FEHILY TIMONEY

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ENVIRONMENTAL EFFECT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED COUMNAGAPPUL WIND FARM, CO. WATERFORD

VOLUME 2 – MAIN EIAR

CHAPTER 3 – SITE SELECTION & ALTERNATIVES

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3. SITE SELECTION & ALTERNATIVES

3.1 Introduction

The following chapter, in accordance with EU guidance document: 'Guidance on the preparation of the Environmental Effect Assessment Report' (EU, 2017), sets out the reasonable alternatives which were considered by the Applicant for the Proposed Development and provides an indication of the main reasons for selecting the chosen option with regards to their environmental effects. It describes the Site selection process, alternative design philosophies considered, alternative layouts and the do-nothing alternative.

3.2 Statement of Authority

This chapter has been prepared by Mr Anthony Ryan with the assistance of Ms Rita Mansfield of Fehily Timoney and Company.

Mr. Anthony Ryan is a Project Planner with Fehily Timoney and Company and holds a Masters' in Planning and Sustainable Development (M.Plan) from University College Cork. He has worked in planning consultancy for over three years and has prepared planning policy for Environmental Reports and wind farm EIARs. Anthony's key capabilities are planning policy, report writing, assisting Senior Consultants and planning research

Ms. Rita Mansfield holds a Bachelor (Hons) Degree in Applied Ecology from University College Cork and a Higher Diploma in Environmental Protection and Pollution Control from the Sligo Institute of Technology. She has worked in environmental consultancy for 19 years and has managed the preparation of EISs/ EIARs for large-scale infrastructure development throughout Ireland. She is experienced in report writing, EIAR chapter writing and project management working on EIARs for wind farm developments in Ireland.

3.3 Alternative Assessment

The requirement in relation to alternatives in the EIA process is set out in the EU's Environmental Effect Assessment (EIA) Directive (2011/92/EU as amended by 2014/52/EU), in Article 5 (1)(d), which states that an EIAR should include:

> *"a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment" Article 5(1)(f) of the EIA Directive requires that the EIAR contains "any additional information specified in Annex IV relevant to the specific characteristics of a particular project or type of project and to the environmental features likely to be affected."*

Annex IV of the EIA Directive states that the information provided in an EIAR should include a:

> *"description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects."*

This chapter has particular regard to the environmental considerations which influenced the selection of alternatives and details the evolution of the Proposed Development through alternatives considered, indicating the main reasons for selecting the chosen option taking into account the effects on the receiving environment and considering the comparison of environmental effects of each alternative.

The alternatives considered have been described in line with the Guidelines on the Information to be Contained in Environmental Effect Assessment Reports (2022). The Guidelines state that:

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

The chapter also details non-environmental factors of the design process where they are relevant to the evolution of the Proposed Development.

Consequently, taking account of the legislation and guidance requirements, this chapter of the EIAR addresses alternatives under the following main headings:

- 'Do Nothing' Alternative;
- Strategic Site Selection;
- Alternative Renewable Energy Technologies;
- Alternative Turbine Numbers, Layout and Design;
- Alternative Transport Routes and Site Access and,
- Alternative Grid Connection Routes
- Alternative Mitigation Measures.

3.3.1 Do-Nothing Alternative

Article IV, Part 3 of the EIA Directive states that the EIAR 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.

Ireland has binding renewable energy targets set by the EU. Ireland is obliged to ensure that 80% of the total energy consumed in heating, electricity and transport is generated from renewable resources by 2030. This is in order to help reduce the nation's CO2 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).

Under the "Do-Nothing" scenario, the Proposed Development would not go ahead i.e. the development of a renewable energy project is not pursued, and the Site remains in use as agriculture and forestry with no changes made to the current land-use practice.

In the "Do-Nothing" scenario, the prospect of creating sustainable energy through County Waterford'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, and result in continued global warming and effect upon the intention to "pursue efforts" to limit warming as agreed to in the Paris Agreement (2015). This will result in continued negative effects to air quality and climate.

According to EirGrid Group's All-island Generation Capacity Statement 2020 – 2029 (Eirgrid, 2020), the growth in energy demand for the next ten years on the Island of Ireland will be between 17% and 41%. 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 infrastructure and may effect on economic growth if energy demand cannot be met. This may be exacerbated by the government's plans to cease the burning of coal at Moneypoint as well as the termination of all peat burning at Bord na Móna's powerplants in 2020.

Under the "Do-Nothing" scenario, the socio-economic benefits associated with the proposed development will be lost. These benefits include between 64 and 78 no. jobs during the construction phase of the Proposed Development, and between 20 and 26 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 Proposed Development which could be used to improve physical and social infrastructure in the area of the wind farm site.

In the "Do-Nothing" scenario, the potential environmental effects of the proposed development as set out throughout this EIAR will not occur. Table 3-1, below, sets out the potential effects of the 'do-nothing scenario' compared to the residual effects associated with the Coumnagappul Wind Farm Project in relation to the various environmental topics covered in the individual chapters of this EIAR.

Refer to each respective chapter for full details of residual effects.

Table 3-1: Comparison of Potential Residual Environmental Effects - Proposed Development vs. 'Do-nothing'

Environmental Consideration	Residual Effect of the Proposed Development	'Do-noting' Alternative
Air & Climate	Slight to moderate temporary localised residual effects arising from fugitive dust emissions during construction. Long-term positive effect on climate due to reduction in burning of fossil fuels. It is estimated that an annual average output of between 60 MW and 72 MW for the Proposed Development will result in the net displacement of 79,417 - 95,365 tonnes of CO2 per annum.	Fossil fuel power stations will likely be the primary alternative to provide the required quantities of electricity resulting in greenhouse gas and other air pollutant emissions.
Noise & Vibration	While the operational wind farm noise levels meet the daytime and night-time noise limits derived using the Wind Energy Development Guidelines 2006, some receptors may be sensitive to a new source of noise introduced into the soundscape.	Under the Do-Nothing scenario, the Proposed Development is not constructed or operated. The noise environment remains largely unchanged, with intermittent temporary increase in noise due to local forestry activities.

