safe stop (between 1 and 2 minutes (see Chapter 16 – Shadow Flicker).
Material Assets – Telecommunications & Aviation	No potential for significant effects on telecommunication links and flight activity in a do-nothing scenario.
Air Quality and Climate	Missed opportunity to contribute to the reduction of carbon and greenhouse gas emissions. No potential for construction, operation or decommissioning phase effects such as dust emissions.
Noise and Vibration	No potential for additional noise at nearby sensitive receptors.
Archaeology, Architecture and Cultural Heritage	No potential impacts on archaeology or local cultural heritage.
Landscape and Visual Impact	Existing landscape and visual amenity in the area will remain unchanged, though any cumulatively considered projects may continue to be built.
Traffic	No potential increased traffic volumes on regional or local roads. No works required in other areas for turbine delivery or grid connection.

3.3.2 Site Selection

The site selection process for wind farm development is guided by high-level plans, strategies and guidance such as Climate Action Plans and the 2006 Wind Energy Development Guidelines. These documents set out appropriate areas and development guidance for wind farm development which is considered at an early stage of site selection for wind energy projects.



Legend

- Wind Farm Site Boundary
- Proposed Grid Connection Route

Site Layout

- Proposed Turbine locations
- Proposed BESS
- Proposed Borrow Pit Locations
- Proposed Construction Compounds
- Deposition Areas
- Turbines Hardstands
- Met Mast Locations
- Overrun Area
- Proposed Passing Bay
- Proposed Site Roads
- Proposed Substation Location
- Turbine Foundations
- Turning areas
- Wheelwash

0 500 1,000
Meters

Spatial Reference
Datum: IRENET95
EPSG: 2157

Copyrights:
Microsoft, Vantor, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS

A	30/10/2025	Draft issue	S.P	J.D
Rev	Date	Description	By	Chkd.

Client: RWE

Project:

Ballincor Wind Farm

Title:

Figure 3-1:
Site Layout

Scale @ A3: 1:20,000

Prepared by: S.Pezzetta
Checked by: J.Dillon
Date: October 2025

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Map Ref: 11333-030-LAY..INFR-P.App.BO-TOB-A

Draft: A

The Applicant continuously examines the lands under their stewardship and otherwise for candidate sites for wind energy development. The following details the RWE Renewables Ireland Ltd. project screening and project selection process which illustrates in broad terms by which the Ballincor Farm site was identified for wind energy development. The process of site screening and project selection is undertaken in house by RWE's team of developers. The development team is made up of planners, engineers, project managers and environmental scientists ensuring that a holistic approach is undertaken during the screening and project selection process. RWE recognises the complexities associated with the development of renewable energy sites and has developed a large database of information that allows the company to identify and screen potential sites.

3.3.2.1 Initial Screening

RWE uses Geographical Information Spatial software (GIS), using a number of criteria and stages to assess the potential for wind energy development across the entire country of Ireland. This exercise utilises a large number of spatial datasets such as ordnance survey land data, house location data, transport, forestry data, existing wind energy and grid infrastructure data and environmental data such as ecological designations. This initial stage in the selection process discounted lands that were not available for development due to technical and/or environmental constraints.

3.3.2.2 Screening

For the assessment of candidate sites, a number of criteria were chosen which not only covered the broad range of considerations for wind farm development but also allowed for direct comparison of the candidate sites to each other to determine their relative suitability for wind farm development. The criteria includes:

- Available wind resource;
- Environmental constraints including low potential for impact on Natura 2000 and Nationally Designated Sites (SAC, SPA, NHA, pNHA) sites;
- Population density;
- Proximity to dwellings;
- Planning Policy;
- Archaeological features;
- Landscape and visual constraints;
- Reasonable access to the national electricity grid;
- Access route availability;
- Land Ownership title constraints;
- Sufficient area of unconstrained land that could potentially accommodate wind farm development and turbine spacing requirements.

3.3.2.3 Summary of the Site Selection Process

A screening process was conducted across the country in 2018, which identified a number of suitable sites, which were then taken forward for detailed assessment. As these sites have all been brought forward to planning (or are in that process), and are subject to EIA, a description of the reasonable alternatives studied which are relevant to each project and its specific characteristics, together with an indication of the main reasons for selecting the chosen option with regards to their environmental impacts, are provided in the EIAR accompanying the applications for same.

Sites that emerged from the 2018 site selection process, outlined above, for which planning applications have been submitted are as follows:

- Fahybeg, County Clare
- Shancloon, County Galway

As such, a description of the reasonable alternatives studied which are relevant to each project and its specific characteristics, together with an indication of the main reasons for selecting the chosen option with regard to their environmental impacts, is provided in the EIAR accompanying the planning application for each project

Sites that emerged from the 2018 site selection process, outlined above, for which are projects in their own right which will be subject to EIA are as follows:

- Muingmore, County Mayo
- Clooncunny, County Sligo

As such, a description of the reasonable alternatives studied which are relevant to each project and its specific characteristics, together with an indication of the main reasons for selecting the chosen option with regards to their environmental impacts, will be provided in the EIAR accompanying the applications for same.

This site was ultimately selected for development on the basis of:

- A viable connection to the electricity grid in close proximity to the Site;
- Favourable wind speed;
- Located in an area with a relatively low population density;
- Low intensity usage agricultural land which allows the current land use to continue in parallel with the proposed project.
- Located outside of areas designated for protection of ecological species and habitats.

3.3.3 Alternative Layouts / Designs

During the EIAR assessment stage, environmental surveys of the site of the proposed project were carried out to establish the baseline environment. All site constraints were identified and updated as further detailed assessment was undertaken. The locations of county roads, streams, residential dwellings, landowner boundaries, telecommunication links, ecologically sensitive areas, archaeological sites and visually sensitive areas were noted. Separation distances to identified constraints were determined using a Geographical Information System (GIS). The scoping and consultation exercises (statutory and non-statutory bodies and the public) also fed into the site layout/design (See Section 1.9 of Chapter 1 (Introduction)), where, for example, information about ecologically sensitive areas was provided by the National Parks and Wildlife Service which resulted in redesign of the WTG layout.

The site layout design stage considered the size, number and positioning of WTGs and layout of associated site infrastructure i.e. internal access tracks, temporary construction compounds, met masts, substations, BESS etc. Alternatives considered for each of these elements are documented in sections 3.3.3.1 to 3.3.3.4 and Figure 3-1 (pg. 6 above). It was an iterative process comprising input from the design team, environmental specialists, internal and external stakeholders. As an iterative process, environmental effects were reduced or eliminated through changes to the design, where possible.

