3 ALTERNATIVES CONSIDERED

3.1 INTRODUCTION

This Chapter of the Environmental Impact Assessment Report (EIAR) provides 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. Alternatives were assessed taking commercial, construction, operational and key environmental constraints into consideration.

3.2 STATEMENT OF AUTHORITY

This chapter has been prepared by Ms. Sarah Moore with the assistance of Ms. Shirley Bradley of Jennings O'Donovan & Partners Limited.

Ms. Sarah Moore is a Senior Environmental Consultant and holds a Bachelor (Hons.) Degree in Environmental Science from University of Limerick and a MSc (Dist.) in Environmental Engineering from Queen's University, Belfast. She has worked in environmental consultancy for over fourteen years and has prepared AA Screenings, Environmental Reports and wind farm EIARs, including the consideration of alternatives.

Ms. Shirley Bradley is a Graduate Environmental Scientist with a First-Class Honours Degree (BSc. Hons) in Environmental Science from the Institute of Technology, Sligo. She was also awarded with the Governing Body award for a BSc in Environmental Protection. Shirley's key capabilities are in report writing, assisting Senior Consultants and GIS.

3.3 METHODOLOGY

3.3.1 Requirements for Alternatives Assessment

Annex IV of the EIA Directive as amended (Information Referred to in Article 5(1) (Information for the Environmental Impact Assessment Report) elaborates as follows:
"2. 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 Protection Agency (2022) states that "*It is generally sufficient to provide a broad description of each main alternative and the key issues associated with each,* *showing how environmental considerations were taken into account in deciding on the selected option".*

The EPA guidance documents on EIAR preparation[1] [2], stipulates the following:
"The presentation and consideration of the various alternatives investigated by the applicant is an important requirement of the EIA process…. and the alternatives can include:

- *alternative locations;*
- *alternative designs; and*
- *alternative processes*".

The objective is for the Developer to present 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.

In an effective EIA process, different types of alternatives may be considered at several key stages during the process. As environmental issues emerge during the preparation of the EIAR, alternative designs may need to be considered early in the process or alternative mitigation options may need to be considered towards the end of the process. These various levels of alternatives are set out in chapter.

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

- 'Do Nothing' Option
- Strategic Site Selection
- Alternative Wind Farm Design and Layout
- Alternative Turbine Numbers and Specifications
- Alternative Grid Connection
- Alternative Renewable Energy Technologies
- Alternative Turbine Haul Route
- Alternative Mitigation Measures

[1] EPA. (2002). Guidelines on the information to be contained in Environmental Impact Statements.
[2] EPA. (2022). Guidelines on the information to be contained in Environmental Impact Assessment Reports.

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

3.3.2 Approach to Alternatives

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"*.

3.4 'DO-NOTHING' ALTERNATIVE

Annex IV, Part 3 of the EIA Directive as amended requires a *"description of the relevant aspects of the current state of the environment (baseline scenario) and 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'."

Ireland has adopted binding agreements to reduce dependency on fossil fuels and increase energy production from sustainable sources, creating a requirement for the nation to transition to a low carbon economy. The binding EU targets have been transposed into Irish National Policy in the 2023 Climate Action Plan which focuses up to 9 GW future electricity production on the wind energy sector. This demonstrates the significance of wind energy in the Irish energy context and highlights the need for the proposed Inchamore Wind Farm in reaching both EU and national renewable energy targets.

Ireland is obliged to ensure that 32% of the total energy consumed in heating, electricity and transport is generated from renewable resources by 2030 and reduce its greenhouse gas emissions by at least 55% by 2030, relative to its 1990 levels, with an overall objective of carbon neutrality by 2050. This is in order to help reduce the nation's CO_2 emissions and to promote the use of indigenous renewable sources of energy. These targets have been incorporated into national policy in the Climate Action Plan (2023) which aims to:

- Reduce CO_2 eq. emissions from the electricity sector by 62-81%.
- Deliver an early and complete phase-out of coal and peat fired electricity generation. (Note although peat-fired electricity generation has ceased in Ireland, coal and oil fired plants are still operational. Tarbert Power Station (620 MW) was supposed to close by 2023, and Moneypoint Power Station (915 MW) was supposed to close by 2025. This is now delayed arising from concerns about security of electricity supply. This delay means that more carbon emissions will arise. It highlights the urgency of constructing this and other wind farms).
- Increase electricity generated from renewable sources to 80%, indicatively comprised of:
  - Up to 9 GW onshore wind energy.

Furthermore, the Climate Action and Low Carbon Development (Amendment) Act (2021) will act to reduce 51% emissions over a ten-year period to 2030, in line with the programme for Government which commits to a 7% average yearly reduction in overall greenhouse gas emissions over the next decade, and to achieving net zero emissions by 2050.

Under a 'Do Nothing' alternative, the Project will not be constructed. The land upon which Project will occur would remain unchanged. The main land use of the Site would remain as commercial forestry and agriculture. Consequently, the environmental impacts, identified in the EIAR, positive and negative, would not occur. However, in the "Do-Nothing" scenario, the prospect of creating sustainable energy through County Cork's wind energy resource would be lost at this Site.

The nation's ability to produce sustainable energy and reduce greenhouse gas emissions to meet EU targets and National targets, as set out above, would be stifled. This may result in the nation incurring significant financial penalties from the EU if targets are not achieved.

The Development has the potential to prevent approximately between 30,038 and 35,373 tonnes of CO_2 emissions per annum, or between 1,051,334 and 1,238,059 tonnes of CO_2 emissions will be displaced over the proposed 35 year lifetime of the wind farm, see **Chapter 10: Air and Climate** for details on the Carbon Calculator method. This would otherwise be released to the atmosphere through the burning of fossil fuels in the "Do-Nothing" scenario. This would not assist in Ireland's contribution to reducing global warming and would fail to limit warming as agreed to in the Paris Agreement (2015). This will result in continued negative impacts to air quality and climate.

According to EirGrid Group's All-island Generation Capacity Statement 2021 – 2030 (EirGrid, 2021), the growth in energy demand for the next ten years on the Island of Ireland will be between 18% and 43%. In the 'Do-nothing' scenario, importation of fossil fuels to maintain growing energy supply will continue and Ireland's energy security will remain vulnerable. A "Do-nothing" scenario would contribute to strain on existing energy production and may impact on economic growth if energy demand cannot be met. The delay in closing Tarbert and Moneypoint means we continue to rely on imported fossil-fuels with unpredictable pricing, a vulnerable supply chain and higher carbon emissions.

Under the "Do-Nothing" scenario, the socio-economic benefits associated with the Project will be lost. These benefits include between 25 to 30 No. jobs during the construction phase of the project, and between 2 long-term jobs once operational. Furthermore, under the "Do-Nothing" scenario the local community will not benefit economically from the community benefit fund associated with the project which could be used to improve physical and social infrastructure within the vicinity of the Project.

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**. Refer to each respective chapter for full details of residual impacts.

Table 3.1: Environmental effects of 'Do-Nothing' compared with a wind farm development

Criteria	Residual Impact of the Project	Do-Nothing Alternative
Population & Human Health (incl. Shadow Flicker)	Long-term positive economic benefit to local area due to job creation and Community Benefit fund.	No increase in local employment and no financial gains for the local economy or community via the community benefit fund. No upgrading of local forest tracks or creation of new tracks which can be used for walking and mountain biking. No potential for shadow flicker or noise to affect sensitive receptors.
Terrestrial Ecology	Slight negative impact on Annex 1 listed habitats. Overall positive benefit due to proposed biodiversity enhancements.	The ecology of the Site would be expected to remain similar as at present though any increase in grazing pressure could be detrimental to the quality of peatland habitats within the site. Also, any further afforestation on heath and bog habitats would be detrimental.