Environmental Consideration	Residual Effect of the Proposed Development	'Do-noting' Alternative
	As such the Proposed Development would pose a long term moderately significant effect for such sensitive receptors.	
Biodiversity	Construction of the wind farm will not result in significant effects for any national or European designated sites. The Proposed Development will lead to some long term habitat loss, with the opportunity to reinstate soil and vegetation at decommissioning. Land use practices at the Site (forestry and low intensity grazing) can continue. The Comeragh Mountains are subject to uncontrolled burning which is believed to be connected to agricultural practices. It is expected that the presence of the Proposed Development within the landscape will have the effect of deterring uncontrolled burning due to the associated risk of causing criminal damage at the wind farm. Effects on mammals, including bats, are not significant given the open nature of the Site. The interaction between the Proposed Development and the aquatic environment is limited to watercourse crossings. The implementation of SuDS and minimum setback distances from watercourses as part of the Site Design will ensure protection of aquatic ecological interests. Additionally the Proposed Development will have a positive effect for aquatic ecology on the Skeheens Stream because of the replacement of the existing concreted river ford crossing with a bottomless culvert.	Under the Do-Nothing scenario the agricultural and forestry practices at the site will continue, with effects on biodiversity unaltered.
Ornithology	The Proposed Development has potential to cause temporary displacement of birds during construction which will have a slight-Imperceptible Reversible Residual Effect on birds. The Collision Risk Model for the Proposed Development assesses that the potential effect on birds will be imperceptible to slight.	Neutral

Environmental Consideration	Residual Effect of the Proposed Development	'Do-noting' Alternative
Land, Soils, Geology	The Proposed Development will not contribute to any significant negative effects given that the Design is sympathetic to the Site topography and will achieve a cut fill balance using the on-site borrow pit.	In the Do-Nothing scenario, it is likely that the current land uses will continue for the foreseeable future. The effect on the Land, Soils and Geology would remain largely unaltered as a result.
Hydrology & Water Quality	Potential effects on hydrology and water quality will be mitigated in Design by application of SuDS and measures will be implements during construction to ensure no significant effects on water quality or hydrology such that the objectives of the WFD and Blue Dot Programme are not affected. There will be no significant residual effect.	The Coligan and Nier catchments have a High WFD status Objective and are part of the Blue Dot Programme. It is anticipated that programmes of measures under the Programme will result in gradual improvement in catchment quality.
Population & Human Health	Long-term slight to positive economic benefit to local area due to job creation and community benefit fund.	No economic benefit for the local area due to no provision of a community benefit fund. No employment opportunities as a result of the construction operation and decommissioning of the Proposed Development. No positive benefit to recreation facilities.
Material Assets	Long-term slight positive residual effect on non-renewable resources by offsetting the use of fossil fuels in electricity generation. Slight positive residual effect on electricity infrastructure in the area of the wind farm site. Slight negative effect to capacity of licensed waste facilities.	No offset to fossil fuel use. No provision of additional electricity infrastructure in the local area. No slight negative effect to capacity of licensed waste facilities.
Traffic & Transport	Temporary short-term slight to moderate effect due to increase in road traffic associated with construction activities.	If the Proposed Development is not constructed, there will be no change to the existing traffic patterns.
Archaeology & Cultural Heritage	Mitigation measures will provide for either the avoidance of potential unrecorded, sub-surface archaeological resource within the footprint of Proposed Development or the proper and adequate recording of this resource by full archaeological excavation. This may result in a potential slight/moderate range of significance of effect in the context of residual effects on possible unrecorded archaeological resource.	Neutral

Environmental Consideration	Residual Effect of the Proposed Development	'Do-noting' Alternative
Landscape & Visual	The significance of residual visual effects for receptors ranges between 'Substantial-moderate' to 'Imperceptible'. The most notable visual impacts will occur within the immediate surrounds of the turbines at local residential receptors to the south of the horseshoe ridge that contains the Site.	Neutral
Telecoms & Aviation	No significant residual effects are expected on telecommunications and broadcasting and aviation as a result of the proposed Coumnagappul Wind Farm.	If the Proposed Development were not to proceed, there would be no change to the existing telecommunications, broadcasting and aviation operations in the area.

3.3.2 Strategic Site Selection

EM Power undertook a detailed screening process in 2018, through Geographical Information Spatial software (GIS), using a number of criteria and stages to assess the potential for wind energy development across the entire country of Ireland. This exercise 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. This initial stage in the selection process discounted lands that were not available for development due to technical and/or environmental constraints.

The key policy, planning and environmental considerations for the selection of a potential wind farm site included:

- Site location relative to the County Council's Renewable Energy Strategy (RES) classification of areas considered suitable for wind farm development;
- Low population density;
- Consistent wind speeds;
- Protection of visual amenity;
- Access route availability;
- Proximity to water bodies;
- Land Ownership title constraints,
- Low potential for impact on designated National and European sites;
- Located outside areas designated for protection of ecological species and habitats;
- Access to the national electricity grid possible within a viable distance;
- Suitable topography / ground conditions;
- Sufficient area of unconstrained land that could potentially accommodate wind farm development and turbine spacing requirements

Particular to the south of Ireland, as this is the context in which the proposed Coumnagappul Wind Farm is being considered, 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.

