3 ALTERNATIVES CONSIDERED

3.1 INTRODUCTION

This chapter of the EIAR provides an assessment of the alternatives considered by the Developer in the design of the Development. Alternatives were assessed taking commercial, construction, operational and key environmental constraints into consideration.

Figures supporting this Chapter are provided in **Volume III.**

3.2 STATEMENT OF AUTHORITY

This section has been prepared by Mr. Ryan Mitchell and Mr. Justin Lohan of Jennings O'Donovan & Partners Ltd. Mr. Mitchell has a Bachelors' Degree in Animal conservation and Biodiversity, has a strong proven background in ecology with 7 years of experience working in the sector. He is experienced in report writing, EIAR chapter writing and project management working on EIARs for wind farm developments in Ireland.

Mr. Lohan has a Bachelors' degree in Environmental Science and Technology. He also has almost 20 years' experience working in the construction and environmental sectors. He is experienced in report writing, EIAR chapter writing and project management working on EIARs for wind farm developments in Ireland

The chapter has been reviewed by Mr. David Kiely of Jennings O'Donovan & Partners Ltd. Mr. Kiely has 35 years' experience in the civil engineering and environmental sector. He has obtained a Bachelor's Degree in Civil Engineering and a Master's in Environmental Protection, has overseen the construction of over 40 wind farms and has carried out numerous soils and geology assessments for EISs. He has been responsible in the overall preparation of more than 20 EIA Reports (EIARs).

3.3 METHODOLOGY

3.3.1 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 assessing these Alternatives. In additionthe 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".

In May 2022 the Environmental Protection Agency (EPA) published Guidelines on the information to be contained in Enviromental Impact Assessment Reports. The EPA Guidelines state that "*It is generally sufficient to provide a broad description of each main alternative and the key issues associated with each, showing how environmental considerations were taken into account in deciding on the selected option".*

3.3.2 Requirements for Alternatives Assessment

Article 5(3)(d) of the EIA Directive requires the following:
"outline of the main alternatives studied by the developer and an indication of the main reasons for his choice, taking into account the environmental effects".

Article 5(1) of the Revised EIA Directive requires:
"Where an environmental impact assessment is required, the developer shall prepare and submit an environmental impact assessment report. The information to be provided by the developer shall include at least: ...
(d) 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";

Annex IV of the Revised EIA Directive (Information Referred to in Article 5(1) (Information for the Environmental Impact Assessment Report) states that:
"… 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 for the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of environmental effects".

The Revised EIA Directive Consultation states that transposition of these provisions is mandatory, and that:
"Guidance will be developed on the requirement to study reasonable alternatives, including reference to the fact that some alternatives may already have been studied in relevant SEAs. The guidance will also deal with relevant considerations, including 'do nothing' alternative(s), alternative site(s), alternative design(s)/layout(s), alternative processes(s), alternative mitigation measure(s). Reference will also be made to the requirement that

"reasonable alternatives ... relevant to the project and its specific characteristics" are required to be studied".

The EPA, in its Guidelines on the information to be contained in Environmental Impact Assessment Reports guidance document[1], 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 nature of the obligation under the EIA Directive to assess "the main alternatives" was the subject of a CJEU ruling in November 2018 in *Holohan* (Case C-461/17). The CJEU was asked to consider whether the obligation meant that the developer must supply information on the environmental effects of the proposed development and of all of the main alternatives studied, even if some or all of those alternatives were rejected at an early stage. The CJEU held that the 'main' alternatives must be those which influence the environmental effects of the project, and it is irrelevant whether they were rejected at an early or later stage. The CJEU also confirmed that there is no need to carry out an environmental impact assessment of those main alternatives, as the Directive refers only to the developer providing an 'outline' to the competent authority. An outline must be provided of all of the main alternatives, and the developer must offer reasons for the choice, taking into account (i.e. specifically addressing) the environmental effects of that choice.

The CJEU did not consider the obligation to provide a description of the reasonable alternatives studied by the developer which are relevant to the project and its specific characteristics.
The presentation and consideration of the various reasonable alternatives investigated by the developer is an important requirement of the EIA process.

The objective is for the Developer to present a representative range of the practicable alternatives considered which would achieve the project objectives. The alternatives should be described with 'an indication of the main reasons for selecting the chosen option'. 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

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

account in deciding on the selected option. As confirmed by the CJEU in *Holohan*, this does not require an EIA of each alternative considered.

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 this section of this document.

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

- 'Do Nothing' Option
- Strategic Site Selection
- Alternative Renewable Energy Technology
- Alternative Turbine Numbers and Model
- Alternative Grid Route connections
- Alternative Layout and Design
- Alternative Transport Route and Site Access
- Alternative Mitigation Measures

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

3.4 'DO-NOTHING' ALTERNATIVE

Annex IV, Part 3 of the EIA Directive states that the description of reasonable alternatives studied by the Developer should include "*an outline of the likely evolution thereof without implementation of the project as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge.*" This is referred to as the "do nothing" alternative. EU guidance (EU, 2017) states that this should involve the assessment of "an outline of what is likely to happen to the environment should the Project not be implemented – the so-called 'do-nothing' scenario."

Under a 'Do Nothing' alternative, The Development will not be constructed. The land upon which Development would occur would remain unchanged. Consequently, the environmental impacts, identified in the EIAR, positive and negative, would not occur.