Criteria	Residual Impact of the Project	Do-Nothing Alternative
Aquatic Ecology	There will be no negative residual impact on any aquatic species, habitat or on water quality at a local or catchment level as a result of the Development.	If the development does not proceed, lands at and in the vicinity of the Site will continue to be used for forestry and agricultural purposes. This 'Do-Nothing' scenario would result in no significant change to aquatic ecology and habitats within or downstream of the Site subject to the continuation of current activities and practices.
Ornithology	Slight negative impact on birds following implementation of mitigation measures.	Without the proposed wind farm development proceeding, it is expected that the present main land uses on Site, namely livestock grazing and forestry, will continue. It is possible that further afforestation would occur on the Site in the future. The value of the Site for birds would be expected to remain similar as at present though any increase in grazing pressure could be detrimental to the quality of peatland habitats of the Site which could affect species such as Red Grouse. Also, any further afforestation on heath and bog habitats would be detrimental to peatland bird species, including Red Grouse, Meadow Pipit and Skylark.
Soils & Geology	The residual impacts on the soils and geology environment as a function of the Development is that there will be a change in ground conditions at the Site with natural materials such as peat, subsoil and bedrock being replaced by concrete, subgrade and surfacing materials. This is a localised, negative, moderate significance at a local scale	Should the proposed development not proceed, the existing land-use practices will continue with associated modification of the existing environment, including the underlying soils and geology, through agriculture and commercial forestry.
Hydrology & Hydrogeology	Non-significant impacts following implementation of mitigation measures.	Should the proposed development not proceed, the existing land-use practice of commercial afforestation and agricultural activities will continue with associated gradual alteration of the existing environment and associated pressures on surface water and groundwater quality.

Criteria	Residual Impact of the Project	Do-Nothing Alternative
Air & Climate	Long-term positive impact on air quality and climate due to avoidance of burning of fossil fuels and the net displacement of between 30,038 and 35,373 of CO_2 per annum.	There will be no increase in air quality or a reduction of greenhouse gas emissions. By the Development not proceeding it will not assist in achieving the renewable energy targets set out in the Climate Action Plan. As a result, fossil fuel power stations will be the alternative to provide the required quantities of electricity resulting in greenhouse gas and other air pollutant emissions.
Noise	Non-significant to slight temporary noise impacts associated with construction activities. Temporary moderate impact along the grid route at certain dwellings during construction. The operational noise impacts are imperceptible.	There will be no change in noise emissions.
Landscape & Visual	The scale of the proposed development will be well assimilated within its landscape context without undue conflicts of scale with underlying landform and land use patterns. For these reasons the magnitude of the landscape impact is deemed to be **High-medium** within the Site and its immediate environs (c.1 km) reducing to **Medium** and then **Medium-low** for the remainder of the central study area. Beyond 5 km from the Site, the magnitude of landscape impact is deemed to reduce to **Low** and **Negligible** at increasing distances as the wind farm becomes a proportionately smaller and integrated component of the overall landscape fabric.	In this instance, the existing forestry plantations contained within the Site would continue to be planted and felled in rotation in the do-nothing scenario. As this aligns with the current scenario, no additional landscape or visual impacts are likely to occur.
Material Assets	Positive impact by offsetting use of fossil fuel. Positive impact due to provision of electricity infrastructure.	No offset to fossil fuel use. No provision of additional renewable electricity generation infrastructure in the local area.
Cultural Heritage	No residual impacts.	There will be no potential for Cultural Heritage impacts.
Traffic and Transportation	Moderate localised short-term impact due to construction and decommissioning activities.	There will be no potential for Traffic and Transport impacts.

3.5 STRATEGIC SITE SELECTION

3.5.1 Strategic Site Screening

The Project Developers, FEI and SSE, continuously examine the lands under their stewardship for candidate sites for wind energy development.

There have been two main screening exercises undertaken by Coillte's Renewable Energy Development Team (now FEI) one in 2014 and one in 2017. The purpose of the site identification exercise was to identify an area that would be capable of accommodating a wind farm development while minimising the potential for adverse impact on the environment. To satisfy this requirement, a significant landholding that would yield a sufficient viable area for the siting of each element of the Development was required.

In 2014 Coillte's Renewable Energy Development Team (now FEI) undertook a detailed screening process, through Geographical Information Spatial software (GIS), using a number of criteria and stages to assess the potential of a large number of possible sites, on lands within its stewardship (c. 441,000 hectares), suitable to accommodate a wind energy development. The GIS database drew upon a wide array of key spatial datasets such as forestry data, ordnance survey land data, house location data, transport, existing wind energy and grid infrastructure data and environmental data such as ecological designations, landscape designations and wind energy strategy designations available at the time.

The following is a summary of the methodology used in this screening process:

Phase 1 – Initial Screening

This stage in the selection process discounted lands that were not available for development under a number of criteria, as follows:

1. Committed Lands for other developments
2. Millennium Sites (This is a Coillte environmental designation – these sites were planted and managed for provision of a tree for every household in the country as part of the Millennium tree planting project)
3. Life Site (This is a Coillte environmental designation – these former forested sites were cleared and are managed for biodiversity)
4. Wild Nephin Properties (This is a Coillte designation. Since 2014 these properties have been incorporated into National Parks)
5. Farm Partnerships and Leased Lands
6. National Parks
7. Natura 2000 and Nationally Designated Sites (SAC, SPA, NHA, pNHA)

Coillte also reviewed the relevant local authority's County Development Plan (CDP) and/or Renewable Energy Strategy (RES) provisions and did not proceed with further analysis where the policy context was not supportive of wind farm development. In this regard, areas were not brought forward for further analysis if they were not identified as being at least "open for consideration" for wind farm development.

Lands where the average wind speed at 80 metres above ground level was less than 7 meters per second and was therefore, potentially not suitable for a commercially viable wind energy development were also discounted at this stage. In addition, sites with a contiguous area of less than 300 hectares were discounted.

Phase 2 – Grid Constraints

The electricity transmission system is the backbone of the nation's power system, efficiently delivering large amounts of power from where it is generated to where it is needed. As part of the Site selection process, it was necessary to consider in principle the potential for grid connection, including in terms of distance to potential connection nodes and the grid capacity at the nodes, in the local area, to accommodate the connection.

Phase 3 – Screening

The next stage of screening out lands from further analysis was due to the presence of the following:

1. Sensitive Amenity or Scenic Areas designation in CDPs (at the time of the screening process);
2. Lands utilised for other wind farm developments;
3. Telecommunications masts and links;
4. Sensitive habitat/species of bird;
5. Land Ownership title issues;
6. Relatively high residential density in vicinity;
7. Unfavourable slopes and ground conditions.

This stage of screening was generally applied using in-house expertise and local knowledge and was subsequently validated externally in terms of the engineering considerations and the likelihood of obtaining a successful grant of planning permission based on industry trends in 2014.

Results of the Screening Process

Sites that emerged from the 2014 site selection process described above are listed below and have been brought forward as separate planning applications alone or with co-development partners:

- Croagh, Co. Leitrim;
- Carrownagowan, Co. Clare;
- Glenard, Co. Donegal;
- Bottlehill (Coom), Co. Cork;
- Castlebanny, Co. Kilkenny (consented).

Each is a project in its own right and is subject to EIA. 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 applications.