All of the above locations were considered to be viable sites for wind energy development. However, comparatively, the Coumnagappul site performed well and was identified as one of the preferred candidate sites to be taken through to the next stage of validation: site-specific assessment, along with the Dyrick Hill wind development which was recently submitted for planning to An Bord Pleanála. While the outcome of the site screening process has identified the site of the current proposal as a suitable location for a wind farm development, it does not preclude other sites within EM Power's portfolio being brought forward for consideration in the future.

The site-specific assessment was guided by the 2013 'Methodology for Local Authority Renewable Energy Strategies' report from the Sustainable Energy Authority of Ireland (SEAI). For the site-specific assessment of candidate sites, a number of criteria were chosen which not only covered the broad range of considerations for wind farm development but also allowed for direct comparison of the candidate sites to each other to determine their relative suitability for wind farm development.

Table 3-2: Site-specific Selection Criteria and Basis for Assessment (carried out in 2018)

	Derrincullig	Killognaveen	Knockmanagh	Dyrick Hill	Coumnagappul
Number of Turbine Units	13	11	19	12	10
CDP Wind Dev. Zone	Open to Consideration	Open to Consideration	Unsuitable	Open to Consideration	Open to Consideration
Wind Resource	Class 2	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	Situated 740m from the Comeragh Mountains SAC

	Derrincullig	Killognaveen	Knockmanagh	Dyrick Hill	Coumnagappul
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'	Moderate - The proposed development lands are located within the foothills of the Comeragh Mountains. The Comeragh Mountains are notable for outdoor recreation. However, the Proposed Development is located within a horseshoe-shaped valley at the foothills.
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	Moderate – Annex 1 species exist in the wider area
Grid risk	Medium – Numerous existing and under construction wind farms in the vicinity. Clonkeen substation located 7km from site.	High – 34km to Oughtragh 110kV substation, need for deep connection works. Potential significant impact on roads during construction.	Low – 5km north of Knockearagh substation where available capacity exists.	Moderate – Connection potential exists at Dungarvan Substation. Slight short-term impact on public road.	Moderate – Connection potential exists at Dungarvan Substation. Slight short-term impact on public road.
Other Wind Developments	Coomagearlahy 1,2 and 3, Midas and Grousemount Wind Farms in the vicinity.	Cahirciveen project located 1.5km from Killognaveen site.	Barna Wind Farm 8km East.	Woodhouse Windfarm located 10.8 km south from the Dyrick Hill site.	Tierney Single Turbine located 5.1km west of Coumnagappul. Kilnagrance Single Turbine, located 14km east of Coumnagappul.

	Derrincullig	Killognaveen	Knockmanagh	Dyrick Hill	Coumnagappul
					Woodhouse wind farm located 17.2km west of Coumnagappul.
Terrain / Land use	Mountainous, bog, agricultural	Rural general, peat harvesting, bog	Rural general, peat harvesting, bog	Strong rural area, agriculture and forestry.	Mountainous, agricultural, with minor pockets of forestry
Housing Density	Low	Medium	Medium	Medium	Low

Of the sites assessed, Coumnagappul was selected as a location with relatively low potential for environmental effects due to, for instance, the close proximity of potential grid connection, low housing density, good natural screening through topography, limited potential for effects on existing land use, and limited potential for cumulative effects with other wind developments. It was deemed that Coumnagappul should be progressed for detailed assessment and planning consideration.

3.3.3 Coumnagappul Wind Farm – Proposed Development Suitability

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.

3.3.3.1 Policy

The most relevant planning policies which are applicable to the Proposed Development are discussed in Chapter 4 of this EIAR. Discussed hereunder is the Waterford Renewable Energy Strategy.

The Proposed Development sits in an area with suitable unconstrained land and a high available wind resource. 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".

The Waterford County Development Plan 2022-2028 was adopted in August 2022 and included an update to the Renewable Energy Strategy. The Proposed Development is located within an area mapped as 'Exclusion' within the current updated Renewable Energy Strategy 2016-2030 (noting that this is in contrast with the previous version of the Waterford Renewable Energy Strategy which designated the Proposed Development Site and surrounding landscape as an area 'Open to Consideration' for wind energy development).

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.

3.3.3.2 Natura 2000 Sites

It is preferable that wind energy development is not located in an area designated as a Special Area of Conservation (SAC), Special Protected Area (SPA) or Natural Heritage Area (NHA). The proposed Coumnagappul Wind Farm site is not located within an SAC, SPA or NHA. The most proximal protected area is the Comeragh Mountains SAC, designated for the protection of upland habitat types:

- Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae) [3110]
- Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260]
- Northern Atlantic wet heaths with Erica tetralix [4010]
- European dry heaths [4030]
- Alpine and Boreal heaths [4060]
- Blanket bogs (* if active bog) [7130]
- Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladani) [8110]
- Calcareous rocky slopes with chasmophytic vegetation [8210]
- Siliceous rocky slopes with chasmophytic vegetation [8220]
- Hamatocaulis vernicosus (Slender Green Feather-moss) [6216]

The Proposed Development lands do not host any Annex I type habitats and is not functionally connected to the SAC.

3.3.3.3 Population Density

Areas with low housing density are preferable for wind energy development so as to minimise potential disturbance to residential amenity which may be caused as a result of construction activities, as well as visual effects, shadow flicker and noise during the operational phase. The population of the proposed development lands is far below the state and County average, as detailed in Table 3-3.

The low population density provides greater capacity for wind energy development at the Coumnagappul Wind Farm Site, allowing for appropriate setback distances from dwellings as set out in the Wind Energy Development Guidelines.