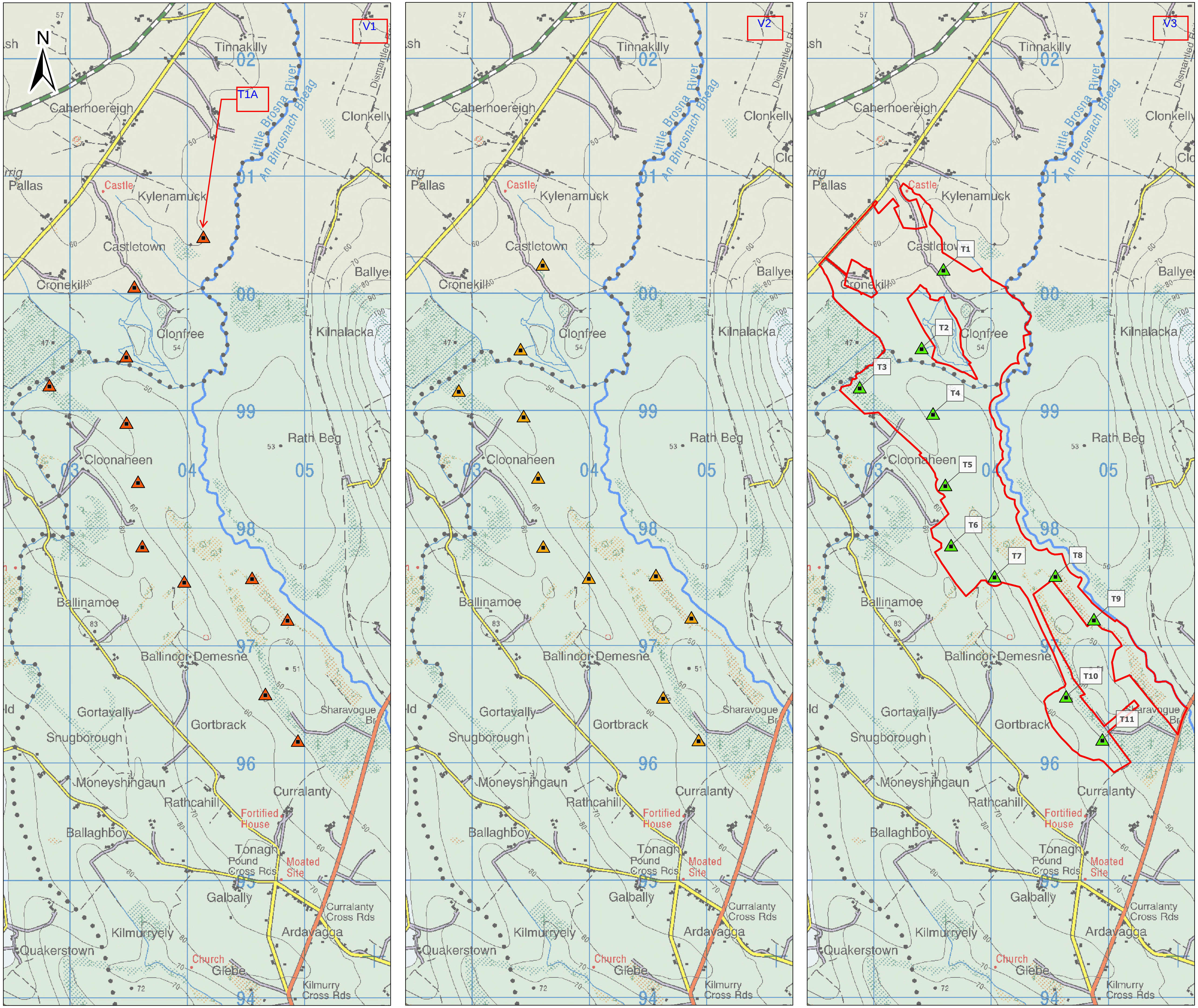
Constraints and environmental sensitivities were first identified, and buffers applied in order to determine a viable area within the site to accommodate development. The constraints identified and resulting design solutions are listed in Table 3-2 below.

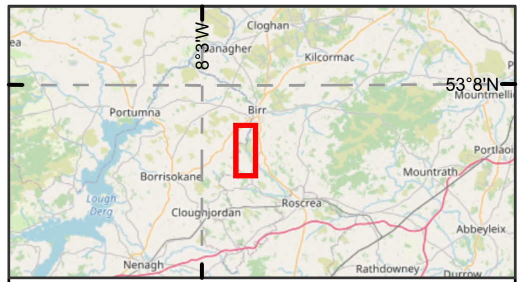
Table 3-2 Environmental Considerations

Environmental Consideration	Required Setback/Constraint	Design solutions
Residential Amenity	The existing 2006 Wind Energy Development Guidelines (WEDGs) do not have a prescribed minimum setback but indicate that a 500m setback distance should be sufficient. The 2019 Draft Revised WEDGs suggest 4 times tip height as a setback.	The proposed project designed to locate turbines as far as practicable from the site boundaries and the proposed layout has achieved a level of separation from dwellings that complies with the 2006 and draft 2019 WEDGs by providing a separation distance of 720m, with the exception of one involved landowner (550m). The closest non-involved dwelling is located 725m away from proposed WTG T11, which is more than 4x times the maximum tip height (in this case 4x 180m), in line with the setback requirements in the 2006 and Draft 2019 Guidelines.
Flora and Fauna	Mitigatory measures designed to avoid potential impacts on species and habitats.	The assessment of effects of the project on Flora and Fauna as outlined in Chapter 6 (Biodiversity) shows that the proposed project will have no significant effects on ecological features. Low biodiversity across the majority site, with part of the site occupied by conifer plantation, cutover peat, agricultural grassland and tillage. Consideration has been given to identify sensitive areas on the site (for example, raised bog and woodlands) and these areas will be avoided. In addition, a biodiversity enhancement plan (BEMP) is proposed.
Ornithology	Avoidance of foraging sites and roosting areas.	As per Chapter 7 (Ornithology), mitigation measures were designed to reduce significant

Environmental Consideration	Required Setback/Constraint	Design solutions
		effects to bird populations, including: • Turbine located to the north was removed from the site layout. • Construction Disturbance Mitigation. • Surface water mitigation to prevent habitat degradation and • Post Construction Monitoring These are described further in Chapter 7 (Ornithology).
Soils and Geology	Avoidance of shallow bedrock	Topography, along with the soils and underlying geology varies throughout the site. Bedrock is generally >5m on the wind farm site with the exception of T1. There is no evidence of peat instability on the site as a result of any previous activity. The proposed infrastructure was designed to avoid steep slopes and minimise construction in areas of deep peat. It is expected that stability risks can be fully mitigated through the adoption of construction and operational good practice.
Hydrology	Avoid impact on drainage regime.	In identifying and avoiding direct effects on drainage features the proposed project has implemented 'avoidance of impact' measures. An example include clear span structure of stream to avoid in stream works. The proposed wind is designed to avoid additional flood risk by incorporating drainage and flood compensation.
Water Quality	Minimum setback from rivers and streams and appropriate mitigation designed to avoid siltation and potential contamination from oils during construction.	There will be one watercourse crossing on the proposed windfarm site and three along GCR. A 50m setback from main infrastructure (WTGs, substation, borrow pits, compounds) to watercourses will be maintained. HDD utilised where sufficient area available on GCR route.

Environmental Consideration	Required Setback/Constraint	Design solutions
Noise and Vibration	The 2006 wind Energy guidelines states that 'a lower fixed limit of 45dB(A) or a maximum increase of 5dB(A) above background noise at nearby noise sensitive locations is considered appropriate to provide protection to wind energy development neighbours.' Similarly, these guidelines indicate "*A fixed limit of 43dB(A) will protect sleep inside properties during the night*."	As stated above a 720 m setback from nearby dwellings has been achieved with the exception of one involved landowner. The appropriate day and night noise limits will be adhered to by the proposed project, as described in Chapter 11 (Noise & Vibration).
Cultural Heritage	No direct impact on recorded archaeological monuments or architectural sites.	The final layout has been designed to ensure that there is no direct effects on recorded archaeological monuments or architectural sites.
Shadow Flicker	Near Zero shadow flicker.	The proposed project has committed to near Zero shadow flicker by adopting mitigation measures using control software, subject to the time it takes for the turbine rotor to come to a safe stop. This is compliant with the 2006 Wind Energy Guidelines and is in line with both the emerging best practice and the Draft Wind Energy Guidelines 2019. This is described in further detail in Chapter 16 (Shadow Flicker).
Material Assets	No significant effects to aviation in the area. Alteration required to low voltage (<38 kV) overhead lines and Eir radio link at T11. No gas or sewerage on the proposed wind farm. No significant effects on sewerage, waste management infrastructure or water supply.	Alternative radio link proposed for T11. It has also been found that the proposed project will have no significant effect on aviation related activities, due to the distance to the nearest operational airports.