In 2017 Coillte once again examined the lands under its stewardship for candidate sites for wind energy development using the same site selection process as described above but this time reducing the required contiguous Site area from 300 ha to 50 ha. The proposed Inchamore Site emerged from this process and the process described in Section 3.5.1 below. Other sites which also emerged and for which FEI are in the process of preparing separate planning applications or are in the planning system are:

- Ballinagree, Co. Cork;
- Croaghaun, Co. Carlow;
- Cummeennabuddoge, Co. Cork;
- Gortyrahilly, Co. Cork;
- Inchamore, Co. Cork
- Lissinagroagh, Co. Leitrim.

Similar to the sites which emerged in 2014; the sites which emerged in 2017 are projects in their own right which will be subject to EIA. Ballinagree, Croaghaun and Gortyrahilly planning applications have been submitted.

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 has been, or will be, provided in the EIAR accompanying the applications for same.

The alternative to this would be to bring forward a site that did not pass the above phases of the screening process. In that instance, there would be the potential for the construction and operation of a wind energy development to have an adverse effect on ecologically designated or sensitive areas and visually sensitive (scenic) or amenity areas. There would also be the potential for greater shadow flicker, noise and traffic impacts if the candidate site was located in an area with a higher number of residential dwellings. In addition, a site with an average wind speed less than 7 m/s (at 80 m above ground level) and/or not located within practical proximity of existing grid infrastructure and may not be economically viable.

As stated above, Coillte conducted two reviews of its land in recent years in which it examined candidate sites for wind energy development. However, as also stated above Coillte (now FEI) continuously assesses its lands for wind opportunities and other sites can emerge periodically.

3.5.2 Suitability of the Candidate Site

It is critical for the Developer and their project team to ensure that the most suitable site for development of a proposed wind farm is identified and progressed through planning due to the financial commitments involved i.e., the cost of building each megawatt (MW) of electricity-generating capacity in a wind farm is in the region of €1.8 million to €2.0 million.

The site suitability has been fully informed by national, regional and local policy constraints and the location accords with these policies and objectives. (See Planning Statement accompanying this application.)

The site was further examined in the context of the following elements which are considered decisive in determining viability for a wind farm project:

- National Grid Connection Capacity;
- Designated sites;
- Wind Speeds, and
- Population Density.

3.5.2.1 National Grid Connection

Potential grid connectivity and constraints were also considered during the strategic site selection process as detailed in the strategic screening exercise. The Inchamore Site was found to be in proximity to two nodes on the national transmission system, notably Ballyvouskill 220 kV GIS substation and Cloonkeen 110 kV substation. These were assessed at a high level for connection and capacity. Ballyvouskill was selected because it had capacity available, as opposed to the very limited capacity at Clonkeen and is closer to the Site (i.e. within 13 km as the crow flies).

The assessment of the grid route options is described in detail in **Section 3.6.4.3**.

3.5.2.2 Designated Sites

It is preferable that wind energy development is not located in an area designated as a Natura 2000 site. The Project is not located within any area designated for ecological protection. The nearest Natura 2000 site, i.e., Special Area of Conservation (SAC) or Special Protection Area (SPA) to the Project is Killarney National Park, Macgillycuddy's reeks & Caragh River Catchment SAC. The closest distance between the cable route corridor and the Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC is 41 m. Killarney National Park, Macgillycuddy's reeks & Caragh River Catchment SAC is the closest Natura 2000 site to the Site, situated 3 km north of the Site at the nearest point. The nearest national designated site, i.e. Natural Heritage Area (NHA) to the Project is Sillahertane Bog NHA, which is located approximately 5.5 km to the south-west of the Site. Please note that there is no connectivity between Silahertane Bog NHA and the Project. The nearest proposed Natural Heritage Area (pNHA) to the Project is Killarney National Park, Macgillycuddy's reeks & Caragh River Catchment pNHA which is located 41 m from the grid route corridor at the closest point.

3.5.2.3 Wind Speeds

Wind speed was assessed at the Site in order to determine if wind energy development would be feasible. Wind speed analysis through the Irish Wind Atlas produced by Sustainable Energy Authority of Ireland (SEAI) was used to determine average wind speeds for the country. With the upland nature of the landscape, the Wind Atlas shows that wind speeds on the Site are consistent with a wind farm development (7.5 m/s at 30 m, 8.3 m/s at 75 m, 8.5 m/s at 100 m and 9.10 m/s at 150 m).

3.5.2.4 Population Density

Areas with low housing density are preferable for wind energy development so as to minimise potential disturbance to residential amenity. Having reviewed the settlement patterns in the vicinity of the Site, the study area has emerged as suitable to accommodate the proposal. The population density of the local Study Area (i.e. Study Area 1 as described in the **Chapter 4: Population and Human Health**) is 18.4 persons per square kilometre[3]. This is significantly lower than the average rural population density of 27 persons per square

[3] https://www.cso.ie/en/census/census2016reports/census2016smallareapopulationstatistics/ [Accessed, 22/06/2022]

kilometre in rural areas[4]. The low population density of the Site provides greater capacity for wind energy development, allowing for a greater number of turbines to be constructed while maintaining appropriate setback distances from dwellings as set out in the Wind Energy Development Guidelines.

3.5.2.5 Summary

From the review of the criteria set out above, the Site was identified as a suitable candidate site for the provision of a wind farm of the scale proposed. The Site is located predominantly within agricultural land and existing commercial forestry which allows the Site to take advantage of existing access roads (which will be upgraded in specific locations). This combined with the proximity to the existing Ballyvouskill substation further highlights the suitability of the Site as it can make further sustainable use of these established items of infrastructure. The Site is also designated as 'Open to Consideration' within the Cork County Development Plan 2022 - 2028, does not overlap with any designated sites and is located in an area with a relatively low population density with appropriate annual wind speeds.

3.6 WIND FARM DESIGN AND LAYOUT

The design of the Development has been informed by the designers, Developers, engineers, landowners, environmental, hydrological and geotechnical, archaeological specialists, telecommunication specialists, and traffic consultants. The aim is to reduce potential for environmental effects while designing a project capable of being constructed and viable and maximising wind resource. Throughout the preparation of the EIAR, the layout of the Development has been revised and refined to take account of the findings of all site investigations, which have brought the design from its first initial layout to the current proposed layout. The design process has also taken account of the recommendations and comments of the relevant statutory and non-statutory organisations, the local community and local authorities and as detailed in **Section 1.10** of **Chapter 1: Introduction**.

3.6.1 Constraints Led Approach

The design and layout of the Development follows the recommendations and industry guidelines set out in the 'Wind Energy Development Guidelines' (Department of the Environment, Heritage and Local Government, 2006), 'Best Practice Guidelines for the Irish Wind Energy Industry' (Irish Wind Energy Association, 2012) and the Draft Revised Wind Energy Development Guidelines, December 2019. The layout and design were an iterative process which followed the constraints-led design approach.

[4] https://www.cso.ie/en/releasesandpublications/ep/p-cp2tc/cp2pdm/pd/ [Accessed 22/06/2022]

The constraints-led design approach consists of the identification of environmental sensitivities within the Site by the design team with a view to identifying suitable areas in which wind turbines may be located. The resulting area is known as the 'Developable Area'.

The constraints identification process included the gathering of information through detailed desk-based assessments, field surveys and consultation. Sensitive receptors were mapped and the design constraints were applied. Setback buffers were placed around different types of constraints to clearly identify the areas within which no development works will take place. The size of the buffer zone for each constraint has been assigned using guidance presented in the Department of the Environment, Heritage and Local Government Wind Energy Guidelines (DoEHLG, 2006) and other relevant Best Practice standards, which are identified in each chapter of this EIAR. The proposed setbacks also comply with the Draft Wind Energy Guidelines 2019 requirements.