Table 3-3: Population Density

Area	Population Density (Persons per square kilometre) 2016
State	70
Waterford County	63.3
Wind Farm Site Area	9.6

3.3.3.4 Other Considerations

Wind speed was assessed at the Site in order to determine if wind energy development would be feasible. Wind speed analysis is available from the Sustainable Energy Authority of Ireland (SEAI). The atlas identifies the Site as having an average wind speed range of 8.6 m/s to 9.6 m/s at 150 m above ground level (refer to Figure 3.1, Volume IV)l. This indicates viable values for wind energy development at this location, considering values of 3-5 meters per second are required for turbines to start operating. The wind resource at the Coumnagappul Wind Farm site is illustrated in Figure 3.2, Volume IV.

The subject site is in proximity to a primary transport routes. The N25 national primary route is located approximately 12.1 km to the south-east of the Site and can be accessed from the Site via the local road network and by the R672 which is located approximately 5.3km to the west of the proposed site. The R672 connects the N25 near Dungarvan.

Grid connection was also considered during the strategic site selection. The Site is located c. 17.3 km northeast (in public road) of the existing Dungarvan 110 kv Substation. Capacity at the substation was examined, and potential routes were identified and assessed in order to determine a viable connection from the proposed Coumnagappul Wind Farm Site to the national grid.

3.3.3.5 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 low intensity usage agricultural land which allows the current land use to continue in parallel with the Proposed Development. 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.

3.3.4 Alternative Renewable Energy Technologies

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). Having regard to the SEAI's Solar Atlas[1] it was determined that the Site would be sub-optimal for solar energy development given that the average annual radiation and associated PV power potential for the Site was mapped as low. Additionally the technical constraints in developing solar panels in such a steep topography would be prohibitive.

[1] https://gis.seai.ie/solar/

3.3.5 Alternative Turbine Numbers, Layout and Design

The design of the Proposed Development has been an informed and collaborative process from the outset, involving the engineers, environmental, hydrological, geotechnical, archaeological and transport specialists. The objective of which is the avoidance of significant environmental effects while designing a project which is technically feasible and maximising wind resource. Throughout the preparation of the EIAR, the layout of the Proposed Development has been revised and refined to take account of the findings of all site investigations and surveys, consultation and impact assessment, all of which have brought the design from its first initial layout to the current proposed layout.

Constraints and environmental sensitivities were first identified, and buffers applied in order to determine appropriate areas within the site to accommodate development. This constraints exercise resulted in a developable area being defined. Once the viable area is established, the siting requirements of the wind turbines in terms of separation distances etc. are considered and a preliminary layout can be developed for the site. Constraints mapping for the Site is presented in Figure 3.1, Volume IV and included the following buffers:

- Residential dwellings plus a minimum 720-metre buffer (4 x tip height achieved from non-participating properties houses);
- European (Natura 2000) Designated Sites plus 200-metre buffer;
- Telecommunication Links plus operator specific buffer;
- Rivers, Streams and Lakes plus 50-metre buffer;
- Archaeological Sites or Monuments - 'Zone of Notification'

A comparison of environmental effects of following this design approach and not following it, i.e. applying mitigation by design versus a design which does not consider the various environmental factors of the receiving environment is presented in Table 3-4.

Table 3-4: Comparison of Potential Residual Environmental Effects - Mitigation by Design

Environmental Consideration	Mitigation by Design Utilised in the Coumnagappul Wind Farm Project	Potential Effect if Mitigation by Design is not Included
Residential Amenity	The applicant set a minimum of 740m (4 times set back) set back from all non-financially involved inhabited dwellings, in line with the Wind Energy Development Guidelines. The closest involved landowner's dwelling is located 820m from the nearest proposed wind turbine.	Potential for effect to residential amenity due to noise, vibration and dust during the construction stage. Further potential effect to residential amenity during operations due to visual effect and noise if an appropriate setback distance is not applied.
Flora and Fauna	Avoidance of designated sites and mitigation designed to avoid potential effects on species and habitats. Areas of higher habitat value were avoided. Watercourse crossings will retain riparian habitat and enhance fishery value. Drainage Design applies SuDS to protect watercourses.	Potential for effect on hydrology and possible water quality and hydromorphology effects downstream. Potential for loss of habitats of high ecological value.
Ornithology	Positioning the turbines within more open areas away from busier flight paths. Limit the need to remove habitat with high potential to support birds e.g., placing turbines in areas of historic burning rather than in higher quality meadows. Isolation of areas of high-quality grassland / heath habitat to be retained and managed. Enhancement of agricultural lands for birds.	Potential effect to avifauna associated with the construction phase including possible deterioration of habitats and disturbance or displacement of birds.
Soils & Geology	Location and alignment of hardstands and roads sympathetic to the natural topography in order to reduce cut/fill and to limit effects on geology and soil stability. Detailed assessment of peat depths and design of the Site so as to avoid areas of deep peat. Layout is appropriately set back from known sensitive geological features e.g., fault lines and areas of high landslide susceptibility.	Alternative development footprint would result in greater volumes of overburden to be excavated. Potential for development on ground with unsuitable slope.
Hydrology and Water Quality	Minimum 50m set back of infrastructure from rivers and streams where reasonably possible. Adaptation of design to existing hydrological regime (streams and drainage channels) and inclusion of SuDS.	Potential effect to the existing hydrological regime in the absence of SuDS. Potential for runoff to directly discharge to streams.