Legend

- Wind Farm Site Boundary
- Turbines

0 0.5 1
Kilometers

Spatial Reference	Copyrights:
Datum: IRENET95 EPSG: 2157	© OpenStreetMap (and) contributors, CC-BY-SA

Rev	Date	Description	By	Chkd.
D01	18/09/2025	Draft issue	K.K	J.S

Client: RWE

Project:

Ballincor Wind Farm

Title:

Figure 3-2:
Site Layout Design History Map - Turbine Locations
V1-V3

Scale @ A3: 1:30,000

Prepared by:	Checked by:	Date:
K.Kale	J.Sherry	Sept 2025

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Map Ref: 11333-015-Dis-P.App.BO-TOB-A

Draft: D01

Within the viable area which emerged from the above constraint analysis three main alternative turbine layout options were considered throughout progressive stages of the design. These alternative designs / layouts are illustrated in Figure 3-2.

The location of individual WTGs is influenced by a range of design constraints. As information regarding the proposed site was compiled and assessed, the number of WTGs, size and location of WTGs were revised and amended to take account of the physical constraints of the site and the requirement for buffer zones and other areas which were not favourable for WTG locations for reasons such as consideration of neighbours, visual constraints, noise constraints, ecological constraints, etc.

The proposed WTG layout has been optimised using appropriate wind farm design software to optimise the energy yield from the site, while maintaining sufficient distances between the proposed WTGs to ensure turbulence and wake effects do not compromise WTG performance. Development of the final proposed wind farm layout has resulted from feedback from assessments carried out during preparation of this EIAR, and feedback received during the scoping and consultation exercises described in Chapter 1 (Introduction) (See Appendix 1-3).

As previously mentioned, consideration was also given to relevant guidance, namely the current WEDGs (2006), the IWEA Guidelines (2012), the EPA EIAR Guidelines (2022) and guidelines and recommendations from the relevant local authority's county development plans and wind energy strategies. Cognisance was also taken of the Draft Revised WEDGs (DoEHLG, 2019), with regards to setback distances to dwellings.

The initial constraints study identified viable areas within the proposed development site, in which potential WTG layouts were developed. These WTG layouts were then refined a number of times following feedback from the project team during detailed site investigations and from consultees. At the initial stage, a project design was drafted (12 turbines) which would maximise the wind energy potential of the site, but this was modified.

The resulting draft layout consisted of 11 no. WTGs with initial distances to houses of >500m – See Figure 3-2. This layout was based on WTG tip height of between 179.5m and 180m, rotor diameter of between 149m and 163m. This layout maximised the available area within the proposed wind farm site whilst staying out of areas constrained for various reasons (neighbouring dwellings, telecommunications links, sensitive biodiversity areas, etc.).

The layout was the subject of a design review by Landscape & Visual specialist consultants Macroworks and TOBIN. This review was focussed on landscape and visual effects while also considering the feedback received from the public consultation. The review considered draft photomontages from several different locations. These locations were selected as a combination of the most sensitive views, population centres and fullest views of the project. This review informed the next iteration of layout design.

A meeting was held with An Coimisiún Pleanála on the 7th May 2025, which was attended by the Applicant and TOBIN representatives, an update regarding the proposed project was given to the An Coimisiún Pleanála. The details for which design flexibility was requested for the proposed project were also discussed. This related to the range of proposed turbine dimensions (tip height, rotor diameter and hub height).

Table 3-3 Layout Design Changes

	Initial 12 no. turbine Consideration	11 no. turbine Consideration	Current 11 Design Proposal
Distance to houses	>500 m	>700 m	>720 m
Shadow Flicker	none	none	none
No. of Turbines	12	11	11
Turbine Height	180 m	179.5-180 m	179.5-180 m
Potential Output	Between 67.2-84 MW	Between 61.6-77 MW	Between 61.6–77 MW

*Note – refer to Figure 3-2

The three turbine types are considered as part of a design flex application to An Coimisiún Pleanála as detailed in Chapter 4 (Policy, Planning and Development Context). The adjustments through each layout iteration resulted in placement changes to turbines to ensure sufficient distances were maintained from sensitive receptors and constraints, and to maintain the required separation distances between turbines. The potential environmental effects of the initial layout (12 no. turbines) and the second/third layout (11 no. turbines) when compared with the current proposed project are provided in Table 3-4 below.

Table 3-4 Table of environmental effects relative to proposed design layout of 11 no. turbines

Environmental Consideration	Initial Consideration – 12 turbines	Design iteration 2/3– 11 turbines
Human Health and Population	Potential for increased effect on sensitive receptors due to closer proximity to some turbines	Similar Effects compared to first design iteration.
Biodiversity and Ornithology	Larger infrastructure footprint results in an increased potential for effects on habitats. Larger number of turbines leads to potential for increased effect to bat and bird populations.	Turbine 1A to the northeast of T1 was removed from consideration as a precautionary avoidance area where whooper swans were noted to occasionally feed in winter months. This layout is preferred where lands to the north are avoided due to the presence of feeding and roosting areas for wintering waterfowl and wader, some of which are associated with nearby designated European sites.
Land, Soils and Geology	Higher number of turbines will give rise to more excavations and disturbance of soil onsite, in addition to requiring more crushed stone for construction. This would therefore have an increased effect.	Reduced level of soils disturbance and use of resources.

Environmental Consideration	Initial Consideration – 12 turbines	Design iteration 2/3– 11 turbines
Hydrology and Hydrogeology	Higher number of turbines will give rise to more excavations and disturbance of soil onsite. This would therefore have an increased effect. One Turbine location are <50m from stream	Reduced level of soils disturbance and use of resources.
Shadow Flicker	Similar residual effects as project has committed to achieving near zero shadow flicker at sensitive receptors by adopting mitigation measures using control software, subject to the time it takes for the turbine rotor to come to a safe stop	Similar residual effect as project has committed to achieving near zero shadow flicker at sensitive receptors by adopting mitigation measures using control software, subject to the time it takes for the turbine rotor to come to a safe stop.
Material Assets	Similar effects across all design iterations	Similar effects across all design iterations
Air and Climate	Depending on the turbine output, there is potential for greater contribution carbon reduction targets.	Depending on the turbine output, there is potential for greater contribution carbon reduction targets.
Landscape & Visual Impact	Increased effect compared to current proposal.	This layout was greatly preferred to the initial layout due to reduced visual and landscape impact.
Noise and Vibration	Some receptors would have slightly higher noise although all would be within recommended noise limits.	Some receptors would have slightly lower noise although all would be within recommended noise limits.
Cultural Heritage	Larger operational site footprint gives rise to a higher potential for negative effects on archaeology although all known sites of interest would be avoided.	This layout was preferred to the initial layout.

In summary, the selected option was chosen to avoid feeding and roosting areas for wintering waterfowl and wader and to reduce the visual and landscape effect.

3.3.3.1 Turbine Delivery

3.3.3.1.1 Port of Entry and Turbine delivery route

The port of entry chosen for turbine delivery to this site is Foynes Port, which minimises the distance to the proposed wind farm and therefore the associated traffic and air quality effects arising from the delivery.