The constraints map for the Site, as shown in **Figure 3.1** encompasses the following constraints and associated buffers:

- 4 x tip height separation distance from residential properties in line with the new draft guidelines)
- Operator specific buffer from existing Telecommunication Links
- 65 m buffer of Watercourses
- 100 m buffer from Archaeological Sites or Monuments
- Available lands for development
- Separation distance (oversail) from landowners not involved in the Project (77.5 m)
- Distance from designated sites
- Good wind resource
- Existing access points and general accessibility of all areas of the Site due to existing road infrastructure
- Avoidance of environmental constraints identified from desk studies

The inclusion of the constraints on a map of the study area allowed for a viable developable area to be identified. The process included the identification of a developable area in the west of the site. However, this was not considered for development due to the size (could accommodate a single turbine) and the separation distance from the other turbines would have a negative visual impact.

The wind farm design process looked at all land that was available for development within and immediately surrounding the preliminary red-line boundary (**Figure 3.2a** and **3.2b**). The constraints, as discussed in **Section 3.6.1** and shown on **Figure 3.1**, associated with these lands were assessed. Some lands were discounted due to the telecommunication links running to the north and south of the site, the presence of habitats including Mosaic of Upland Blanket Bog and Wet Heath and residential receptors.

The first turbine layout (**Figures 3.3**) was then developed to take account of all the constraints mentioned above and their associated buffer zones and the separation distance required between the turbines.

Following the mapping of all known constraints, detailed site investigations were carried out by the project team. The ecological assessments of the Site encompassed habitat mapping and extensive surveying of birds and other fauna. These assessments, as described in **Chapter 5: Aquatic Ecology**, **Chapter 6: Terrestrial Ecology** and **Chapter 7: Ornithology**, optimised the decision on the siting of turbines as explained in Section 3.6.2.

Similarly, the hydrological and geotechnical investigations of the Site informed the proposed locations for turbines, roads and other components of the Development, such as the substation and the construction compound. This included peat depth and peat stability analysis (**Chapter 8: Soils and Geology**) and the identification of watercourses, groundwater constraints, flood risk and wells (**Chapter 9: Hydrology and Hydrogeology**). Where specific areas were deemed as being unsuitable (e.g., unstable peat giving high risk for slippage) for the siting of turbines or roads, etc., alternative locations were proposed and assessed, taking into account the areas that were already ruled out of consideration. The turbine layout for the proposed wind farm has also been informed by wind data which has been collected from an on-site meteorological mast and the results of noise assessments as they became available.

3.6.2 Turbine Layout

The final proposed turbine layout of the Development shown in **Figure 3.6** takes account of all site constraints and the distances to be maintained between turbines and from houses, roads, etc. The layout is based on the results of all site investigations and feedback from consultations that have been carried out during the EIAR process.

The final selection of turbine number and layout has had regard to wind-take by siting the turbines to achieve optimal performance (three times the rotor diameter (3d) in the crosswind direction and seven times the rotor diameter (7d) in the prevailing downwind direction). Potential noise emissions considerations were also incorporated into turbine layout by ensuring no turbines are constructed in a location that would lead to unacceptable noise impacts on nearby receptors. Potential shadow flicker impacts were also considered by maintaining a 4 x tip height buffer from sensitive receptors and selecting suitable candidate turbines with built in shadow shut down measures where the turbine operating control system detects when sunlight is strong enough to cast a shadow on a property or properties, and automatically shuts down for a period until the conditions resulting in the shadow impact have passed.

The EIAR and wind farm design process was an iterative process. As information regarding the Site was compiled and assessed, the number of turbines and the proposed layouts was revised and amended to take account of the physical constraints of the Site. The requirement for buffer zones and other areas in which no turbines could be located was also compiled and assessed. Findings at each stage of the assessment were used to further refine the design, always with the intention of minimising the potential for environmental impacts.

The Development of the final proposed wind farm layout has resulted following feedback from the various studies and assessments carried out as well as ongoing negotiations and discussions with landowners and the local community. The specific locations of the various turbines were reviewed during the optimisation of the Site layout. This was achieved by strictly adhering to the Developable Area for the location of the turbines and avoiding known constraints for the site infrastructure.

Preliminary Layouts

In 2018 and 2019, the Developer looked at layouts with 15 No. smaller turbines and 5 No. larger turbines at the selected Site respectively as shown in **Figure 3.2a** and **3.2b**. In 2018 a landscape and visual impact assessment was undertaken for the 15 turbine layout. It found the main issue with the layout was the sprawling lateral extent of the development, which was generally concentrated on one hillside/ridge, but extended across a shallow valley to the west to form another cluster which in-turn linked to an existing / permitted wind energy development on a skyline ridge to the west. Consequently, the western half of the scheme contributed disproportionality to a negative visual impact including negative cumulative impacts, which were considered to be a particular issue for the 15 turbine layout. The study therefore recommended to reduce the overall extent and scale of the proposed development to reduce localised impacts and also to maximise the buffer to the nearest large cluster of Kilgarvan wind farms. Following the 2018 assessment a new layout was designed in 2019 which reduced the turbine number to five significantly reducing the negative visual impact.

At the preliminary design stage in 2018 and 2019 the constraints-led approach was limited and did not include all the constraints listed in Section 3.6.1.

First Layout

In 2020 a constraints study was undertaken for the Site using all criteria outlined in 3.6.1. The redline boundary was reduced from that used in the preliminary design as a number of private landholders did not want to proceed with long-term lease agreements. The study identified a viable area within the overall study area suitable for five turbines. In line with the 2006 Wind Energy Guidelines a separation distance between the turbines of three times the rotor diameter (3d) in the crosswind direction and seven times the rotor diameter (7d) in the prevailing downwind direction was applied to ensure optimal performance.

The first layout in shown in **Figure 3.3**.

Second Layout

Following the design of the first layout and a review of the viable lands the number of turbines was increased from 5 No. to 6 No. as a result of additional technical information provided by the wind turbine supplier which allowed the separation distance between the turbines to be reduced from 7d to 5d.

The second layout is shown in **Figure 3.4**.

Third Layout

The third layout as presented in **Figure 3.5** takes account of all site constraints arising from the site investigation results collated during the EIAR (e.g., ecology, ornithology, hydrology, peat depths etc.) and design constraints (e.g., setback distances from houses and third-party lands/infrastructure and distances between turbines on-site etc.). As stated above this layout also takes account of the results of all detailed site investigations and baseline assessments that have been carried out during the EIAR process.

The turbine locations from the third layout remained the same as the second layout. However, the crane hardstand for T3 was adjusted as it was located in a potential landslide susceptibility area. The access road from T3 to T1 and T3 to T2 were also realigned to avoid high risk landslide susceptibility areas. The red-line boundary was reduced to encompass only the area of the Site that was now confirmed as viable for development see **Figure 3.1**. The area within the red-line boundary reduced from 481 ha to 170.1 ha.

Fourth and Final Layout

Following further conversations with the owner of H5, a derelict, unoccupied property which is shown in **Figure 1.3** as located within the 4 x tip height housing buffer, it was decided to remove a turbine, T6 (**Figure 3.5**). The final five turbine layout is show in **Figure 3.6**.

A comparison of the potential environmental effects of the three wind turbine layouts when compared against the final layout are presented in **Table 3.2**.