A comparison of the potential environmental effects of the 'Do-Nothing' Alternative when compared against the chosen option of developing a renewable energy project at this site are presented in Table 3.1.

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)	Positive impact on recreation and health gain due to the upgrade of roads. Long-term positive economic benefit to local area due to job creation and Community Benefit fund. Some potential for shadow flicker or noise to affect sensitive receptors.	No increase in local employment and no financial gains for the local community. No potential for shadow flicker or noise to affect sensitive receptors.
Terrestrial Ecology	Slight negative impact on species and habitat. Positive benefit from 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 which adjoin the site. Also, any further afforestation on heath habitats would be detrimental.
Aquatic Ecology	Neutral	Neutral
Ornithology	The wind turbines and site infrastructure will have a slight negative impact on birds. The biodiversity enhancement measures such as habitat restoration and grazing management could be beneficial for ground nesting bird species which utilise heathland habitat. Such as Golden Plover and Curlew.	Without the proposed wind farm development proceeding, it is expected that the present mainland 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.
Soils & Geology	Imperceptible residual impact following implementation of mitigation measures.	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.

Criteria	Residual Impact of the Project	Do-Nothing Alternative
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.
Air & Climate	Slight to moderate temporary localised residual impacts arising from fugitive dust emissions during construction. Long-term positive impact on air quality and climate due to avoidance of burning of fossil fuels and the net displacement of between 84,107 and 92,854 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. Fossil fuel power stations will be the primary 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. Long-term slight to moderate negative impact on the dwellings closest to the project as a result of the operational phase.	Neutral
Landscape & Visual	Aside from design iterations, which are embedded in the assessed project, other specific landscape and visual mitigation measures are not considered necessary / likely to be effective. Thus, the impacts assessed in Chapter 12, Section 12.4 and 12.5 are the equivalent of residual impacts in this instance. The proposed development will bring about a Moderate significant impact to the landscape.	Neutral
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 electricity infrastructure in the local area.
Cultural Heritage	Slight-moderate indirect visual impacts on nearby monuments. No residual impacts envisaged that cannot be reversed following decommissioning.	Neutral

Criteria	Residual Impact of the Project	Do-Nothing Alternative
Traffic and Transportation	Moderate localised short-term impact due to construction and decommissioning activities.	Neutral

3.5 STRATEGIC SITE SELECTION

3.5.1 Project Site requirements

This section details the project screening and project selection process where an examination of several potential alternative project locations was undertaken.

In locating potential projects, a geographical information system (GIS) screening exercise across the entire country of Ireland was initially carried out in 2018. This exercise utilised 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, landscape designations and wind energy strategy designations available at the time.

Residential and commercial building locations were attained from Eircode's database of 2.2 million address points in Ireland. A buffer of 500m was applied to each building point, provisionally ensuring an adequate setback distance from each dwelling ensuring compliance with all relevant wind energy guidelines. As potential Study Area assessments progressed, this dwelling setback distance was further refined to comply with project and area specific details. The 2018 EMPower GIS screening process outlined certain areas that warranted further study and some areas were not considered for further study.

Study Areas not selected for further study were largely excluded because of some or all the following:

- Wind Speeds available;
- Proximity to existing grid connection points;
- Airport proximity;
- Existing electrical generation, grid upgrades and electrical loads in the area;
- Environmental designations and sensitivities;
- Existing planned and permitted projects;
- Tourism amenity;
- Topography;

- Access route availability;
- Water bodies;
- Land use and number of landowners.

Whilst the site selection exercise was carried out throughout Ireland, for the purpose of this section we focus on sites identified in the Southern most Region of Ireland, i.e Counties Waterford, Cork and Kerry. This is in order to provide site selection alternatives relative to the proposed Dyrick Hill Wind Farm site.

County Waterford was examined with a focus on developing projects within the vicinity of Waterford City and County Council's designated areas of ''Strategic'', ''Preferred'' and 'Open for ''Consideration'' as outlined in Appendix A8 of Waterford County Council Wind Energy Strategy 2011 to 2017. County Cork was examined with a focus on developing sites within Cork County Council's designated areas of 'Acceptable in Principle' and areas 'Open to Consideration', as illustrated in Figure 9.3 of the Cork County Development Plan (2014). Sites identified within these designated areas were brought forward for further consideration. Furthermore, areas of County Kerry designed 'Open to Consideration' or 'Strategic Site Search Area' were also examined to accommodate a wind energy project. The following sites were shortlisted for additional environmental and planning constraints analysis to determine development opportunity potential.

- Derrincullig, Co Kerry,
- Killognaveen, Co Kerry;
- Knockmanagh, Co Kerry;
- Dyrick Hill, Co Waterford.

Derrincullig

A potential project at Derrincullig located within an area designated "Open to Consideration" was examined during the site selection process. This is a mountainous area bordering counties Kerry and Cork. This site is in the vicinity of several existing wind farms, including Coomagearlahy 1,2 and 3, Midas and Grousemount Wind Farms.

There was a planning application for a wind energy project previously submitted (partly) on these lands which was refused by Kerry County Council and An Bord Pleanála in 2013 and 2014 respectively.