Access from Galway is limited by lengthy off-motorway sections) and the longer distance of travel required. Routes from Galway would require delivery via the N52 via Tullamore and Birr.

TDR route options to the site as described above and these are presented in Table 3-5 and in Appendix 2-1 Abnormal Indivisible Load Route Survey (Pell Frischmann, 2025). An alternative port option of a route from Galway Port was also considered as shown in Table 3-5.

Table 3-5 Comparison of environmental effects relative to proposed TDR options

Environmental Considerations	Route A - Foynes Port	Alternative Route B –Galway Port
Human Health and Population and environment generally	This shorter route (over 30km shorter compared to Galway Port) would require fewer enabling works (widening of the road, removal/movement of street furniture, waste management etc. at pinch points, disturbances) to get to site, resulting in a reduced impact to residents along the route. No pinch point in Birr as access is from the south of Birr.	This longer route (over 30km longer compared to Foynes Port) would require additional enabling works and disturbances (widening of the road, removal/movement of street furniture, etc. at pinch points) to get to site, resulting in a greater impact to the public and residents along the route. Pinch point in Birr.
Biodiversity and Ornithology	No measurable difference	No measurable difference
Land, Soils and Geology	No measurable difference	No measurable difference
Hydrology and Hydrogeology	No measurable difference	No measurable difference
Climate and Air Quality	Shorter haul route leading to lower potential for emissions.	Longer haul route leading to greater potential for emissions. As it is over 30km longer and also includes almost all of the Foynes options, it has potential to cause a greater impact.
Landscape & Visual	Neutral	Neutral
Noise and Vibration	Lower potential for noise effects	Pinch point in Birr, potential for additional traffic noise
Cultural Heritage	Lower potential for cultural heritage effects in Birr	Pinch point in Birr, potential for cultural heritage effects
Traffic and Transportation	Lower potential for traffic and transportation effects in Birr	Pinch point in Birr, potential for additional traffic effects
Summary	Option A – Route from Foynes Port is more preferable due to less environmental constraints	Option B – Route from Galway Port is less preferable due to more environmental constraints

The Galway Port delivery route would be a similar length however there are additional pinch points in the towns of Tullamore and Birr. For this reason, the Galway Port option as the origin is not practical or usable when compared with the Foynes option which has received deliveries of wind turbine components previously for wind farms.

Delivery via Foynes Port allows for the more direct route to the proposed wind farm site, with the lowest number of pinch points. It therefore has the lowest impact.

The route from Foynes initially heads on N69 eastbound and onto the N18 and N7/M7 Dublin-Limerick Road. The route continues east and departs the M7 at Junction 21 and join the northbound R435 and R445 towards Roscrea. Loads will turn right from Dublin Road onto the N62 travelling northwest through Roscrea. From here the route turns northwest on the N62 to Sharavogue Crossroads, Co Offaly. At Sharavogue Crossroads, the TDR leaves the N62 for a short offroad section at the Sharavogue Crossroads and onto the R492. The proposed site entrance is located off the R492, 2.5km to the south.

The TDR is discussed further in Chapter 2 (Description of the Proposed Project) and Chapter 14 (Traffic and Transportation) of this EIAR. The required works at each pinch point are detailed in Chapter 2 (Description of the Proposed Project).

All works required along the turbine delivery route have been assessed as part of this EIAR.

In summary, the preferred option was chosen as it allows for the more direct route to the proposed wind farm site, with the lowest number of pinch points. It therefore has the lowest impact.

3.3.3.2 Traffic Management / Transport Routes

Based on consultation feedback, it was considered that traffic through Birr would have a greater effect. On this basis, it is proposed to utilise site sourced material to reduce effects and also identify quarries to the south. It is proposed to have the majority of heavy good vehicles (HGV) deliveries from the R492/N62 towards Roscrea.

A review of the proposed wind farm site following all site investigation works was carried out with onsite borrow pits identified as a source of materials. The use of onsite borrow pits reduces the need to transport construction material along the public road network.

3.3.3.3 Site Entrances

Three site entrances were considered from an early stage. The use of L1071 was initially considered as the main site entrance (marked as Option 2 on Figure 3-3) for all vehicles during the construction and operational phases. A review of the local road network concluded this entrance would not be suitable without road upgrades to allow the required passage of oversize loads and HGVs which would be required for the construction phase. As a result, it is proposed to only use the L1071 access for light vehicles to avoid disturbances by larger vehicles during the construction phase. It was found that although the use of the site entrance by HGVs would be very infrequent, the road network here was only suitable for light vehicles, which would only be used in small numbers, see Chapter 14 (Traffic and Transportation) of this EIAR.

An alternative operational phase site entrance (marked as Option 3 on Figure 3-3) was considered to the west of the proposed wind farm (see Figure 3-3), from the L1072 but it was found to be less suitable due to the limited road width, limited sightlines and traffic capacity.

The main site entrance (Option 1) for the proposed wind farm site will be located along the R492 road between Sharavogue and Shinrone (Figure 3-3). Option 1 will be the main construction phase entrance to the proposed wind farm site. It will facilitate material deliveries to the proposed wind farm site and staff access, as well as large oversize components such as turbine blades, tower sections and substation components and is the most suitable.

For further information see Chapter 14 (Traffic & Transportation) and the Traffic Management Plan (Appendix 2-2). Option 1 will also be used as the main access/egress point for wind farm maintenance vehicles during the operational phase of the proposed project as well as ongoing farm activities.

The two proposed site entrances on the R492 (Option 1) and L1071 (Option 2) will have adequate visibility as also discussed in Chapter 14 (Traffic & Transportation).