Table 3.2: Environmental effects from first and second layout iteration compared to the final layout

Criteria	First Layout (5 wind turbines)	Second Layout (6 wind turbines)	Third and Final Layout (6 wind turbines with realigned roads and hard standing for T3)	Fourth and Final Layout (5 wind Turbines)
Population & Human Health (incl. Shadow Flicker)	No material environmental difference for population or human health.	No material environmental difference for population or human health.	No material environmental difference for population or human health.	No material environmental difference for population or human health.
Biodiversity	No significant environmental impacts.	No significant environmental impacts.	No significant environmental impacts.	No significant environmental impacts.
Ornithology	No significant environmental constraints	No significant environmental constraints	No significant environmental constraints	No significant environmental constraints
Soils & Geology	Slight decrease in the volume of peat and spoil to be managed. Overall no significant environmental impacts.	Slight increase in the volume of peat and spoil to be managed. Overall no significant impacts.	This layout was amended following geotechnical investigations to avoid areas of peat slide susceptibility areas. Overall no significant environmental impacts	Slight decrease in the volume of peat and spoil to be managed. Overall no significant environmental impacts.
Hydrology & Hydrogeology	No significant environmental impacts.	An increase in the volume of peat and spoil to be managed on site would increase the potential for runoff. Overall no significant environmental impacts.	The hydrology and hydrogeology impacts remain the same as the second layout. Overall no significant environmental impacts.	No significant environmental impacts.

Criteria	First Layout (5 wind turbines)	Second Layout (6 wind turbines)	Third and Final Layout (6 wind turbines with realigned roads and hard standing for T3)	Fourth and Final Layout (5 wind Turbines)
Air & Climate	Slight increase in the carbon payback time. Overall a long-term, significant, positive impact on Climate.	Slight decrease in the carbon payback time. Overall a long-term, significant, positive impact on Climate.	The carbon payback time remains the same as the second layout. A long-term, significant, positive impact on Climate.	Slight increase in the carbon payback time. Overall a long-term, significant, positive impact on Climate.
Noise	No significant noise impacts	No significant noise impacts	No significant noise impacts	No significant noise impacts
Material Assets	Slight decrease in the area of forestry removal required. No significant impact on material assets.	Slight increase in forestry removal required. No significant impact on material assets.	The area of forestry is the same as the second layout. No significant impact on material assets.	Slight decrease in the area of forestry removal required. No significant impact on material assets.
Landscape & Visual	Slightly less visual impact. No significant landscape and visual impacts.	The visual impact is slightly increased with the additional turbine. However, overall there are no significant landscape and visual impacts.	The landscape and visual impacts are the same as the second layout. Overall no significant landscape and visual impacts.	Slightly less visual impact. No significant landscape and visual impacts.
Cultural Heritage	No significant cultural heritage impacts.	No significant cultural heritage impacts.	No significant cultural heritage impacts.	No significant cultural heritage impacts
Traffic and Transport	A smaller development footprint would require less construction traffic and the volume of construction traffic using public roads would be less. Overall no significant impact to traffic and transport.	Larger development footprint would lead to an increase in construction traffic using the public roads.	The volume of construction traffic would be the same as the second layout. Overall no significant impact to traffic and transport.	A smaller development footprint would require less construction traffic and the volume of construction traffic using public roads would be less. Overall no significant impact to traffic and transport.

3.6.3 Internal Site Access Road Layout

Roads must be of a gradient and width sufficient to allow safe movement of equipment and vehicles. It was deemed necessary during the initial design of the Development that existing roads would be utilised where possible to minimise the potential for impacts by constructing new roads as an alternative.

As the overall site layout was finalised, the most suitable routes between each component of the Development were identified, taking into account the existing roads and the physical constraints of the Site. Locations were identified where upgrading of the existing road would be required. This included where sections of new roads would need to be constructed, in order to ensure suitable access to and linkages between the various project elements, and efficient movement around the Site.

An alternative option to utilising the existing road network within the Site would be to construct a new road network, having no regard to existing roads. This approach was considered unfavourable, 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 these new roads. A comparison of the potential environmental effects of constructing an entirely new road network when compared with maximising the use of the existing road network is presented in **Table 3.3**.

Table 3.3: Comparison of environmental effects from constructing a new Internal Site Access Road network verses utilising existing Site Access Roads and supplementing with new Site Access Roads where required

Criteria	Comment
Population & Human Health (incl. Shadow Flicker)	Larger development footprint results in additional dust and noise generated during construction.
Biodiversity	Larger development footprint will result in greater habitat loss.
Ornithology	Larger development footprint will result in greater habitat loss which could impact birds.
Soils & Geology	Larger development footprint will result in greater volumes of peat and spoil to be excavated and stored. Larger volume of stone required from on-site borrow pit for road construction.
Hydrology & Hydrogeology	Larger development footprint and increased number of new watercourse crossings, therefore, increasing the

Criteria	Comment
	potential for silty runoff to enter receiving watercourses.
Air & Climate	Potential for greater dust emissions due to the requirement of an increased volume of stone from the on-site borrow pit. Potential for greater vehicular emissions due to increased volume of construction traffic. However, these will not be significant.
Noise	Larger development footprint results in additional nose generated during construction.
Material Assets	Larger development footprint will result in greater land-take and a greater change in land use.
Landscape & Visual	Potential for visual and landscape impacts due to the construction of new roads. However, this will not be significant.
Cultural Heritage	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.
Traffic and Transport	Larger development footprint will increase the volume of construction traffic impacting the public road network. However, these will not be significant.

3.6.4 Location of Ancillary Structures

The alternatives considered are discussed for the following ancillary infrastructure required for the Development: a temporary construction compound (a single compound versus two smaller compounds) electricity substation (location) and borrow pit (using local quarries versus an onsite borrow pit).

3.6.4.1 Construction Compound

The use of a single temporary construction compound as opposed to two smaller compounds located in different areas of the Site is proposed and will result in less disturbances to the Site and a reduced visual impact during construction. A comparison of the potential environmental effects of constructing a single, large construction compound when compared against constructing two smaller compounds is presented in **Table 3.4**.

Table 3.4: Comparison of environmental effects from constructing two smaller construction compounds compared to one large construction compound

Criteria	Comment
Population & Human Health (incl. Shadow Flicker)	Potential for increased noise impacts on nearby sensitive receptors.
Biodiversity	Potential for a greater impact to the Site ecology by constructing two construction compounds in different areas of the Site as the footprint of two smaller construction compounds is larger than one large compound.
Ornithology	Potential for a greater impact to the Site ornithology by constructing two construction compounds in different areas of the Site.
Soils & Geology	Larger development footprint will result in greater volumes of peat and spoil to be excavated and stored. Larger volume of stone required from on-site borrow pit for road construction.
Hydrology & Hydrogeology	The use of multiple construction compounds sites has the potential to increase the risk of erosion and increase risk to watercourses.
Air & Climate	Potential for greater dust emissions due to the requirement of an increased volume of stone from the on-site borrow pit. Potential for greater vehicular emissions due to increased volume of construction traffic. However, these will not be significant.
Noise	Potential for increased noise impacts on nearby sensitive receptors.
Material Assets	Larger development footprint will result in greater land-take and a greater change in land use.
Landscape & Visual	Potential for visual and landscape impacts due to the construction of two construction compounds in different parts of the Site. However, this will not be significant
Cultural Heritage	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.
Traffic and Transport	More efficient movement and management of material across the Site.

3.6.4.2 Onsite Substation incorporating Control Building

The north and south of the Site were assessed for locating the Onsite Substation. Having regard to the Site constraints, the grid connection to Ballyvouskill and the EirGrid requirement to maintain 3.5 times the turbine fall over distance, the location of the Onsite Substation including Control Building the south of the Site was selected as the location of the Onsite Substation.