Reasons cited in the refusal included the visual impact that the project would have on the landscape. Although this site is in the "Open to Consideration" zone and it may be possible

to minimise the visual influence on the landscape through layout design, the proposed Dyrick Hill Wind Farm project is deemed to be of less impact and a preferable development opportunity.

Killognaveen

The Killognaveen site is located due east of the town of Cahersiveen in South Kerry. It is located within Kerry County Council's "Open to Consideration" wind development zone and benefits from an excellent wind resource. The site is located within 5km of the Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC. In addition, the site is situated 34km from the nearest substation, Oughtragh 110kV substation, which may present economic challenges concerning grid connection as well as potential impact on roads, traffic and transportation. For these reasons, the proposed Dyrick Hill Wind Farm project is considered to have lesser environmental impact and presents a more technically feasible alternative.

Knockmanagh

The 2018 project screening process showed the Knockmanagh site, which is located approximately 7.5km due north-east of Killarney, to have strong wind resource and a relatively large contiguous buildable area. This is a rare combination given the housing density of many parts of rural Ireland. The site is also situated within close proximity to Knockearagh substation. However, the site falls outside Kerry County Council's "Strategic Site Search" and "Open to Consideration" wind development zones and would be clearly visible from areas of Killarney National Park and the Mcgillicuddy's Reeks mountain range, two visually sensitive areas of national importance. The proposed Dyrick Hill Wind Farm project was therefore considered an alternative with less potential visual impact than the Knockmanagh site.

Dyrick Hill

Measured in a straight line direction, the proposed Dyrick Hill Wind Farm Study Area is located approximately 16km northwest of Dungarvan and 8.5km southwest of Ballymacarbry in the townlands of Dyrick, Ballynaguilkee Upper, Broemountain and Lisleaghmountain. The land is comprised of a mix of private, third party land and shared land (commonage) and the principle land use in the general area is comprised of farmland, forestry and upland heath. The Dyrick Hill Study Area is located in an area designated as 'Open to Consideration' for Wind Farm development under the Waterford County Development Plan 2011 - 2017. Accordingly, the principle of a wind farm at the study area

is acceptable in planning terms, subject to other development control considerations, including demonstration of no adverse impacts on the receiving environment.

The proposed Dyrick Hill Wind Farm project's comparative advantage is demonstrated across numerous categories as set out in **Table 3.2** Based on the analysis completed, it was deemed to present a viable opportunity from a technical, financial, and planning perspective, while imposing the least impact on its receiving environment, in comparison to the alternative sites considered above.

Table 3.2 comparative advantage is demonstrated across numerous categories

	Derrincullig	Killognaveen	Knockmanagh	Dyrick Hill
Number of Turbine Units	13	11	19	12
CDP Wind Dev. Zone	Open to Consideration	Open to Consideration	Unsuitable	Open to Consideration
Wind Resource	Class 2	Class 2	Class 2	Class 2
Designated sites	Situated within 2km of the Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC.	Situated within 2km of the Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC.	Situated 2.6km from the Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC.	Blackwater River SAC within 1 km west at its closest point. Lower River Suir SAC c. 6.3 km north Nier Valley Woodlands SAC c. 8.1 km northeast
Tourism	High – Visual impact sited as reason for refusal of previous planning application on site.	High – Views possible from the Mcgillicuddy's Reeks.	High- Views possible from Macgillicuddy's Reeks and Killarney National Park.	The project Study Area is located between areas classed as 'Sensitive' and 'Normal'
Ornithology risk	High – Eagle activity sited as reason for refusal in previous planning application.	Medium – Area not known to have Annex 1 birds present.	Medium - Area not known to have Annex 1 birds present.	Moderate – Annex 1 species exist in the wider area
Grid risk	Medium – Numerous	High – 34km to Oughtragh 110kV	Low – 5km north of Knockearagh	Moderate – Connection potential exists at

	Derrincullig	Killognaveen	Knockmanagh	Dyrick Hill
	existing and under construction wind farms in the vicinity. Clonkeen substation located 7km from site.	substation, need for deep connection works. Potential significant impact on roads during construction.	substation where available capacity exists.	Dungarvan Substation. Slight short-term impact on public road.
Planning precedence in area	Coomagearlahy 1,2 and 3, Midas and Grousemount Wind Farms in the vicinity. There was also a previous application submitted including lands within this site, which was refused by Kerry County Council and An Bord Pleanála in 2013 and 2014 Respectively.	Cahirciveen project located 1.5km from Killognaveen site.	Barna Wind Farm 8km East. Reduced potential for cumulative impact at this site.	Woodhouse Windfarm located 10.8 km south from the Dyrick Hill site.
Terrain / Land use	Mountainous, bog, agricultural	Rural general, peat harvesting, bog	Rural general, peat harvesting, bog	Strong rural area, agriculture and forestry.
Housing Density	Low	Medium	Medium	Medium

The Projects considered for a wind energy development as detailed in **Table 3.2** presented a range of different environmental constraints and sensitivities. When compared, the proposed Dyrick Hill project was found to have the greatest capacity for a wind energy development due to its robust receiving environment and lack of significant environmental constraints.