Environmental Consideration	Mitigation by Design Utilised in the Coumnagappul Wind Farm Project	Potential Effect if Mitigation by Design is not Included
	Clear-span bridge and horizontal direction drilling to be used at stream crossings to avoid in-stream works.	Potential migration of silt or petrochemicals to watercourses. Potential effect on water quality and aquatic biodiversity. Potential effect on designated sites downstream.
Noise & Vibration	Ensure compliance with the relevant guideline limits for noise. A 740m setback between the turbines and non-financially involved dwellings has been achieved which will assist in maintaining residential amenity at local dwellings. Location of the turbines with a natural horseshoe-shaped ridge to form natural noise attenuation.	Potential for effect to residential amenity at nearby dwellings due to reduced separation distances.
Shadow Flicker	Shadow flicker detection systems to be installed in turbines to avoid shadow flicker at nearby dwellings, in line with the Draft Revised Wind Energy Development Guidelines (2019).	Potential effect on residential amenity due to shadow flicker at nearby dwellings if control measures are not applied.
Cultural Heritage	Design takes cognisance of nearby recorded monuments and avoids them and their zone of influence where possible.	Potential effect on cultural heritage assets if infrastructure is placed in proximity.
Material Assets	On site borrow bit and balance of cut and fill within the Site in order to reduce road haulage.	Potential for greater traffic volumes during construction phase if material usage on site is not balanced.
Landscape & Visual	Design consideration of sensitive visual receptors in the greater area and uses the natural topography to reduce visual effects.	Potential negative visual effect on sensitive visual receptors and potential effect on residential amenity if not considered in the design of the wind farm.

3.3.5.1 Alternative Turbine Scales and Layouts

Alternative layouts for the Proposed Development were developed in an iterative design process which aimed to avoid environmental sensitivities, minimise potential environmental effects both on and off site and to maximise the wind potential on site. The design has been carried out in accordance with industry guidelines and best practice, namely the Department of Environment, Heritage and Local Government's (DoEHLG) Wind Energy Development Guidelines (2006), The Department of Housing, Planning and Local Government's (DoHPLG), and the Irish Wind Energy Association Best Practice Guidelines (2012). The design process of the Proposed Development has had regard to the Draft Revised Wind Energy Development Guidelines (2019) in the aesthetic considerations in the siting and design of the wind farm and in terms of mitigation by design including increased setback from nearby dwellings and the policy regarding zero shadow flicker.

Fáilte Ireland (2012) in their assessment of 'Visitor Attitudes on the Environment' concluded that in relation to the perceived impact of wind farms on natural beauty, "*the majority of visitors also still favour large turbines (47%) over small turbines (28%), and in smaller numbers, with the option of 5 turbines proving the most popular, followed by two clusters of 10 and finally wind farms of 25 turbines".*

There is a balance to be struck between the visual and spatial dominance of turbines and the clutter and the frequency of turbines within a view as both of these effects contribute towards the magnitude of visual effect.

Initially, following the establishment of the developable area for the Coumnagappul Wind Farm, and as part of the design alternative process, an early stage layout (Design Iteration 1), as shown in Figure 3.3, Volume IV, was established which comprised 10 turbines. This layout focussed on capitalising on wind speeds and as such positioned the turbines towards the upper ridges of the upland areas within the developable area. From the outset, this turbine layout was considered to have a higher significance of visual effect when viewed from a distance given the location of the turbines on the ridgeline. Furthermore, turbines were located within approximately 100m of the boundary of the Comeragh Mountains SAC. This had a greater potential for effects on the European Site, particularly given the internal road alignment and hardstand alignment would likely need to be nearer to the SAC. From a civil design perspective the slopes near the upland ridges were of a significant angle and would prove difficult to achieve the gradients required for turbine delivery. As such, on the combined basis of the above factors, some turbines were moved towards more lowland areas as shown in Figure 3.4, Volume IV.

This new turbine arrangement (Design Iteration 2), which considered wind ellipse based on an 80m rotor (assuming 185m tip height) to establish optimal turbine spacing, allowed for the addition of one more turbine to the array, bringing the number of turbines to 11. Most significantly, Turbine no. 3 was moved from an upland area into a low lying area set within forestry land use. However, following visual impact assessment of this revised layout, it was determined that T3 appeared slightly disconnected from the development as it was to be located in a different landscape type in a much more low lying area from the remainder of the development. Similarly, because other turbines had been moved downhill, T9 now similarly appeared disconnected from the development as it remained in a more elevated section of the available development lands compared to its nearby counterparts. This lead T3 and T9 to be perceived as slight outliers to the Proposed Development. A decision was taken to remove T3 and T9 from the array, and to introduce a new turbine T12 into the array with the foothills of Bleantasour Mountain. As such, the Proposed Development would appear as a much more consolidated and legible cluster of ten turbines located within the landscape basin context. Turbines were then microsited relative to local environmental constraints in order that an optimal layout was arrived at (refer to Design Iteration 3, Figure 3.5, Volume IV).

As part of the design optimisation process, the approach of locating the turbines within the basin created by the natural topography of the available development lands was adopted. Consideration was next given to the implications of using differing turbine heights. The relationship between the turbine height and density (number of turbines) required to achieve a particular output was a key design consideration. Tip heights of 150 m, 185 m and 200 m were considered, whereby the tip heights of 180 m and 200 m aligned to the 10 turbine layout in Design Iteration 3 and the tip height of 150 m considered an alternative 14 turbine layout (refer to Figure 3.6, Volume IV) such that a similar MEC output could be achieved. These are detailed in Table 3-5, with comparative views of these layouts illustrated in Appendix 16.3, Volume III).

Table 3-5: Alternative Wind Farm Design Options

Layout No.	No. of Wind Turbines	Tip Height	Hub Height	Rotor Diameter
Option 1	10	185m	104m	162m
Option 2	10	200m	119m	162m
Option 3	14	150m	91.5m	117m

It was considered that the layout of 14 turbines at a tip height 150m presented slightly disjointed in this landscape context with little sense of order and extended in to the elevated uplands. With regard to the 10 turbine arrays, both of these (at 200m tip height or 185m tip height) were viewed in a much more compressible manner in this landscape context and presented as being contained within and along the horseshoe ridge. Nonetheless, it was considered that the 200m tip height turbines had more potential to generate a sense of overbearing for local receptors in this context than the 185m tip height turbines.