Table 3.5: Comparison of environmental effects from constructing an onsite substation in the South to one in the North of the Site

Criteria	Comment
Population & Human Health (incl. Shadow Flicker)	Potential for increased noise impacts on nearby sensitive receptors at both locations.
Biodiversity	Potential for increased noise impacts on nearby sensitive receptors at both locations.
Ornithology	No potential for impacts to ornithology at either location.
Soils & Geology	The volume of spoil removed for both sites will be the same.
Hydrology & Hydrogeology	The potential for silt or sediment laden run-off to impact surface water bodies and the aquatic ecology they support the same for both sites.
Air & Climate	The potential dust emissions and exhaust emissions the same for both locations.
Noise	The potential for noise impacts will be the same for both locations.
Material Assets	The land-take will be the same for both locations.
Landscape & Visual	The visual impact of the onsite substation will be the same or both locations.
Cultural Heritage	The potential for impacts on unrecorded, subsurface archaeology is the same for both locations.
Traffic and Transport	The volume of traffic associated with the construction of the onsite substation will be the same for both locations.

3.6.4.3 Borrow Pit

Fill material required for the construction of access roads and turbine bases will be obtained from one onsite borrow pit and will be located to the east of T5. The use of the borrow pit represents an efficient use of existing onsite resources and eliminates the need to source material from outside the site and transport large volumes of construction materials along the local public road network to the Site. The location for the borrow pit was identified following detailed geotechnical site investigations and site-specific constraints outlined in **Section 3.8.1,** namely 65 m buffer of watercourses, 100 m buffer from archaeological sites or monuments and the avoidance of environmental constraints identified from desk studies. The borrow pit will provide up to 50,276 m^3 of site won general fill. The proposed borrow pit shall also be reinstated with excavated soil material which will avoid the need to export excess spoil to off-site facilities.

An alternative to using onsite borrow pits was the option of sourcing all stone and hardcore materials from locally licensed quarries. The transport of such material to Site would result in a significant increase in construction traffic and heavy loads and was therefore considered the least preferable option.

A comparison of the potential environmental effects of using an onsite borrow pit in comparison to using an offsite quarry is presented in **Table 3.6**.

Table 3.6: Environmental effects from utilising local quarries compared to the on-site borrow pit

Criteria	Comment
Population & Human Health (incl. Shadow Flicker)	Potential for increased noise, vehicular and dust emissions from transporting material from offsite quarry locations to the site which could have adverse health effects. Increased HGV disturbance will lead to increased environmental nuisance.
Terrestrial Ecology	Neutral – potential for a small area of vegetation to be removed to access the borrow pit and the quarry. No significant impacts to terrestrial ecology.
Aquatic Ecology	Neutral – potential for silt or sediment laden run-off to impact surface water bodies and the aquatic ecology they support from the borrow pit and the quarry.
Ornithology	Neutral – no potential impact to ornithology.
Soils & Geology	Effect on local quarry resource.
Hydrology & Hydrogeology	Neutral – potential for silt or sediment laden run-off to impact surface water bodies and the aquatic ecology they support from the borrow pit and the quarry.
Air & Climate	Potential increase in dust emissions and vehicle emissions associated with off-site vehicle movements.

Criteria	Comment
Noise	Whilst there would be less noise generated from the Site as a result of using an offsite source, there will be an increase in noise emissions from the transport of material from offsite quarry locations on public roads. This will impact on dwellings and facilities situated along these roads.
Material Assets	Effect on local quarry resource.
Landscape & Visual	Neutral - no potential landscape and visual impact.
Cultural Heritage	Neutral - The potential for impacts on unrecorded, subsurface archaeology is the same for both locations.
Traffic and Transport	Additional HGV trips required for importation of fill.

3.7 ALTERNATIVE DESIGN PHILOSOPHY AND SPECIFICATIONS

Consideration was given to an appropriate limited range of turbine dimensions that would allow suitable flexibility at procurement stage. This is necessary because of the rate of change in technology and the length of time required to progress a project from early planning stage to turbine purchase. Different models that are currently available may not be available in a number of years and models that are not available now are likely to become available. The Developer undertook a review of currently available technology and chose a range of dimensions that ensures the best chance of a competitive procurement process for the proposed limited range of dimensions.

The result was the proposed limited range of dimensions as set out below:

- A tip height range of 177 m to 185 m;
- A hub height range of 102.5 m to 110.5 m, and
- A rotor diameter range of 149 m to 155 m.

The range of dimensions are shown on **Figure 1.4**.

3.7.1 Turbine Type

This output may vary as a result of the final turbine type, power output modelling and turbine development over the period leading up to construction. For the purposes of this EIAR, a minimum rated output of 5.6 MW and a maximum rated output of 6.6 MW has been used to calculate the power output of the proposed wind farm, which will result in an estimated installed capacity of between 28 MW to 33 MW. A wind farm with the same potential power output could also be achieved on the Site by using smaller turbines (for example 3.5 MW machines). However, this would necessitate the installation of up to 11 turbines to achieve a similar output. Furthermore, the use of smaller turbines would not make efficient use of the wind resource available having regard to the nature of the Site. Taller wind turbines with larger rotor diameters allow wind turbines to sweep more area, capture more wind, and produce more electricity.

3.7.2 Number of Turbines

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

The 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 5 No. turbine layout selected for the Site has the smallest development footprint, while still achieving the optimum output.

3.7.3 Height of Turbines

The turbine model to be installed on the Site will be the subject of a competitive tendering process and will be within the following dimensions. The height of the turbines that will be selected for construction on the Site will have an overall ground to blade tip height ranging from 177 m to 185 m, a rotor diameter ranging from 149 m to 155 m and a hub height ranging from 102.5 m to 110.5 m. The use of alternative smaller turbines at this Site would fail to make the most efficient use of the wind resource passing over the Site.

Following the establishment of the developable area of the Site, as part the design alternative process, specific turbine models with different heights (177 m, 180 m and 185 m) were considered before settling on the tip height range of 177 m to 185 m now proposed.

The relationship between the turbine height and density (number of turbines) required to achieve a particular output was a key design consideration. From research carried out by Betakova *et al*. (2015) people have highlighted that when given an option, they tend to prefer a scenario of fewer larger turbines:

"People prefer reducing the number of turbines by replacing smaller turbines with larger ones even though larger ones might be visible from a larger number of residences"

One such study commissioned by Fáilte Ireland in 2008 found that:

"In terms of the size and composition of wind farms, tourists tended to prefer farms containing fewer turbines. If both produced the same amount of electricity, tourists also preferred wind farms containing a small group of large turbines (55%) to a large group of smaller turbines (18%)."[5]

On the basis of these factors and through design stage analysis, consideration was given to the approach that the slightly increased sense of visual dominance imparted by taller turbines is preferable to the reduced level of permeability and increased visual array associated with a greater number of shorter turbines required to achieve the same output. Moreover, the perceived visual dominance of taller turbines is further offset by increased setback distances from residential receptors.

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. The use of less turbines also reduces the impact on the receiving environment with less land-take required to accommodate the wind farm, with 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 Carrownagowan Wind Farm, Co. Clare (ABP ref. PA03.308799) which consists of 19 No. wind turbines at 169 m tip height, Castlebanny Wind Farm, Co. Kilkenny (ABP ref PA10.309306) which consist of 21 No. wind turbines at 185 m tip height, Ardderroo Wind Farm, Co. Galway (ABP ref. PL07 .303086) which consists of 25 No. wind turbines at 178.5 m tip height. Coole Wind Farm, Co. Westmeath (ABP ref. PL25M.300686) which consists of 13 No. wind turbines of 175 m tip height, and Derrinlough Wind Farm (ABP ref. PA19.306706) which consists of 21 No. wind turbines of 185 m tip height.