3.1.1 Preliminary Constraints Mapping and Landscape Study

Constraints mapping and a Landscape Capacity Assessment (LCA) review were carried out at the preliminary stage of the project for the identified sites. The constraints mapping process involved the placing of buffers around different types of constraints so as to identify clearly the areas within which no development works could take place. A description of the constraints and buffers applied are outlined in section 3.8.1.

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 selection process for the current proposal has been fully informed by national, regional and local policy constraints at a macro level as well as site specific constraints that influence the turbine layout and project design on site at a micro level. The main policy, planning and environmental considerations for the selection of a potential wind farm site include:

- Site location relative to the Waterford City and County Wind Energy Strategy's classification of areas considered suitable for wind farm development from a planning policy perspective
- Access to the national electricity grid possible within a viable distance
- Located outside areas designated for protection of ecological species and habitats
- Consistently high average annual wind speeds; medium housing density; and Visual Amenity Classification is relatively favourable.

3.5.2.1 Waterford County Development Plan (CDP) 2011-2017

Chapter 8 of the outgoing Waterford City and County Council CDP established the 2016 – 2030 Renewable Energy Strategy which sets out the Council's policies and objectives for renewable energy in the county and mapped out areas with potential for wind energy development in County Waterford: these are discussed in Chapter 4 of this EIAR.

Waterford City and County Council's Renewable Energy Strategy was presented in Appendix 8 of the 2011 – 2017 CDP. The area of the proposed Development was shown to be in an area *"Open for Consideration: Applications for planning permission will be treated on their merits with the developer having a clear responsibility to demonstrate as to why the development should be granted permission".*

3.5.2.2 Waterford City and County Development Plan 2022-2028

The Waterford City and County CDP has now been adopted. The most relevant planning policies from the Waterford City and County CDP which are applicable to the Development are discussed in Chapter 4 of this EIAR.

The Landscape and Seascape Characterisation Assessment presented in Appendix 8 of the CDP indicates that the Site is predominantly within an area of "High Sensitivity" – *Distinctive character with some capacity to absorb a limited range of appropriate new developments while sustaining its existing character*. A small area of the northwest of the Site is an area deemed "Most Sensitive" – *Very distinctive features with a very low capacity to absorb new development without significant alternations of existing character over an extended area*.

During the Waterford City and County Development plan 2022 – 2028 public consultation stage the applicant lodged a submission with Waterford City and County Council setting out rationale for retaining the existing spatial designations within the 2016 – 2030 Renewable Energy Strategy.

3.5.2.3 National Grid Connection

The Site is located c. 11 km northwest of the existing Dungarvan 110 kv Substation. A wind energy development at this location has several route options to enable connection to the national electricity grid.

3.5.2.4 Designated Sites

The Site is not located within any area designated for ecological protection. The nearest Natura 2000 site, i.e. Special Area of Conservation (SAC) or Special Protection Area (SPA) is the Blackwater River SAC, located c. 0.2 km west at its closest point. The nearest proposed Natural Heritage Area (pNHA) is Glenboy Wood, located c. 2.5 km to the northwest.

3.5.2.5 Wind Speeds

The Irish Wind Atlas produced by Sustainable Energy Ireland (SEAI) shows average wind speeds for the country. With the upland nature of the landscape, the SEAI Wind Atlas shows that wind speeds on the Site are consistent with the desired speeds for a wind farm development (6.5m/sec at 30m, 7.0m/sec at 75m, 8.2m/sec at 100m and 8.4m/sec at 150m/s).

3.5.2.6 Population Density

The applicant sought to identify an area with a relatively low population density. Having reviewed the settlement patterns in the vicinity of the proposed development site, the study area has emerged as suitable to accommodate the proposal. The population density of the Study Area is 8.54 persons per square kilometre, as described in Chapter 5 of this EIAR. This is significantly lower than the average national population density of 68.1 persons per square kilometre.

3.5.2.7 Summary

From the review of the criteria set out above, the Site was identified as a suitable location for the provision of a wind farm of the scale proposed. The Site is located predominantly within agricultural land and commonage which allows the site to take advantage of existing access roads (which will be upgraded). This, when combined with the proximity to the existing Dungarvan 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 located in an area with a relatively low population density with appropriate annual wind speeds.

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. In order 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.

3.6 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 the Site following its identification was solar energy. Commercial solar energy production is the harnessing and conversion of sunlight into electricity using photovoltaic arrays (panels). Solar farms require 1.5-2 hectares per MW[2], the land area required would be in the region of 108 to 163.8[3] hectares. This compares to a wind turbine footprint of 7.3 ha for the 12 no. proposed turbines. The proposed wind farm will be between 14.7 – 22.43 hectares per-MW and this value is dependent on the turbine generator specification ultimately chosen.

[2] https://www.teagasc.ie/rural-economy/rural-development/diversification/solar-pv-solar-panels/
[3] Calculations based on MW envelope for Dyrick Hill Wind Farm 6.0MW-7.2MW and hectares land take range per MW provided by Teagasc. Best case land take area scenario (12 x 6.0 x 1.5= 108) Worst case land take area scenario (12 x 7.2 x 2= 163.8).

Table 3.2 outlines the potential impact from the development of a solar PV array when compared against the selected wind energy development. The selected wind energy development is the most efficient method of energy production with the lesser potential for significant, adverse environmental effects.