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 the 185m turbines is preferable to the reduced level of permeability and increased visual clutter associated with a greater number of shorter 150m 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 effect on the receiving environment with less land-take required to accommodate the wind farm and less associated construction works as detailed above. Recent permitted wind farm applications in Ireland tend towards larger/taller turbines (i.e. the larger turbine tip heights that are available on the market in Ireland). Examples of recent consented wind farms which include larger/taller turbines are the Ardderroo Wind Farm, Co. Galway (ABP ref. PL07 .303086) which consists of 25 no. turbines at 178.5m tip height, the Coole Wind Farm, Co. Westmeath (ABP ref. PL25M.300686) which consists of 13 no. wind turbines of 175m tip height and Barnesmore Windfarm, Co Donegal (ABP ref. PL14 .306303) which consists of 13 turbines with tip height up to 180m.

A comparison of potential environmental effects of the wind farm site design iteration options and the final design iteration for the proposed Coumnagappul Wind Farm is detailed in Table 3-6. The proposed option was developed to present the least potential environmental effect through the project philosophy of mitigation by avoidance in design.

The final design iteration was chosen to take forward for the Proposed Development as a 10 turbine array and a 185m turbine tip height (Figure 3.5, Volume IV) as it strikes a balance between energy production capacity and avoidance of environmental sensitivities. The chosen option provides for the greatest amount of energy production while avoiding potential significant effects on the receiving environment and achieving appropriate setback from dwellings and sensitive environmental receptors such as the nearby Comeragh Mountains SAC.

Table 3-6: Comparison of Potential Residual Environmental Effects of the Wind Farm Design Iterations

Environmental Consideration	Layout: Design Iteration 1 (10 Turbines) Turbine Design: 150m – 185m tip height	Layout: Design Iteration 2 (11 Turbines) Turbine Design: 185m tip height	Layout: Design Iteration 3 (10 turbines) Turbine Design: 185m Tip height	Layout: Design Iteration 3 (10 turbines) Turbine Design: 200m Tip height	Layout: Alternative 14-turbine layout Turbine Design: 150m tip height
Air & Climate	Location of the turbines closer to or on the upland ridged would require extensive civil works with associated potential for vehicle emissions and dust emissions due to an increased volume of material and turbine component deliveries to the site during the construction phase.	Lesser civil works required for construction; however large rock cutting required at T9 could result in increased dust emissions. Larger area of forestry felling required due to T3 being located within planted conifer lands.	Significant reduction in rock cutting through civil layout which is sympathetic to local topography.	Larger turbines with greater potential productivity output from 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 utilize fossil fuels.	Similar MEC output to Design Iteration 3 (185 tip height), however, would require much larger internal road and hardstand footprint, with some locations requiring extensive areas of cutting to accommodate the works.
Noise & Vibration	Turbine array located further away from sensitive noise receptors.	Turbine array located closer to sensitive noise receptors and increase number of turbines has greater potential for noise effects. Particularly T3 located in the lowlands, within ca. 900m of ribbon development along the L5119.	Reduced number of turbines on Site. T3 removed. Positive effect.	Larger turbines with greater Sound Power Level and as such greater potential for noise effects.	Larger number of turbines, located closer to residential properties. Greater potential for noise effects
Biodiversity	Turbines located within 100m of the Comeragh Mountains SAC. Turbines were located within rockier and steeper upland areas, requiring that access routes to the turbines would have a much larger footprint as they would need to wind up the steep slopes in order to meet turbine manufacturer requirements for turbine delivery. Thereby resulting in greater habitat loss, and a loss of a greater variety of habitat types given the roads would traverse heath and siliceous rock environments.	Turbines are located >500m from the Comeragh Mountains SAC. Movement of turbine (originally called T7, now T5) away from nearby watercourse (Colligan stream) will result in the need to fell additional forestry. This stand of forestry is used for commuting by bats.	Turbine 5 moved northwards, away from on-site forestry in order to reduce potential for effects on bats.	Larger rotor swept area with associated greater potential collision risk for bats. Larger turbine would require bigger hardstand area, with associated increased potential for habitat loss.	Larger development footprint would result in greater potential habitat loss.
Ornithology	Possible increase in potential for displacement of birds as mountain ridge often act as a guiding line for bird movement.	Reduced potential for bird collision risk through the movement of turbine (originally called T7, now T5) away from nearby watercourse (Colligan stream) as this area had a greater prevalence of bird activity.	Turbine 5 moved northwards, away from the area of Kestrel activity within Commonage lands to the south.	Larger rotor swept area with associated greater potential collision risk for birds.	Greater potential collision risk for birds due to the presence of more turbine
Land, Soils, Geology	Larger development footprint due to more upland location would result in greater volumes of soil and subsoil to be excavated and removed to dedicated onsite spoil management area.	Neutral	Neutral	Neutral	Larger development footprint due to more upland location would result in greater volumes of soil and subsoil to be excavated and removed to dedicated onsite spoil management area
Hydrology & Water Quality	More complex construction stage and operation stage drainage arrangements are required due to steep topography at turbine locations. Turbine # 7 is located immediately adjacent to the Colligan stream.	Movement of turbine away from the Colligan River.	Introduction of clear span bridge crossing of the Colligan River	Neutral	Larger development requiring higher number of drain crossings and cross drains. Several turbines located close to watercourses, would likely require additional bridge crossings.