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 3.7**.

[5]https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/4_Visitor_Insights/Visitor-Attitudes-on-the-Environment.pdf?ext=.pdf [Accessed 25/10/2022]

Table 3.7: Environmental effects from a large number of smaller wind turbines compared to the Development

Criteria	Comment
Population & Human Health (incl. Shadow Flicker)	Greater potential for shadow flicker impact on nearby sensitive receptors.
Biodiversity	Larger development footprint would result in greater habitat loss.
Ornithology	The presence of more turbines would increase the potential effects on birds.
Soils & Geology	Larger development footprint would result in greater volumes of peat and spoil to be excavated.
Hydrology & Hydrogeology	The larger development footprint would increase the potential for silty runoff to enter receiving watercourses.
Air & Climate	Neutral – Potential air and climate impacts would be similar.
Noise	Potential for increased noise impacts on nearby sensitive receptors.
Material Assets	Neutral – Potential material assets impacts would be similar.
Landscape & Visual	A larger number of smaller turbines would have a greater visual impact.
Cultural Heritage	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.
Traffic and Transport	Potential for greater traffic volumes during construction phase due to larger development footprint and requirement for more construction materials and turbine components.

3.8 ALTERNATIVE GRID CONNECTION

3.8.1 Grid Connection Technology and Routes

A key consideration in determining the Grid Connection technology for a proposed wind energy development is whether the cabling is undergrounded or run as an overhead line. While overhead lines are less expensive and allow for easier repairs when required, underground lines will have no visual impact. A comparison of the potential environmental effects of constructing overhead lines when compared against constructing underground lines is presented in **Table 3.8**.

Table 3.8: Environmental effects from overhead lines compared to underground lines

Criteria	Comment
Population & Human Health (incl. Shadow Flicker)	Potential to impact property prices due to visual impact.
Biodiversity	Where underground lines are unable to be placed in the road there is greater potential for impact to biodiversity as the footprint of cable trenches will be greater than that of wooden poles.
Ornithology	Neutral – No potential impact to ornithology.
Soils & Geology	Cable trenches have a larger footprint than OHL pole and will have a greater potential to impact soils and geology as the excavation volumes will be greater.
Hydrology & Hydrogeology	There is greater potential for water impacts due to sediment release for cable trenches as there will be a greater volume of material excavation than with OHL poles.
Air & Climate	Slightly less dust emissions associated with OHL installation due to the smaller excavation footprint.
Noise	Potential for noise impacts similar for OHL and cable trench installation during the construction and decommissioning phases. Potential for greater operational noise from OHL.
Material Assets	Neutral – Potential impacts to material assets similar for OHL and cable trench installation.
Landscape & Visual	Potential for greater visual impact due to overground poles and cables.
Cultural Heritage	Potential for impacts on unrecorded, subsurface archaeology is greater for underground lines as they will be placed on land/off-road and will cover a greater surface area than OHL poles.
Traffic and Transport	Potential for a slight impact to traffic using the forest track running from the Site entrance to the N22 during the cable trench installation, however the majority of the proposed grid connection route is offroad. No traffic impacts associated with OHL as it would be all offroad.

3.8.2 Grid Connection Routes

Potential grid connectivity and constraints were also considered during the strategic site selection process as detailed in the strategic screening exercise as discussed in **Section 3.5.2.1**. Ballyvouskill 220 kV GIS substation was selected because it had capacity available when compared to Clonkeen and because of its closer proximity to the Site (i.e., within 13 km as the crow flies).

Four underground cabling route options from Inchamore to Ballyvouskill were initially considered and assessed as part of a civil and structural due diligence to determine which route would be brought forward. . The four routes, Route A, B, C and D are shown on **Figure 3.7**. Route D has three route options for connection to Ballyvouskill. The initial grid route assessment found a combination of Route B and C combined with Route D Option 2 or Option 3 was the most favourable as the majority of the route is within Coillte lands and there are less bridge crossings.

On review, a combination of Route B (excluding the section running towards the Sullane), Route C and Route D Option 3 was chosen as the grid route. This route was selected as it avoided utilising the alternative Route A. The risks associated with the constructability of Route A were the Macroom to Millstreet bypass, crossing a protected bridge, and existing services in the road. The selected grid route has less bridges and the majority of it is located within Coillte lands, reducing the requirement to access further third party owned property. A comparison of the potential environmental effects of constructing Route A compared against the chosen option (combined Routes B, C and D) is presented in **Table 3.9**.

Table 3.9: Environmental effects of grid Route A compared against the chosen option (combined Routes B, C and D)

Criteria	Route A	Route Option (combined options B, C, D,)
Population & Human Health (incl. Shadow Flicker)	Neutral as the temporary works will avoid Ballyvourney.	Neutral as the temporary works will avoid Ballyvourney.
Terrestrial Ecology	Route A travels along public roads within St Gobnets Wood SAC and Mullaghanish to Musheramore Mountains SPA with some off-road sections proposed where lands are hydrologically connected to St Gobnets Wood SAC and Mullaghanish to Musheramore Mountains SPA.	The chosen route (combined options B, C and D travels through an area which is hydrologically connected to Killarney National Park, Macgillycuddy Reeks and Caragh River Catchment, is ecologically connected to Mullaghanish to Musheramore Mountains SPA and there is a potential ecological connection to Killarney National Park SPA.
Aquatic Ecology	Route A drains to Sullane and Foherish catchments with 14	Route B and C drains to the River Flesk (which is hydrologically

Criteria	Route A	Route Option (combined options B, C, D,)
	stream crossings along the route. Annex II Freshwater Pearl Mussel (*Margaritifera margaritifera*) and Atlantic Salmon (*Salmo salar*) are present within both river systems.	connected To Killarney National Park, Macgillycuddy Reeks and Caragh River Catchment SAC), and Foherish River. Route D drains to the Garrane stream, a tributary of the Foherish River. Route B drains to the Sullane River. There are Annex II Freshwater Pearl Mussel ((*Margaritifera margaritifera*) and Atlantic Salmon (*Salmo salar*) present within the above mentioned river systems.
Ornithology	Route A runs through St. Gobnet's Wood SPA and Mullaghanish to Musheramore Mountains SPA.	Route D is ecologically connected to Mullaghanish to Musheramore Mountains SPA and is potentially connected to Killarney National Park SPA.
Soils & Geology	Route A is typically adjacent to farmland, with rushes frequently present which suggests a soft peaty soil underlies the area, although areas with till, weathered rock and rock outcrops were also observed.	The Grid Connection Route is approximately 19.9 km of which 1.3 km is within the Site. The remaining 18.6 km is located off-road and in third-party lands. The potential impacts associated with the Grid Connection Route in relation to soils and geology in general are considered slight.
Hydrology & Hydrogeology	Route A has five bridge crossings which would increase the potential for silty runoff and hydrocarbons to enter receiving watercourses.	There are three bridge crossings and therefore less potential for silty runoff and hydrocarbons to enter receiving watercourses.
Air & Climate	Temporary dust and exhaust emissions from construction vehicles	Temporary dust and exhaust emissions from construction vehicles
Noise	Temporary noise impacts during the construction phase.	Temporary noise impacts during the construction phase.
Material Assets	Neutral – No impact to material assets.	Neutral - No impact to material assets.
Landscape & Visual	Neutral – No visual impact.	Neutral – No visual impact.