Table 3.2 Environmental effects from a solar PV array compared to a wind farm development

Criteria	Comment
Population & Human Health (incl. Shadow Flicker)	Solar PV has no potential for shadow flicker to affect sensitive receptors. Potential for Solar PV to exhibit glint and glare impacts on local road users.
Biodiversity	Solar PV larger development footprint would result in greater habitat loss. Solar PV have no direct collision risk to bats compared to Wind Farms i.e. Borrow trauma.
Ornithology	Solar PV potential for mimicry of sensory cues i.e., glint and glare similar to water. Solar PV have no associated collision risk to birds compared to Wind farms.
Soils & Geology	Larger development footprint area of Solar PV would result in greater volumes of soil to be excavated. Shallower excavations involved in Solar PV array development decrease the potential for soil overburden instability to occur.
Hydrology & Hydrogeology	A solar PV array development would require a larger development footprint area and therefore increased potential for silt 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	Solar PV has less potential for noise impacts on nearby sensitive receptors.
Material Assets	The larger development footprint of Solar PV will have a greater impact on the land use (Forestry and Agriculture) of the Site. Solar PV would generate considerable less renewable energy from same size footprint than a Wind Farm. Solar PV would have no negative impact on surrounding telecommunications networks.

Criteria	Comment
Landscape & Visual	Solar PV is potentially less visible from surrounding area due to low level screening from forestry and topography.
Cultural Heritage	Solar PV potentially less risk to archaeological features onsite due to the limited excavation work required. However, extensive pilling onsite may damage undiscovered archaeological remains. The extensive excavation work required for wind farms has the potential to disturb/damage archaeological remains. However, also increases the possibility of discovering new archaeological sites/remains in the process.
Traffic & Transport	Solar PV development has potential for greater traffic volumes during construction phase due to the number of deliveries of solar panels required to achieve the same output. Solar PV would not require associated works along the haul route due to components being smaller.

3.7 ALTERNATIVE TURBINE NUMBERS AND MODEL

The proposed wind turbines will have a potential power output in the 6.0 -7.2. MW range. It is proposed to install 12 no. turbines at the Site which could achieve 72 – 86.4 MW output. 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 over 21-25 turbines to achieve a similar output. A larger number of smaller turbines would result in the wind farm occupying a greater footprint within the 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 12-no. turbine layout selected for the Site has the smallest development footprint, while still achieving the optimum output at a more consistent level than would be achievable using different turbines.

The turbine model to be installed on the Site will be the subject of a competitive tendering process.

The maximum height of the turbines that will be selected for construction on the site will not exceed 185 metres when measured from ground level to blade tip. For the purposes of this

EIAR a range of four turbines within this size envelope has been assessed (e.g. tallest turbine within defined range has been assessed for visual impact, loudest for noise etc.). The EIAR therefore provides a robust assessment of the turbines that could be considered within the Development description. The use of alternative smaller turbines at this Site would not be appropriate as they would fail to make the most efficient use of the wind resource passing over the Site and would potentially require a larger development footprint. This alternative would potentially lead to additional environmental effects.

A comparison of the potential environmental effects of the installation of a larger number of smaller wind turbines when compared against the chosen option of installing a smaller number of larger wind turbines are presented in Table 3.3.

Table 3.3 Environmental effects from a larger 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 collision risk for birds.
Soils & Geology	Larger development footprint would result in greater volumes of overburden to be excavated.
Hydrology & Hydrogeology	The larger development footprint would increase the potential for silt laden runoff to enter receiving watercourses.
Air & Climate	Increased potential for vehicle emissions and dust emissions due to an increased volume of construction material and turbine component deliveries to the Site. No impact on output so no gains in terms of the use of renewable energy over fossil fuels.
Noise	Potential for increased noise impacts on nearby sensitive receptors.
Material Assets	Potential for increased impact on any existing telecommunication links traversing the Site.
Landscape & Visual	A larger number of turbines would have a greater visual impact.

Criteria	Comment
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 LAYOUT AND DESIGN

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 being to reduce potential for environmental effects while designing a project capable of being constructed and viable. Throughout the preparation of the EIAR, the layout of the Development has been revised and refined to take account of the findings of all site investigations, which have brought the design from its first initial layout to the current proposed layout. The design process has also taken account of the recommendations and comments of the relevant statutory and non-statutory organisations, the local community and local authorities as detailed in Section 1.10 of Chapter 1.

3.8.1 Constraints Mapping

The design and layout of the Development follows the recommendations and 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, 2008) and the Draft Revised Wind Energy Development Guidelines, December 2019.

The constraints mapping process involves the placing of buffers around different types of constraints so as to identify clearly the areas within which no development works will take place. The size of the buffer zone for each constraint has been assigned using guidance presented in the Department of the Environment, Heritage and Local Government Wind Energy Guidelines (DoEHLG, 2006). As it is considered likely that that the new guidelines will be issued during the application process timeframe, current set back requirements proposed in the 2019 Guidelines have been incorporated into the design.

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

- 740m buffer of residential dwellings (exceeding the requirement for a 4-x tip height separation distance from the curtilage of properties in line with the new draft guidelines);
- Operator specific buffer of Telecommunication Links ;
- 50m buffer of Watercourses.
- 60m buffer of Archaeological Sites or Monuments.
- 200m buffer from identified bat roosts.