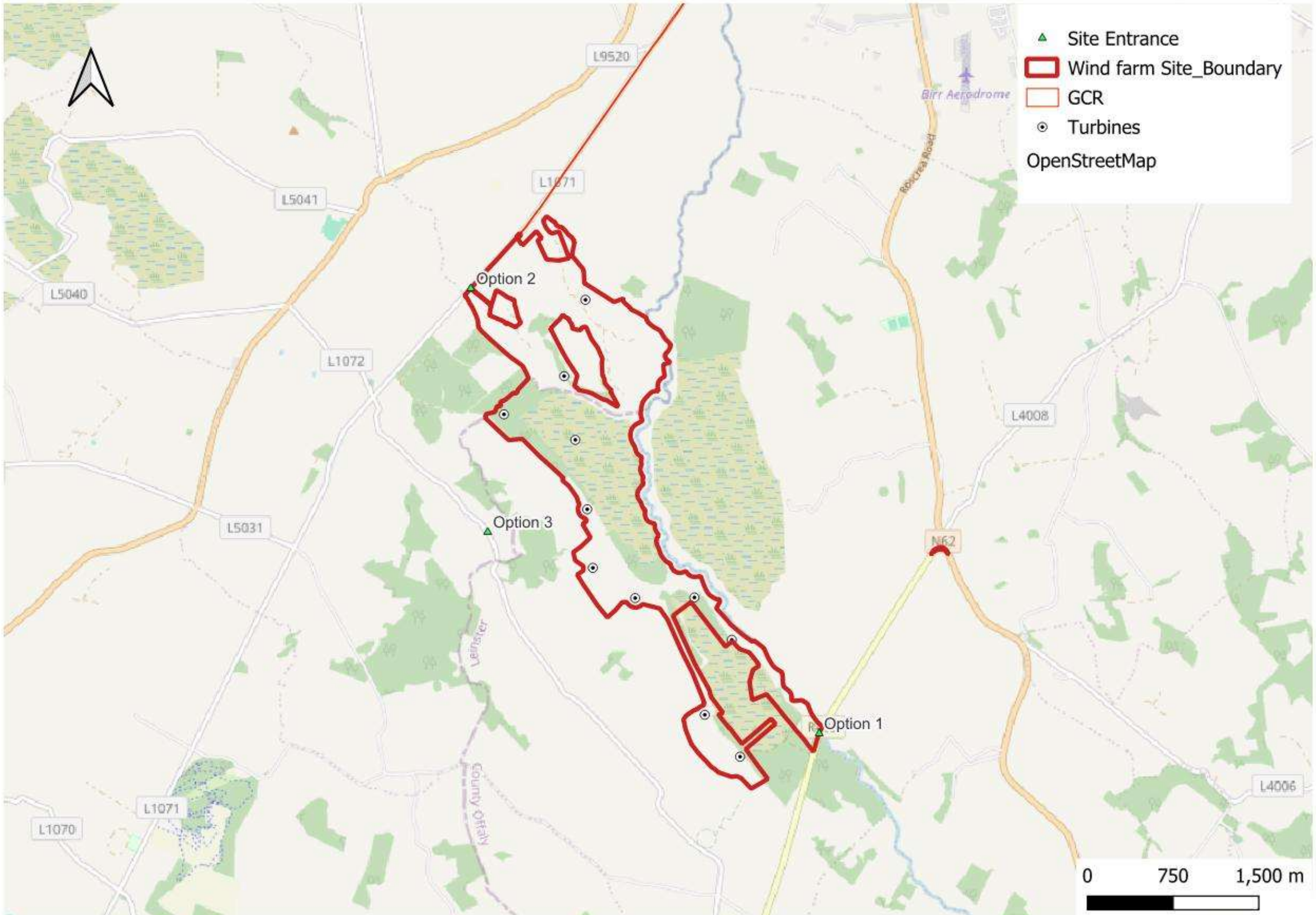

Figure 3-3 Entrance Options

Table 3-6 Table of environmental effects relative to proposed site entrance

Environmental Considerations	Option A – (utilising - L1071 and R492 for HGV construction elements)	Option B – Preferred option Having HGV traffic from the R492 only
Human Health and Population	This would result in site traffic using more of the public local road network, potentially increasing the heavy HGV traffic impacts on the L1071	This would result in no HGV traffic using the L1071 local road network
Biodiversity	Not significant	Not significant
Ornithology	Not significant	Not significant
Land, Soils and Geology	Not significant	Insignificant. There would be an imperceptible reduction in the effect based on a slightly reduced length of site track construction.
Hydrology and Hydrogeology	Not significant	Not significant
Climate and Air Quality	Not significant	Overall Not significant. No HGV traffic using the L1071 local road network and imperceptible reduction in in the effect. There is an existing site entrance at R492 and L1071 would remain in use.).
Landscape & Visual	Not significant	Not significant
Noise and Vibration	Additional traffic on L1071 site entrance road, potentially increasing noise effect.	This would require site traffic on R492, increasing the potential for noise effects .
Cultural Heritage	Not significant	Not significant
Traffic	Additional traffic on the L1071 local road, potentially increasing traffic impacts on the local road network. Limited capacity for HGV traffic on L1071	This would require site traffic on one route, increasing the potential impacts on the R492.
Environmental Considerations	Option A – Alternative site entrance (utilising L1071 for construction elements)	Option B – Having only one site entrance

In summary, the preferred option was chosen as it results in less traffic on the local road network, and less potential for environmental impact.

3.3.3.4 Substation, BESS Location and Grid Connection Route

The initial screening process undertaken by Mullan Grid highlighted the nearby electrical grid infrastructure and the available capacity in the area. Options considered included connection to the nearest 110kV substations,

- Dallow 110 kV substation (Birr, Co. Offaly),
- Ikerrin 110kV substation (Roscrea, Co. Tipperary) and
- Nenagh 110kV (Nenagh, Co. Tipperary).

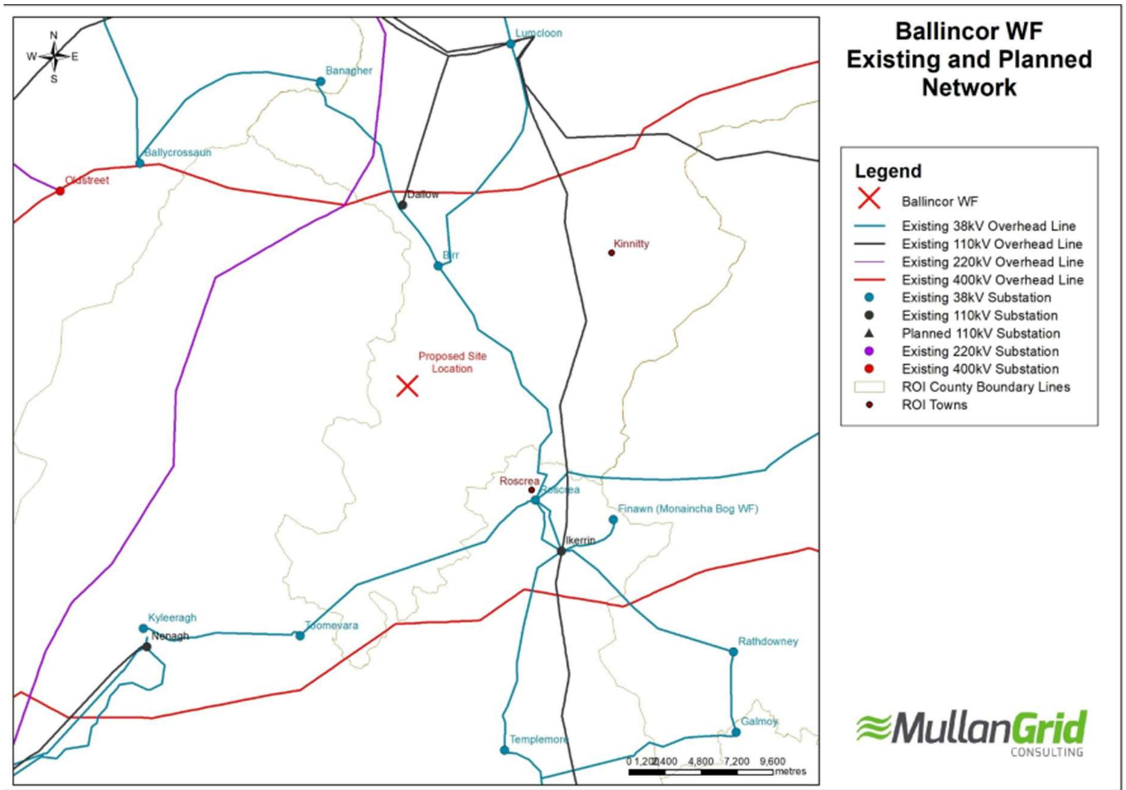

Figure 3-4 Grid Network Options

Due to the scale of the proposed project, there is no potential to connect to the 38 kV network in the area. The Skehanagh (4.25 MW) wind farm and Carrig (Lacka (2.55 MW)) wind farm are both located 1.7 km and 2.7 km west of the nearest proposed turbine (T6) respectively. These wind farms connect via a dedicated Medium Voltage (MV) line to Birr 38 kV substation, which is fed from Dallow 110 kV substation.