Criteria	Route A	Route Option (combined options B, C, D,)
Cultural Heritage	Neutral – route located in existing roads and tracks.	Neutral – route located in existing roads and tracks.
Traffic and Transport	Neutral as some temporary road closures will be necessary of narrow roads to facilitate the installation of cables.	Neutral as some temporary road closures will be necessary on narrow roads to facilitate the installation of cables.

3.9 ALTERNATIVE RENEWABLE ENERGY TECHNOLOGIES

Forestry and agriculture will continue to be carried out on the Site around the footprint of Development. An alternative source of renewable energy considered for Site following its identification was solar energy. Commercial solar energy production is the harnessing and conversion of sunlight into electricity using photovoltaic arrays (panels). The capacity factor of solar energy is significantly lower than that of onshore wind energy, requiring approximately three times the capacity of the Development (i.e. X (3) x Y (33 MW) = Z (99 MW)) to produce the same amount of energy. Solar farms require 1 hectare per MW, the land area required to generate the equivalent amount of MW would be in the region of 40 ha. This compares to a footprint of 14.86 ha for the five proposed turbines. **Table 3.10** outlines the potential impact from the development of a solar photovoltaic array when compared to a wind farm energy development. The selected wind farm energy development is the most efficient method of energy production with the lesser potential for significant, adverse environmental effects.

Table 3.10: Environmental effects from a solar photovoltaic array compared to a wind farm development

Criteria	Comment
Population & Human Health (incl. Shadow Flicker)	No potential for shadow flicker to affect sensitive receptors. Potential for glint and glare impacts on local road users and at dwellings.
Biodiversity	Larger development footprint would result in greater habitat loss.
Ornithology	Potential for mimicry of sensory cues i.e., glint and glare similar to water leading to bird fatalities caused by collision. This can be mitigated.
Soils & Geology	Although Solar PV has a larger development footprint the volume of peat and spoil to be excavated is less

Criteria	Comment
	than that required for a wind farm due to the shallow excavation works required during construction.
Hydrology & Hydrogeology	A solar PV array development would require a larger development footprint therefore increasing the potential for silty laden runoff to enter receiving watercourses.
Air & Climate	Reduced capacity factor of solar PV array technology would result in a longer carbon payback period.
Noise	The potential noise impacts from a solar PV are less than that of a wind energy development due to the smaller scale construction and there is no noise associated with the solar panels.
Material Assets	The larger development footprint would have a greater impact on the land use (Forestry and Agriculture) of the Site.
Landscape & Visual	Potentially less visible from surrounding area due to screening from existing forestry and topography. More of a local low level visual impact due to the increased land take and slope of the land.
Cultural Heritage	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.
Traffic & Transport	Potential for greater traffic volumes during construction phase due to the number of solar panels required to achieve the same output. However, due to the smaller size of the solar panels there may be less work required along the TDR route to accommodate their delivery.

3.10 ALTERNATIVE TURBINE HAUL ROUTE

Alternative ports of entry and transport routes to the Site were considered, the latter in relation to turbine component delivery as well as general construction-related traffic.

3.10.1 Port of Entry

The alternatives considered for the port of entry of wind turbines into Ireland for the Development include Ringaskiddy Port, Co. Cork and the Foynes Port, Co. Limerick. Both Ports offer a roll-on-roll-off procedure to facilitate import of wind turbines. Ringaskiddy Port was selected as the port of entry for this Project because it is located closer to the Site and a number of the existing wind farms in the locality have successfully utilised this port. This reduces the work required on the Turbine Delivery Route.

3.10.2 Turbine Component Delivery to Site

Turbine component delivery routes from Ringaskiddy Port included the N40 and the N22. This route has proven suitable for the transport of turbine components for other wind farm developments in the area. The transport analysis (as presented in **Chapter 15: Traffic and Transportation**) shows that only minor additional accommodation works will be required to accommodate the proposed turbines.

3.10.2.1 Civil Construction Haul Route

The local road network in the vicinity of the Site and the supplier locations were assessed for the Civil Construction Haul Route. A number of the local roads were not suitable as they were too narrow or they would have required upgrade works.

The proposed Civil Construction Haul Routes are shown on **Figure 15.3**.

Specific grades of rock fill will be required as fill under turbine foundations while sub-base and base course materials for the access track and turbine hardstand construction will be sourced on site from borrow pits. Concrete, crushed stone and concrete blocks for construction of the Development will come from licenced quarries in the locality such as:

- McGroup Keim Quarry;
- Coppeen Concrete, Enniskeane;
- Mid-Cork Quarries, Gortnadiha;
- McSweeney Bros, Kilmichael;
- Keohane Readymix, Ballygurteen, and
- Murray Bros Tarmacadam Ltd, Ardcahan.

These quarries will also be the source of crushed stone and road surfacing for widening works to the turbine haul route (existing Coillte track) and for grid connection works.

From Keim, trucks will follow the R582 in a southern direction and then travel in a westerly direction along the L-5226-0, the L-7418-55, the L-7418-25 and the L-7418-0 to Ballyvourney and will then follow the N22 to the site entrance.

For the quarries to the south (all bar Mc Group Keim), trucks will use the R587, then the R584 to the new Macroom By-Pass (N22) and then follow the old N22 to the site.

For the Grid Connection Route, general material excavated from trenches in public roads will be disposed of to a licenced facility while excavated road surfacing material will be recycled. Excavated road surfacing materials will be recycled and used for temporary reinstatement of trenches. General soil waste will be transported to one or more of the following licensed facilities:

- Tomas Mullins, Scrahanagown, Coolea, Co. Cork;
- Richard & Dennis Carroll Plant Ltd., Clonfadda, Macroom, Co. Cork;
- Ciaran Ryan Plant Hire Ltd., Ballymacorcoran, Clondrohid, Co. Cork, and
- Séan Ó Luasa, Na Foithrí (Fuhirees), Cúil Aodha, Maighchromth, Co. Chorcaí.

Soil and stone spoil from road widening on the Turbine Haul Route will be disposed of to the same facilities.

Bitumen and supplementary road surfacing for trench reinstatement can be sourced from Lehane Tarmacadam, Kilbarry, Macroom, Co. Cork or McSweeney Bros, Kilmichael or Murray Bros Tarmacadam Ltd., Ardcahan and will use the routes as shown on **Figure 15.3**.

Grid construction traffic will use the grid route and link with the N22 at Cummeenavrick or will be serviced from the wind farm site.

3.11 ALTERNATIVE MITIGATION MEASURES

Mitigation by avoidance has been central to the Project's evolution. By avoiding the sensitive areas of the Site using the constraints led approach described in **Section 3.6.1** the potential for environmental effects is limited. As noted above, the site layout aims to avoid any environmentally sensitive areas through the application of site-specific constraints. Where loss of habitat occurs at the Site, this has been mitigated with the proposal of enhancement lands.

The alternative to this approach is to encroach on the environmentally sensitive areas of the site and accept the potential environmental effects associated with this. The best practice design and mitigation measures set out in this EIAR will contribute to reducing any risks and have been designed to break the pathway between the Site and any identified sensitive receptors.

3.12 CONCLUSION

A description of the reasonable alternatives in terms of wind farm design and layout, design philosophy and specifications, grid connection, renewable energy technologies, turbine haul route and mitigation measures, studied by the Developer, which are relevant to the proposed project and its specific characteristics (maximum 33 MW output, five turbines with a tip height range of 177 m to 185 m, a hub height range of 102.5 m to 110.5 m and a rotor diameter range of 149 m to 155 m – large scale wind farm), and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects has been provided.