The Site layout design builds on the existing advantages and include the following:

- Available lands for development;
- Separation distance from un-associated landowners;
- Distance from designated sites;
- Good wind resource;
- Existing access points and general accessibility of all areas of the Site due to existing road infrastructure;
- Limited extent of constraints.

The inclusion of the constraints on a map of the study area allowed for a viable developable area to be identified. An initial turbine layout 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 6: Biodiversity** and **Chapter 7: Ornithology** of this EIAR, optimised the decision on the siting of turbines and the carrying out of any development works, such as the construction of roads.

The hydrological and geotechnical investigations at the Site examined the proposed locations for turbines, roads and other components of the Development, such as the substation and the construction compound. Where specific areas were deemed as being unsuitable for the siting of turbines or roads, etc., alternative locations were proposed and assessed, taking into account the areas that were already ruled out of consideration. The turbine layout for the proposed wind farm has also been informed by wind data and the results of noise assessments as they became available.

3.8.2 Turbine Layout

The final proposed turbine layout of the Development 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 that have been carried out during the EIAR process. As information regarding the Site was compiled and assessed, the number of turbines and the proposed layout have been revised and amended to take account of the physical constraints of the Site and the requirement for buffer zones and other areas in which no turbines could be located. The selection of turbine number and layout has also had regard to wind-take, noise and shadow flicker impacts and the separation distance to be maintained between turbines. The EIAR and wind farm design process was an iterative process, where findings at each stage of the assessment were used to further refine the design, always with the intention of minimising the potential for environmental impacts. The development of the final proposed 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. There were several reviews of the specific locations of the various turbines during the optimisation of the site layout. The initial constraints study identified a significant viable area within the overall study area, suitable for approximately 12 no. turbines. The initial turbine layout, shown in **Figure 3.2** occupied the viable area within the wider study area, however the proposed turbine layout was refined following feedback from the project team and applicant. The chosen turbine layout is considered optimal as the alternative, earlier iterations of the layout had the potential for greater environmental effects.

The first iteration of the turbine layout, shown in **Figure 3.2**, reviewed a 12-turbine layout. It involved repositioning all turbine locations to achieve greater separation distances between turbines and residential dwellings.

The second iteration of the proposed turbine layout, illustrated in **Figure 3.3** involved adding one additional turbine to bring the layout to 13 no. turbines. This additional turbine was included after further wind analysis and additional land which was acquired after the first iteration. Following scoping feedback all turbine locations were moved taking into account ecology, ornithology, hydrology, Eircode's and landowners' advice. Results of the initial geotechnical site investigation were also used to refine the layout. The most notable change was to T6. This moved due to the existing topography and design complexity.

The third and final iteration of the proposed turbine layout, illustrated in **Figure 3.4** below, involved moving all turbine locations. These changes were minor adjustments to refine the

design. It was also at this point that the boundary of the Site for the purposes of the EIAR was defined. The initial boundary was amended to focus on the final iteration of the layout and proposed entrance and access route. The final proposed turbine layout as presented in **Figure 3.4** takes account of all site constraints (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.). The layout also takes account of the results of all site investigations and baseline assessments that have been carried out during the EIAR process. A comparison of the potential environmental effects of the layout as presented in the initial, first and second iterations when compared against the final layout are presented in Table 3.4.

Table 3.4 Environmental effects from initial, first and second layout iteration compared to the final layout

Criteria	Initial Layout	First Iteration	Second Iteration
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.
Biodiversity	No significant environmental	T04 hardstand and access road will have a direct negative impact on native woodland and hedgerows would be removed.	T04 position will have less direct negative impact on native woodland and hedgerows would be removed.
Ornithology	No significant environmental	T13 outside of viewshed of ornithology surveys.	T13 now located within viewshed of ornithological studies.
Soils & Geology	Neutral	Neutral	Neutral
Hydrology & Hydrogeology	Neutral	Close proximity to Blackwater SAC within 50m buffer.	The new access road presents a minor flood risk within Finisk floodplain.
Air & Climate	Neutral	Inclusion of T13 increases the potential productivity output of the wind farm. There will be a slight positive impact on the local climate by reducing the amount of power generated by alternative power sources which utilise fossil fuels and	Neutral T07 has been removed due to changes in landowner portfolio.

Criteria	Initial Layout	First Iteration	Second Iteration
		generates greenhouse gasses.	
Noise	Neutral	Neutral	T09 has moved closer to H93 a slight negative noise impact. Still outside the required 500m (710m).
Material Assets	Neutral	Neutral	Neutral
Landscape & Visual	Neutral	Inclusion of T13 has a Negative impact from a Landscape and visual aspect.	Inclusion of T13 has a Negative impact from a Landscape and visual aspect.
Cultural Heritage	Neutral	T06 located near a national monument within 60m moderate negative impact on the surrounding environment. However is reversible. T04 was located on an historic non listed building.	T06 located near a national monument within 60m moderate negative impact on the surrounding environment. However is reversible.
Traffic and Transport	Neutral	Neutral	The site access road for the turbine delivery is the most significant change. The new access road approximately 1,750m road linking the site directly to the regional road R671. This avoids negative impacts local road traffic in the near vicinity of the wind farm site.