Environmental Consideration	Layout: Design Iteration 1 (10 Turbines) Turbine Design: 150m – 185m tip height	Layout: Design Iteration 2 (11 Turbines) Turbine Design: 185m tip height	Layout: Design Iteration 3 (10 turbines) Turbine Design: 185m Tip height	Layout: Design Iteration 3 (10 turbines) Turbine Design: 200m Tip height	Layout: Alternative 14-turbine layout Turbine Design: 150m tip height
Population & Human Health	Turbine array located further away from sensitive receptors.	Potential for shadow flicker impacts on nearby sensitive receptors due to location of T3 within a lowland area.	Neutral	Greater potential for shadow flicker impacts on nearby sensitive receptors due Larger turbines.	Greater potential for shadow flicker impacts on nearby sensitive receptors due to the increased number of turbines. And larger sprawling footprint of the turbine array.
Material Assets	Neutral – no telecommunication links or aviation in the area	Neutral – no telecommunication links or aviation in the area	Neutral – no telecommunication links or aviation in the area	Neutral – no telecommunication links or aviation in the area	Neutral – no telecommunication links or aviation in the area
Traffic & Transport	Potential for greater traffic volumes during construction phase due to greater earthworks requirements in steeper upland areas.	Potential for greater traffic volumes during construction phase due to greater number of turbines.	Neutral	Neutral – might require larger hardstand areas but Design would aim to achieve cut/fill balance.	Potential for greater traffic volumes during construction phase due to greater earthworks requirements associated with larger number of roads and turbines.
Archaeology & Cultural Heritage	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology. However, shallow soils associated with rocky environment reduces the potential.	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.	Neutral	Neutral	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology
Landscape & Visual	Greater visual intrusiveness due to location of turbines along mountain ridgelines.	Turbines T3 and T9 causing a perception of the wind farm 'spilling out' of the natural topographical mountain basin thereby creating greater visual intrusiveness.	Turbine array layout is such that it capitalizes on the natural screening created by land topography of the mountain basin.	Greater visual intrusiveness due to scale of turbines.	A larger number of smaller turbines would have a greater visual impact causing a cluttered view.

3.3.6 Alternative Construction Methods

The construction methods for any wind farm are not unique in the context of ground preparation, foundation installation and turbine erection. When considering the construction methodology for the Proposed Development consideration was given to the site investigative surveys undertaken on site and the most appropriate means of constructing the onsite infrastructure without allowing for significant environmental effects. Foundations for wind turbines will be of the ground bearing gravity type. The site specific data has informed the likely construction methods that will be employed for the groundwork and foundation installations as well as the road and handstand designs. The construction methods that will be employed are not unique potential sources of contamination and so the chosen options are considered neutral.

3.3.7 Alternative Transport Routes 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

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 the proposed Development because it is located closer to the Site and road connections between the Port of Waterford and the Proposed Development are dominated by national road infrastructure and as such reduce the requirement for third 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. Once the route leaves the national road various options to arrive at site were available. The route chosen was such to reduce potential for interaction with third party lands while finding the most direct route to Site. In this regard, alternative entrance points to the Site were also considered:

- Access from the South via the L1041 – this approach encountered some difficult bends at Lackdarra which would have required temporary land take at numerous third-party properties, and similarly there would be a need for additional land take at Comarglin junction. This route was deemed unsuitable for turbine delivery, however the access tot eh meteorological mast will be via this route.
- Access from the northwest off the L5119 - Local residents in this area raised concerns that this proposed route would increase traffic and bring larger component deliveries into this area. The residents noted that if the project delivery route was shortened, the dwellings to the north would be unaffected from an increased traffic point of view. Additionally, access would need to be gained via a hairpin bend in the road and would require the replacement of a bridge structure. The design team committed to exploring alternative routes which would leave the L5119 road earlier and approach the Site fromt the west, which would shorten the overall delivery route.
- Access from the west off the L5119 – this was determined as the optimal route in to the Site. Several potential routes in fromt eh west were examined. It was determined that using the existign Coillte forestry access road would be most preferred in order to reduce the amount of new road infrastructure required for the Proposed Development.

Ultimately the most viable turbine delivery / abnormal load route to Site was determined as follows (Figure 2.3, Volume IV):

- Loads will depart the Port of Waterford (Belview) and travel along the N29, taking the third exit on the Slieverue Roundabout to continue on the N29;
- Loads will proceed to the Luffany Roundabout where they will take the first exit onto the N25;
- Loads will travel west on the N25;
- Loads will continue west onto the N72;
- Loads will depart the N72 and head north on the R672;
- Loads will depart the R672 right near Touraneena onto the L5119;
- Loads will continue north-east on the L5119 to the proposed site entrance.

The objective will be to maintain the strategic capacity and safety of the N29, N25 and N72 carriageways at all times, cognisant of the National Development Plan, 2021 – 2030, with key sectoral priorities for maintaining the N25 and N72 national road network to a robust and safe standard for users.

As presented in Chapter 14 - Traffic and Transportation of this EIAR and shown on planning drawings, only minor accommodation works will be required to allow for abnormal load delivery.

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 14.3, Volume IV.

The location of the on-site construction compounds were selected relative to the location of the access in to the Site and proximity to the on-site substation.

3.3.8 Alternative Grid Connection Routes

TLI Group (the Consultant) were engaged by EM Power (the Client) to identify and analyse potential 110kV grid connection options available for the Coumnagappul Wind Farm Project.

When considering an appropriate substation to connect the proposed Coumnagappul Wind Farm to the national grid, substations in proximity to the Site were identified and a feasibility study was carried out to identify which substation was the most appropriate from an environmental effect perspective.