The closest 110 kV substation to the proposed wind farm site is Dallow 110 kV substation located approximately 9.3 km due north. The Dallow 110 kV substation is tail-fed from the Shannonbridge-Portlaoise 110kV network. The Ikerrin 110kV substation and the Nenagh 110 kV substation are also located in the wider vicinity of the site, 15.1km and 23.5km respectively. The Nenagh 110 kV substation connects to Killonan 220kV substation and the wider transmission network via a 110 kV overhead line. Due to the distance involved, the connection to Nenagh 110 kV substation is not viable.

3.3.3.4.1 Onsite substation and BESS

The proposed onsite 110kV substation site and Battery energy storage systems (BESS) was chosen following an analysis of the site constraints (setbacks from watercourses, turbine locations and avoidance of unsuitable ground conditions such as steep terrain). There were a number of other locations briefly considered, but the preferred/proposed location was chosen, as it minimised the length of the main grid connection, it reduced the chance of derating of the grid connection as a result of crossing any internal cables, it was adjacent to the existing site access road network (which would be used for the wind farm), it avoided sensitive habitats and maintained a 50m setback from natural watercourses, minimised soil disturbances and was located on relatively flat ground that was not prominent on the landscape. The BESS is located adjacent to the substation to minimise the cabling requirement while achieving the required set back from turbines.

Based on the scale of the proposed project, it was known that a 110 kV connection would be required to accommodate the likely output from the project. An assessment of the two nearest 110 kV infrastructure identified two potential connection points:

- 110 kV underground cable system to 110 kV Dallow Substation (Option A), and
- 110 kV underground connection to Ikerrin 110 kV substation (Option B).

The alternative grid connection locations are shown in Figure 3-4 and described in Table 3-7.

Table 3-7 Table of environmental effects relative to proposed grid connection option

Environmental Considerations	Option A - Dallow 110kV substation Preferred option	Option B connection via connection to Ikerrin 110kV substation
Human Health and Population	Less potential effect due to the level of works within the public road and the length of the route, total length is 12.23km.	Greater effect due to the level of works within the public road and the length of the route, total length is 19.5km.
Biodiversity and Ornithology	Shorter route with less potential for effect.	This would require more significant works over a longer route, increasing the potential for effect.
Land, Soils and Geology	Shorter route with less potential for effect.	This would require more significant works over a longer route, increasing the potential for effect.
Hydrology and Hydrogeology	Shorter route with less potential for effect.	This would require more significant works over a longer route, increasing the potential for effect.
Visual Impact	Neutral	Neutral
Noise and Vibration	Shorter route with less potential for effect.	This would require more significant works over a longer

Environmental Considerations	Option A - Dallow 110kV substation Preferred option	Option B connection via connection to Ikerrin 110kV substation
		route, increasing the potential for effect .
Cultural Heritage	Shorter route with less potential for effect .	This would require more significant works over a longer route, increasing the potential for effect .
Traffic	Less potential effect due to the traffic being within the public road and the length of the route.	Greater effects due to the traffic being within the public road and the length of the route

In summary, the preferred option was chosen as it is a shorter route with less works required, with potential for environmental impacts from soil disturbance, traffic on local road network and use of material resources.

3.3.3.4.2 Grid Connection Options to Dallow 110 kV Substation

Following the selection of the Dallow 110 kV substation, an assessment of four potential grid connection routes options (some with more than 1 branch) was undertaken – See Figure 3-5. These grid connection options were identified from a desktop analysis of the local and regional road network.

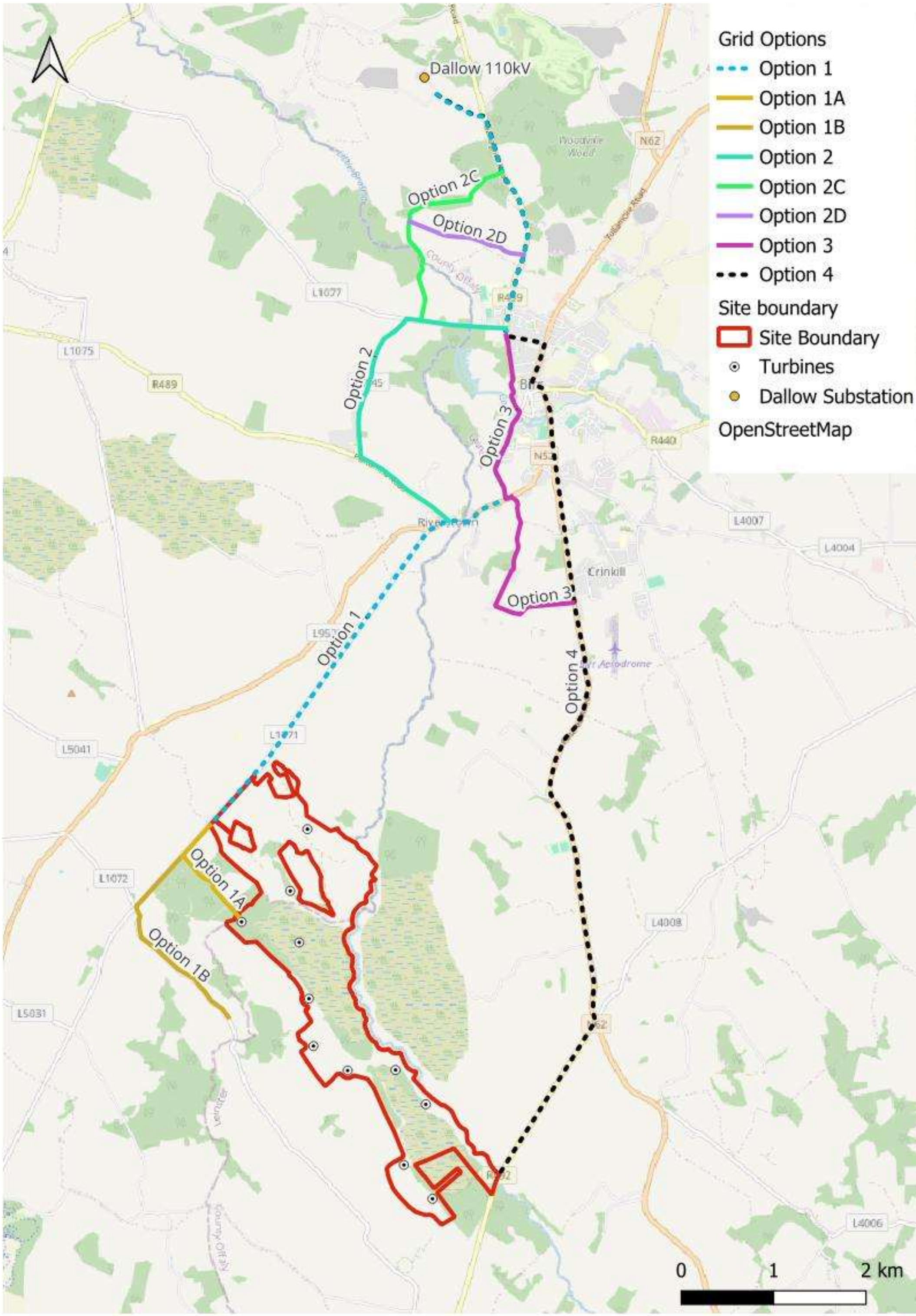

Figure 3-5 Grid route alternatives[3]

[3] Options 1/1A/1B and 3 follow a route via High Street and Castle Street, Birr

All options from Dallow 110 kV substation follow the R489 for a short section close to the existing substation and go on to utilise various routes through and around Birr town to the proposed windfarm site.