3.8.3 Road Layout

Access roads are required onsite to enable transport of infrastructure and construction materials within the Site. Roads must be of a gradient and width sufficient to allow safe movement of equipment and vehicles. It was decided during the initial design of the Development that existing farm access roads would be utilised where possible to minimise the potential for impacts by constructing new site access roads as an alternative.

As the overall site layout design has progressed, the most suitable routes between each component of the Development have been identified, taking into account the existing farm access roads and the physical constraints of the Site. Locations have been identified where upgrading of the existing farm access roads would be required and 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 against maximising the use of the existing road network is presented in Table 3.5.

Table 3.5 Environmental effects from constructing a new road network compared to utilising existing roads and creating new road where required

Criteria	Comment
Population & Human Health (incl. Shadow Flicker)	Neutral
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 would result in greater volumes of overburden to be excavated and stored. Larger volume of stone required from on-site borrow pit for road construction.
Hydrology & Hydrogeology	Larger development footprint may result in an increased number of new watercourse crossings, therefore, increasing the potential for silt laden runoff to enter receiving watercourses.
Air & Climate	Potential for greater dust emissions due to the requirement of an increased volume of stone from the on-site borrow pit. Potential for greater vehicular emissions due to increased volume of construction traffic.

Criteria	Comment
Noise	Potential for increased noise impacts on nearby sensitive receptors during the construction of the new site access roads.
Material Assets	Larger development footprint will result in greater land-take and a change in land use.
Landscape & Visual	Potential for greater visual and landscape impacts due to the construction of new site access roads.
Cultural Heritage	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.
Traffic and Transport	Potential for greater traffic volume during construction phase due to larger development footprint and requirement for more construction materials.

3.8.4 Location of Ancillary Structures

The ancillary infrastructure required for the proposed development include a temporary construction compound, electricity substation, grid connection and a borrow pit.

3.8.4.1 Construction Compound

The temporary construction compound will be used as a secure storage area for construction materials and to contain temporary site accommodation units for sealed type staff welfare facilities. The compound will contain cabins for offices space, meeting rooms, canteen area, a drying room, parking facilities, and similar personnel type facilities. The temporary construction compound is located in the east of the Site and is accessed off a new site access road. The use of a single temporary construction compound as opposed to two smaller compounds located in different areas of the Site will result in less disturbances to the Site and a reduced visual impact. 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 3.6.

Table 3.6 Environmental effects from constructing two smaller construction compounds compared to one large construction compound

Criteria	One large construction compound	Two smaller construction compounds
Population & Human Health (incl. Shadow Flicker)	Neutral	Neutral

Criteria	One large construction compound	Two smaller construction compounds
Biodiversity	Only one area of habitat will be affected from one construction compound.	Potential for a greater impact to the Site ecology by constructing two construction compounds in different areas of the Site
Ornithology	Only one area has potential tp impact the Site ornithology .	Potential for a greater impact to the Site ornithology by constructing two construction compounds in different areas of the Site.
Soils & Geology	Neutral	Neutral
Hydrology & Hydrogeology	The use of one construction compound sites contains the risk of erosion and risk to watercourses.	The use of multiple construction compounds sites has the potential to increase the risk of erosion and increase risk to watercourses.
Air & Climate	The use of one construction compound site has the potential to restrict the potential dust sources on site. However, could localise the intensity of potential particulate pollution source on the Site.	The use of multiple construction compounds sites has the potential to increase the number of potential dust sources on the Site.
Noise	More localised noise impacts on nearby sensitive receptors.	Potential for increased noise impacts to more additional sensitive receptors. The use of two construction compounds could increase construction time and therefor nose.
Material Assets	Neutral	Neutral
Landscape & Visual	No required access road as adjacent to the access track. This area will have a non-significant impact on LVIA of the site.	Potential for greater visual and landscape impacts due to the construction of new roads.
Cultural Heritage	Neutral	Neutral
Traffic and Transport	Less efficient movement and management of material across the Site.	Slightly more efficient movement and management of material across the Site.

3.8.4.2 On-Site Substation

In order to provide flexibility to the electrical network provider, and having regard for the Site constraints, the location of the onsite substation is restricted to the centre of the site. It should also be noted that, while the operational lifespan of the proposed turbines is expected to be 40 years (following which they may be replaced or decommissioned), the electricity substation and associated infrastructure will become an ESB asset and will be a permanent feature of the proposal as it will be required to continue to form part of the electrical infrastructure of the area in the event of the remainder of the Site being decommissioned.

3.8.4.3 Grid Connection

A key consideration in determining the grid connection method for a proposed wind energy development is whether the cabling is undergrounded or routed wholly or partly as an overhead line. While overhead lines are less expensive and allow for easier repairs when required, underground lines will have no visual impact. For this reason, it is considered that underground lines are a preferable alternative to overhead lines. The draft Wind Energy Guidelines 2019 also indicate that underground cables are the preferred option for connection of a wind energy development to the national grid. The current ESB and Eirgrid policy is a preference for utilising the public road infrastructure.

The electricity output capacity of the windfarm is such that it needs to connect to a 110kV substation. Three options were initially considered: Dungarvan 110kV Substation, Cahir 110kv Substation and Clonmel 110kV Substation. Initial constraints studies found that any cable routes to Cahir and Clonmel Substations would be substantially longer and involve a high number of watercourse crossings. It was therefore established that the grid connection option to Dungarvan Substation should be considered as a first preference.