Considering ESB/EirGrids' Nodal Assignment rules which indicate that applications above 10MW will be assumed to connect to a 110kV node and new 38kV nodes (such as the proposed on-site substation) will be assumed to connect to a 110kV node, the 38kV substations in proximity to the site were discounted from the study as not being a reasonable alternatives. Therefore, 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.

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.

Following the selection of the substation node for connection to the national grid, alternative grid routes were considered from the proposed on-site substation to the Dungarvan 110kV substation. Four potential grid route options were considered and are illustrated in Figure 3.8, Volume IV. All options consist of an underground connection as this is the preferred method as set out in the Draft Revised Wind Energy Development Guidelines:

> *"In general, it is considered that underground grid connections for wind energy projects are the most appropriate environmental and/or engineering solution, particularly in sensitive landscapes where the visual effects need to be minimised. Therefore, this should be the default approach. However, there may be cases where specific ground conditions would prevent this, e.g. in upland locations where peat stability issues can arise form large-scale excavation."*

Ground conditions along the local public roads were observed to be favourable for underground cables. Therefore, an option for an overhead line connection was not examined by the Applicant.

The '110 kV Grid Connection Feasibility Study' is presented in Appendix 3.1 of this EIAR and a comparison of potential environmental effects of each route option is presented in Table 3-7.

Table 3-7: Comparison of Potential Environmental Effects of the Alternative Grid Route Options

Environmental Consideration	Grid Route Option A	Grid Route Option B	Grid Route Option C	Grid Route Option D
Approx. Length (km)	22.51	23.05	19.17	20.47
Residential Amenity Including Noise and Air Quality	Route passes c. 68 no. dwellings with potential for heightened noise and effect from dust during construction due to close proximity to works.	Route passes c. 80 no. dwellings with potential for heightened noise and effect from dust during construction due to close proximity to works.	Route passes c. 73 no. dwellings with potential for heightened noise and effect from dust during construction due to close proximity to works.	Route passes c. 69 no. dwellings with potential for heightened noise and effect from dust during construction due to close proximity to works.
Flora and Fauna	Three watercourse crossings required. No interaction with European or nationally protected sites.	Fiver watercourse crossings required. No interaction with European or nationally protected sites.	Three watercourse crossings required. No interaction with European or nationally protected sites.	Three watercourse crossings required. No interaction with European or nationally protected sites.
Ornithology	No likely effect.	No likely effect.	No likely effect.	No likely effect.
Soils & Geology	Route is mainly within road alignment. Will require off-road section in agricultural lands.	Route is mainly within road alignment. Will require off-road section in agricultural lands.	Route is wholly in public road.	Route is mainly within road alignment. Will require off-road section in agricultural lands.
Hydrology & Water Quality	Three watercourse crossings required.	Fiver watercourse crossings required.	Three watercourse crossings required.	Three watercourse crossings required.

Environmental Consideration	Grid Route Option A	Grid Route Option B	Grid Route Option C	Grid Route Option D
	5 culvert crossings needed.	6 culvert crossings needed.	8 culvert crossings needed.	4 culvert crossings needed.
Cultural Heritage	Passes close to zone of notification of six recorded monuments and passes two protected structures/NIAH features.	Passes close to zone of notification of three recorded monuments and passes two protected structures/NIAH features.	Passes close to zone of notification of three recorded monuments and passes two protected structures/NIAH features.	Passes close to zone of notification of seven recorded monuments and passes two protected structures/NIAH features.
Traffic & Transportation	1 No. Bridge crossings with HDD required. 3 No. Bridge crossings total.	At least 1 No. Bridge crossings with HDD required. 8 No. Bridge crossings total.	At least 1 No. Bridge crossings with HDD required. 6 No. Bridge crossings total.	At least 1 No. Bridge crossings with HDD required. 3 No. Bridge crossings total.
Material Assets	Existing ESB UGCs installed at the entrance of Dungarvan Substation	Existing ESB UGCs installed at the entrance of Dungarvan Substation	Existing ESB UGCs installed at the entrance of Dungarvan Substation	Existing ESB UGCs installed at the entrance of Dungarvan Substation
Landscape & Visual	No likely effect.	No likely effect.	No likely effect.	No likely effect.

Option D was identified as the preferred route option for the Proposed Development as it has the minimal number of bridges along the route that would be required to be crossed, has the least interaction with the natural environment in terms of drain/culvert and watercourse crossings. While there are several archaeological features along the route, these are mainly ring forts and enclosures, the grid will be within the curtilage of the road and as such there is little potential for effects.

3.3.9 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.

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.

3.4 Conclusion

This chapter of the EIAR has described the reasonable alternatives considered throughout the development process for the proposed Coumnagappul Wind Farm in terms of project design philosophies, technology, size and scale for the development. This Chapter sets out the evolution of the Proposed Development and the alternatives considered. The section details the strategic site screening process i.e. the high-level considerations in finding a suitable site for a renewable energy project. Alternative renewable energy technologies were considered and a comparison of potential environmental effects of the alternatives was provided.

The alternative layouts of the Proposed Development were established through the project philosophy of mitigation by design. Alternative density and scales were considered, and the potential environmental effects of various alternative turbine scales and numbers were compared. The alternative grid connection options were examined, and the optimal option was chosen as a result of environmental assessment.

Alternatives were also considered for other individual elements of the Proposed Development including the grid connection route and turbine delivery route. These elements were arrived at through the avoidance of potential environmental effects as detailed in the comparisons provided throughout this Chapter.

The final proposed layout of the Coumnagappul Wind Farm as assessed throughout this EAIR is thought to be the optimal design which minimises effects on the receiving environment, while providing significant renewable electricity to the national grid, in line with national energy and climate policy.

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