Option 1, 1A and1B

This option is for underground cabling from Dallow 110 kV substation to the proposed wind farm site utilising the most direct route available in the public road network. After exiting the Dallow 110 kV substation, the route merges onto the R439 and follows the regional road southwards through Birr town. The route leads through Castle Street and High Street via local roads to Riverstown and the N52. Eventually the route follows the L1071 to the southwest leading close to the proposed wind farm site. A large number of archaeology notification zones occur using option 1/1A/1B in Birr Town.

From public road L1071 to the proposed wind farm site, the route diverges into three potential options near the wind farm site. Option 1 (10 km) enters the proposed wind farm site at the wind farm boundary with Option 1A continuing on the local road L1071 to the proposed wind farm site via private forest and enters the wind farm site from the west.

Option 1B follows the L1071 to the junction with the L1072, Option 1B continues on the L1072 to enter the proposed wind farm site from the southwest. Depending on the options described above, the total length of the route is either 11.6km (UGC Option 1A) or 13.2km (UGC Option 1B).

Option 2C/2D

This option follows the public road network from Dallow 110 kV substation to the proposed wind farm site. The route follows the same initial route from the proposed wind farm to Riverstown as Option 1/2, while avoiding the denser residential area within Birr town for the most part. After exiting the Dallow 110 kV substation, the route merges on the R439 and follows the road southwards to Birr town. The route turns on the L1077 to the west and bends on the L5045 to the south afterwards. Following this the route goes southeast on the R489 and turns southwest onto the N52 for a short section. The route follows the L1071 to the southwest leading close to the proposed wind farm site. Depending on the option, the total length of the route is either 12.9km (Option 2C) or 14.5km (Option 2D). This option also avoids a large number of archaeology notification zones identified in option 1, 1A and 1B.

Option 3

Option 3 from Dallow 110 kV substation follows Option 1, 1A and 1B until the bend on the N52 where it separates and continues to the southeast via the N52 and Rock Lane. It then follows the N62 and the R492 to enter the proposed wind farm site from the southeast. Option 3 covers a distance of approximately 14.9 km. Option 3 is located within a large number of archaeology notification zones within Birr Town.

Option 4

Option 4 from Dallow 110kV substation follows along the public road network avoiding the long section within the Birr archaeology notification zone in Option 1, 1A and 1/B and Option 3 for the most part. At the intersection with Pound Street the route separates from the other routes and follows Pound Street to the east and joins onto the N52/N62 southwards. Eventually Option 4 follows the N62 and the R492 to enter the proposed wind farm site from the southeast. Option 4 covers a distance of approximately 14.1 km. In summary, the preferred option (2D) was chosen as it avoids works along the N62 and a large number of archaeology notifications zones in Birr Town (i.e High Street and Church Street).

Summary

Based on a review of the various options – Option 2 is preferred due to the avoidance of Birr Town centre and the associated archaeology. Options 2 also avoids extensive works along the N62 to the south of Birr.

3.3.4 Alternative Technology

The process selection for alternative renewable energies, was largely carried out after Ballincor was chosen as a suitable site for wind energy development. As described previously this site selection process was driven by the suitability and availability of areas and site assessment of private land holdings for potential wind farm development. Only when this site was identified, were the full suite of potential technologies for the production and supply of renewable energy to the Irish national electricity grid considered. The following section outlines the alternative technologies and respective considerations in relation to the chosen alternative for the project, onshore wind.

3.3.4.1 Solar Energy

There has been a recent surge of interest in solar energy in Ireland due to rapid improvements in solar technology and cost competitiveness. A report undertaken by KPMG entitled *A Brighter Future – Potential Benefits of Solar PV in Ireland* (November 2015)[4], detailed the potential impacts of solar energy on the Irish electricity network and market, and how it will interact with other technologies, principally onshore wind.

The report notes that while solar PV would diversify Ireland's renewable energy portfolio, its output is unlikely to be always correlated with that of wind.

The KPMG report notes that: "*Ireland's progress to date towards meeting its targets has principally been through the deployment of onshore wind energy*".

While solar energy could in theory be implemented at the site as a reasonable alternative to wind energy, it would be less productive in terms of energy output for the same footprint and will contribute less towards meeting Ireland's renewable energy targets. It would also be restricted in certain parts of the site which have steeper slopes. The environmental and financial impacts would be more extensive in terms of the area of forestry required to be felled and replanted elsewhere to accommodate a solar farm. The capacity factor of solar energy is significantly lower than that of onshore wind energy, requiring approximately 3 times the capacity of the proposed wind farm development, (approx. 184.8-231MW) to produce the same amount of energy. Taking solar farms to require 1.6-2 hectares per MW, the land area required for solar is 295 to 462 hectares. This area of land would also have to be acquired and replanted

[4] KPMG (2015), A Brighter Future. Available at: http://www.irishsolarenergy.org/news-docs/A-Brighter-Future.pdf

elsewhere. There are likely to be increased effects on land use, geology, and hydrology as well as biodiversity, as a result of increased felling works.

Large scale solar farms require a larger footprint than wind farms to produce the equivalent level of electricity. This technology can therefore have a greater environmental effect, especially in forested lands. A wind farm, substation and BESS is proposed at this site because wind energy produces the lowest level of environmental effects at the site. The options are discussed in Table 3-8 below.

Table 3-8 Table of environmental effects of alternative technology relative to proposed wind farm technology

Environmental Considerations	Solar
Human Health and Population	No potential for shadow flicker, but there is some potential for glint/glare.
Biodiversity	Increased habitat loss due to larger development footprint.
Ornithology	No potential for collision risk effects with operational turbines, but an increase in suitable foraging habitat lost to a larger development footprint
Land, Soils and Geology	Greater development footprint resulting in larger areas of works. Works are less intrusive generally than wind.
Hydrology and Hydrogeology	Larger felling area would result in increased risk of silt runoff to local watercourses. Felling will occur on site regardless as part of the forestry cycle.
Air and Climate	Longer carbon payback period associated with solar energy developments.
Material Assets	Less potential to impact on telecommunication links or flight activity. Glint and glare can result in potential aviation effects.
Landscape and Visual Impact	Potentially less visible from locality due to topographical and vegetative screening.
Noise and Vibration	Less potential for noise effects from solar.
Cultural Heritage	More potential for impact on cultural heritage due to the increased site footprint, however, works are less intrusive generally.
Traffic	Increased potential for effects in the construction phase due to the larger number of traffic movements required to clear larger area of forest and to bring the infrastructure to site. There are no oversize loads to be brought to site with solar, as the panels fit on normal trucks.

In summary, wind turbines were selected as the preferred renewable technology type, in order to deliver electricity to the grid in the most efficient manner, while also minimising the impact on the habitat and the environment.

3.3.5 Other Alternatives

Throughout the design and assessment process other aspects of the proposed project underwent a high-level sifting process of alternative options. A summary of this process is provided here for completeness.

The construction methods for the proposed project are dependent on a number of factors specific to the site and design, and have been considered in relation to ground conditions, foundation installation and turbine erection. Site-specific information gathered through intrusive site investigation and environmental surveys was taken into consideration when reviewing alternative methodologies for construction. So, decisions on the construction methods for groundwork and foundation installations, as well as the internal road and grid connection, were informed and based on best practice.

Alternative timelines for the proposed project in terms of construction start date and operational lifespan were evaluated. The delivery timeframe was reviewed in context of the need for the scheme (Section 1.3, Chapter 1 – Introduction) to decarbonise the economy and reduce reliance on fossil fuels, and the proposed construction start date of 2028 reflects this.

The operational lifespan of the wind farm turbines was discussed when reviewing the different turbine types and specifications available on the market. Turbines are generally designed to last for 35 years therefore the operational lifespan of the proposed project was centred around this.