Two underground grid connection (UGC) cabling route options to Dungarvan were considered and assessed as part of the initial design process in order to determine which route would be brought forward as part of the planning application:

- UGC Option A – UGC from Dungarvan SS to Dyrick Hill WF utilising sections of UGC in the national road, primarily regional roads, and private lands (19km).
- UGC Option B – UGC from Dungarvan SS to Dyrick Hill WF utilising sections of UGC in the national road, primarily regional roads, and private lands (16.8km).

The initial grid route assessment found that Option B was the most favourable as it is the shortest route available and has significantly less constraints along the route than Option A (See, **Appendix 12.1**).

Table 3.7 Environmental effects of grid route Options A, and B.

Criteria	Comment
Population & Human Health	Neutral
Biodiversity	Option B traverses less water crossing points and designated ecological / environmental constraint areas and presents a lesser impact option than option A with less excavation/trenching work disruption associated with it than with option A.
Ornithology	Option B requires less excavation and trenching work and associated disruption through noise and vibration than option A.
Soils & Geology	Option B will require less excavation and trenching work and associated groundworks / ground contamination risk.
Hydrology & Hydrogeology	Option B will require less excavation and trenching work and associated surface water and groundwater contamination risk from related works.
Air & Climate	Option B will require less excavation and trenching work and air emissions from activity associated with groundworks
Noise	Option B will require less excavation and trenching work and noise emissions from activity associated with groundworks
Material Assets	Option B will utilise less resources in terms of raw materials and will involve reduced impact on 3rd party property and assets both during construction and longer term through operation life of the transmission cable.
Landscape & Visual	Neutral
Cultural Heritage	Neutral
Traffic and Transport	Option B will utilise less cross-sectional trenching work requirement under public road infrastructure and associated reduction in disruption to traffic and transport during installation and maintenance work.

3.8.4.4 Borrow Pits

Fill material required for the construction of access roads and turbine bases will be obtained from an onsite borrow pit The use of an onsite borrow pit represents an efficient use of existing onsite resources and eliminates the need to transport large volumes of construction materials along the local public road network to the Site. The location for the borrow pit was identified following detailed geotechnical site investigations and site-specific constraints outlined in **Section 3.8.1.**

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

A comparison of the potential environmental effects of using onsite borrow pits in comparison to using an offsite quarry is presented in Table 3.8.

Table 3.8 Environmental effects from utilising local quarries compared to the on-site borrow pits

Criteria	Comment
Population & Human Health (incl. Shadow Flicker)	Potential for increased vehicular and dust emissions from transporting material from offsite quarry locations to the site which could have adverse health effects.
Biodiversity	Neutral
Ornithology	Neutral
Soils & Geology	Neutral
Hydrology & Hydrogeology	Neutral
Air & Climate	Potential increase in dust emissions and vehicle emissions associated with off-site vehicle movements.
Noise	Whilst there would be less noise generated from site as a result of using an offsite source, there is still the potential for an increase in noise emissions from the transport of material from offsite quarry locations.
Material Assets	Neutral
Landscape & Visual	Neutral
Cultural Heritage	Neutral

Criteria	Comment
Traffic and Transport	Potential for increased vehicular movement on local roads.

3.9 ALTERNATIVE TURBINE HAUL ROUTE AND SITE ACCESS

Wind turbine components (blades, nacelles and towers) are not manufactured in Ireland and therefore must be imported from overseas and transported overland to the Site. Alternative transport routes to the Site were considered in relation to turbine components, general construction-related traffic, and site access locations.

3.9.1 Port of Entry and Delivery to the Site

The alternatives considered for the port of entry of wind turbines into Ireland for the proposed development include the Port of Waterford, Ringaskiddy Port and Foynes Port. Each Port offers a roll-on roll-off procedure to facilitate import of wind turbines. The Port of Waterford was selected as the port of entry for this project because it is located closer to the Site and road connections between the Port of Waterford and the Development reduce 3rd party land take and / or remediation work on the Turbine Delivery Route.

The turbine delivery transport route will utilise the national and primary roads available insofar as possible to ensure the road network has the capacity to manage the large/abnormal loads proposed. The selected preferred route for turbine delivery is via the N29 from the Port of Waterford to the N25 routing to the west of Waterford city before joining the N72 2km northeast of the town of Dungarvan. The Turbine delivery route will stay on the N25 for approximately 47.1km before turning off the N72 to access the R672 Local Road. The turbine delivery route will utilise the R672 for approximately 15.1km then turn left joining the R671. The route will continue on the R671 heading south for 6.7km until reaching the site access road.

The updated transport analysis as presented in **Chapter 14: Traffic and Transport** of this EIAR), shows that only minor accommodation works will be required to accommodate the proposed turbines.

The delivery route for general HGV construction traffic will follow a more direct route to the site via the local road network as shown on **Figure 14.4** in **Chapter 14: Traffic and Transport** of this EIAR.

3.10 ALTERNATIVE MITIGATION MEASURES

Mitigation by avoidance has been central to the Project's evolution. By avoiding the ecologically sensitive areas of the Site, 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 in the Site, this has been mitigated with the proposal of enhancement lands. Forestry felled within the Site will be replaced offsite, with no net loss.

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