3.3.5.1 Wind Turbine Model

The Proposed Development is for an 11-turbine layout with a ground to blade tip height range of 179.5 m to 180 m. The wind turbines will have a rotor diameter ranging from 149 m to 163 m and a hub height ranging from 98.5 m to 105 m. The proposed wind turbines will have a rated electrical power output of between 5.6 MW and 7 MW. Based on the 11-turbine layout the Proposed Project has an estimated capacity of 61.6 MW to 77 MW. Consideration was given to achieving a similar MEC using smaller turbines: c.150m in height with a 4.2 MW rating. In such a case between 14 and 17 turbines would be required and would have an associated increased land take and associated environmental effects. Furthermore, the use of smaller turbines would not make as efficient use of the wind resource available at higher elevations above ground level.

The 11-turbine layout selected for the site has the smallest development footprint of the alternatives considered, while still achieving the optimum output at a more consistent level than would be achievable using different turbines.

A comparison of the potential environmental effects of the installation of a larger number of smaller wind turbines when compared against Proposed Project is presented in Table 3-9 below.

Table 3-9 Table of environmental effects of alternative wind turbine model relative to proposed wind farm technology

Environmental Considerations	Larger number of smaller turbine models (14-17 turbines 150m tip height)	Proposed Project (11 turbines 179.5m – 180m tip height)
Human Health and Population	Increased potential for shadow flicker due to the increased number of turbines	Lower potential for shadow flicker due to setback from receptors
Biodiversity	Greater potential for effects on bats due to greater number of turbines. Larger footprint with associated potential removal of higher value habitats.	Lower number of turbines reduces area of habitat removal and allow more strategic placement of turbines away from higher value habitats and designated areas.
Ornithology	Larger number of turbines increase collision risk area for birds. Larger footprint has an associated greater habitat removal with greater potential for displacement of birds.	Fewer wind turbines reduce potential collision risk for birds. Has allowed the positioning the turbines within more open areas away from busier flight paths associated with the bog habitats and river habitats in the locality. Larger wind turbines have a slower blade rotation thereby reducing potential collision risk for birds.
Land, Soils and Geology	Larger footprint would require greater peat and spoil management and make it more difficult to avoid areas of deeper peat or locations of dolines. Given ground conditions, smaller turbines would not negate the need for pilled foundations.	Smaller development footprint would result in smaller volumes of peat and spoil to be excavated and managed. Location and alignment of hardstands and roads can be more sympathetic to the natural topography allowing optimization of cut/fill.
Hydrology and Hydrogeology	Larger number of turbines might necessitate a greater number of drain and watercourse crossings and may require siting of turbines closer to rivers.	Lower number of turbine allow for greater setback distances from rivers.
Air and Climate	Lower output increases carbon payback period relative to embodied carbon value and lowers contribution to climate targets.	Higher output means faster carbon payback period relative to embodied carbon and higher contribution to climate targets.
Material Assets	Higher potential for interaction with local services e.g. telecommunications.	Site designed to minimise significant interactions with material assets.
Landscape and Visual Impact	Increased visual effect due to cluttered / stacked effect	Larger turbines viewed as more significantly imposing infrastructure by closer

Environmental Considerations	Larger number of smaller turbine models (14-17 turbines 150m tip height)	Proposed Project (11 turbines 179.5m – 180m tip height)
	caused by increased number of turbines.	sensitive receptors. Can achieve greater setback from properties with fewer turbine.
Noise and Vibration	Larger footprint and associated increase in proximity to sensitive receptors with potential for noise effects.	As stated previously a 720 m setback from nearby dwellings has been achieved with the exception of one involved landowner. The appropriate day and night noise limits will be adhered to by the proposed project, as described in Chapter 11 (Noise & Vibration).
Cultural Heritage	Larger footprint has higher potential to unearth undiscovered cultural artifacts; however foundations are relatively shallow.	Smaller footprint with lower potential to unearth undiscovered cultural artifacts. Design takes cognisance of nearby recorded monuments and avoids them and their zone of influence where possible.
Traffic	Greater number of turbine component deliveries to site. Larger footprint requiring greater haulage.	Lower number of component and material deliveries to Site.

Fewer, but taller turbines were selected for the final design due to the lower overall footprint and associated reduced environmental effects.

The consideration to provide fewer, larger turbines with greater power output is in line with industry trends. This option increases energy efficiency, improving the energy output to the national grid per turbine, thus reducing the cost of energy for the consumer while also providing more positive impacts in terms of climate change mitigation and energy security. The use of less turbines also reduces the effect on the receiving environment with less land-take required to accommodate the wind farm and less associated construction works as detailed above. Recent permitted wind farm applications in Ireland tend towards larger/taller turbines (i.e. the larger turbine tip heights that are available on the market in Ireland). Examples of recent consented wind farms which include larger/taller turbines are the Ardderroo Wind Farm, Co. Galway (ABP ref. PL07 .303086) which consists of 25 no. turbines at 178.5m tip height, the Coole Wind Farm, Co. Westmeath (ABP ref. PL25M.300686) which consists of 13 no. wind turbines of 175m tip height and Barnesmore Windfarm, Co Donegal (ABP ref. PL14 .306303) which consists of 13 turbines with tip height up to 180m.

3.3.6 Alternative Mitigation Measures

The mitigation measures proposed in relation to the elements of the project are detailed in the chapters to follow and are also summarised in Chapter 20 (Schedule of Mitigation Measures). The concept of mitigation by avoidance has informed the development of the wind farm design and layout. The final design/layout has been selected to minimise as much as possible the level of construction and operational mitigation required through design minimisation of the potential for environmental effects in the first instance. The mitigation measures proposed are considered to be proven and best practice and the level of mitigation proposed is determined to be proportionate to the potential effect. These are discussed through each of the EIAR chapters as appropriate. The alternative to the proposed mitigation measures would be to propose measures which are not best practice or else not proposing any mitigation measures, neither of which would be appropriate.

The main mitigatory measures considered in this chapter have been those which avoid developing on or minimising effects on environmentally sensitive areas and the local population.

3.4 CONCLUSIONS

A study of the reasonable alternatives in terms of project design, technology, location, size and scale has been undertaken and presented in this chapter. The options which are relevant to the proposed project and its specific characteristics of a large-scale wind farm in a lowland rural area have been discussed. The overriding reason for selecting the chosen options is to maximise the renewable energy production from the site while minimising the environmental impact and the impact on humans. For each alternative, a comparison of the environmental effects has been provided, showing the reasons for the chosen option being favoured relative to the others.

As discussed above the siting and design of the proposed wind farm project has evolved through the consideration of alternatives and allowing for stakeholder input into the process (See Section 1.9 of Chapter 1 on this EIAR (Introduction)). This included initial consideration of the need for renewable energy, the site selection process, the consideration of different viable alternative processes to produce renewable energy, and alternative layouts, scales, and design processes.

Reasonable alternatives were considered with specific regard to the characteristics of the project. Comparisons of environmental effects of the identified alternatives and the selected option in each case were noted. The alternatives chosen focused on mitigation by design in order to avoid potential impacts on the environment.

When weighed against all of the alternatives and constraints/facilitators outlined in this chapter, the proposed Ballincor Wind Farm has been found to be a highly suitable location for a wind farm and BESS site with regard to a number of criteria including wind speed, likely significant environmental effects when assessed against the objectives of the EIA Directive and EPA Guidelines, distance from dwellings and landscape character. The location is particularly appropriate with regard to the foregoing and with regard to ease of access, and proximity to the grid connection.