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CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

BALLINAGREE WIND FARM EIAR

VOLUME 2 - MAIN EIAR

CHAPTER 17 – INTERACTIONS OF THE FOREGOING

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17.1 Introduction

The requirement for the identification of interactions between the various aspects of the environment as detailed throughout the EIAR is set out in Article 3(1) of the EIA Directive 2011/92/EU as amended by the Directive 2014/52/EU, which states the following:

> "The environmental impact assessment shall identify, describe and assess in an appropriate manner, in the light of each individual case, the direct and indirect significant effects of a project on the following factors:
>
> a) population and human health;
> b) biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC;
> c) land, soil, water, air and climate;
> d) material assets, cultural heritage and the landscape;
> e) the **interaction between the factors referred to in points (a) to (d).**"

In the preparation of this chapter, regard was had to the Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact interactions (European Commission, 1999)[1], the EPA's Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (2017)[2], and the European Commission's Guidance on the Preparation of the Environmental Impact Assessment Report (2017)[3]

This Chapter considers the potential for interactions and inter-relationships between each aspect of the environment assessed throughout this EIAR which can result in an impact being either positive or negative, as well as having varying significance. The chapter considers potential significant environmental effects that may occur in terms of the interaction and inter-relationships of Air Quality & Climate, Noise & Vibration, Biodiversity, Land, Soils Hydrogeology & Geology, Hydrology & Water Quality, Population & Human Health, Material Assets, Shadow Flicker, Traffic & Transportation, Archaeology, Architectural & Cultural heritage, Landscape & Visual and Telecommunications & Aviation, as a result of the proposed project as described in Chapter 3 of this EIAR.

Direct, indirect, cumulative, and interactive impacts were considered during the siting of the proposed turbines and associated infrastructure in order to minimise impacts on the environmental aspects mentioned above. The interactions and inter-relationships of the potential impacts as set out throughout this EIAR are detailed in this Chapter.

[1] European Commission (1999), Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions. Office for Official Publications of the European Communities, May 1999

[2] Environmental Protection Agency (2017), Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. EPA

[3] European Commission (2017), Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report. Publications Office of the European Union

17.2 Assessment of Potential Interactions

Table 17-1 herein provides a matrix detailing the key interactions and inter-relationships between the key environmental aspects of the proposed project, including the wind farm, grid connection route (GCR), turbine delivery route (TDR) and biodiversity enhancement management plan lands (BEMP lands). Table 17-2 provides further details and examples of the diverse range of interaction and inter-relationships between the key environmental aspects.

Each individual chapter of the EIAR has had regard to interactions between different potential impacts. For example, Hydrology & Water Quality has had regard to potential impacts on Biodiversity; and Land, Soils and Geology has had regard to potential impacts on both Biodiversity , Hydrology & Water Quality and Traffic & Transportation.

The project is made up of four distinct elements as listed below and referred to throughout this Chapter.

- The wind farm site **(referred to in this EIAR as** 'the Site');
- The grid connection route (**referred to in this EIAR** as the 'GCR');
- The turbine delivery route **(referred to in this EIAR as** the 'TDR');
- The biodiversity enhancement management plan lands (**referred to in this EIAR as** the 'BEMP Lands').

Table 17-1: Summary of Interactions between Key Environmental Aspects

	Air Quality & Climate	Noise & Vibration	Biodiversity	Land, Soils, Hydrogeology & Geology	Hydrology & Water Quality	Population, Human Health & Material Assets	Shadow Flicker	Traffic & Transport	Archaeological, Architectural & Cultural Heritage	Landscape & Visual	Telecommunications & Aviation
Air Quality & Climate		■	■	■		■		■			
Noise & Vibration	■		■	■	■	■	■	■		■	
Biodiversity	■	■		■	■	■		■			
Land, Soils, Hydrogeology & Geology	■	■	■		■	■		■	■		
Hydrology & Water Quality		■	■	■		■		■	■		
Population, Human Health & Material Assets	■	■	■	■	■		■	■	■	■	
Shadow Flicker		■				■				■	
Traffic & Transport	■	■	■	■	■	■					
Archaeological, Architectural & Cultural Heritage				■	■	■				■	
Landscape & Visual		■				■	■		■		
Telecommunications & Aviation											

■ = interaction or inter-relationship □ = no interaction or inter-relationship

Table 17-2: Description of Interactions between Key Environmental Aspects

Interaction	Description
Land, Soils Hydrogeology & Geology Air Quality & Climate Traffic & Transportation Population & Human Health	During the construction phase of the proposed project there is potential for impact to human health as a result of construction activities. Dust arising from earthworks, tree felling activities, trench excavation along the GCR, construction of the new and upgrade of existing access tracks, the temporary storage of excavated materials, the movement of construction vehicles, loading and unloading of aggregates/materials and the movement of material can lead to the migration of dust. Dust emissions arise when particulate matter becomes airborne making it available to be carried downwind from the source. Dust emissions can lead to elevated PM10 and PM2.5 concentrations impacting on air quality and potentially impacting on human health at nearby dwellings. This is further exacerbated by the increase in traffic movements associated with the construction phase which can spread dust, particularly during dry spells of weather. This potential impact is unlikely to occur at the Site due to the setback of the proposed construction site from nearby dwellings. There is greater potential for this impact to occur along the GCR where installation works will be located in close proximity to dwellings. Due to the rolling nature of the proposed grid route works, this will have a short-term, temporary and slight impact on nearby dwellings. Mitigation measures have been set out in Chapter 6: Air Quality & Climate, Chapter 9: Land, Soils, Hydrogeology & Geology and Chapter 13: Traffic & Transportation to avoid the impact of dust on nearby residential properties. Mitigation measures include the use of a specific haul routes, diversions and speed limits to limit the spread of dust and the implementation of a dust control plan where construction works will be in proximity to residential properties.
Hydrology & Water Quality Land, Soils, Hydrogeology & Geology Biodiversity Traffic & Transportation	The construction phase of the proposed project has potential to impact on water quality, aquatic biodiversity and habitats as a result of excavation and tree felling. This can result in the deterioration of water quality due to sediment and nutrient release to watercourses and has potential to impact on European sites hydrologically connected to the project, including the Site, GCR and TDR. Furthermore, the potential for spillage of hydrocarbons from refuelling or from malfunctioning machinery also has potential to impact on water quality and aquatic biodiversity. Excavation works associated with the installation of the GCR may result in suspended solids reaching watercourse, affecting water quality and biodiversity. Suspended solids also have the potential to reach watercourses by being transported from the construction site to the public road on the wheels of construction traffic. This has potential to migrate to roadside drains. Mitigation measures have been set out in Chapter 8: Biodiversity, Chapter 9: Land, Soils, Hydrogeology & Geology, Chapter 10: Hydrology & Water Quality and Chapter 13: Traffic and Transportation, in order to reduce potential impact on watercourses and biodiversity. This includes the use of silt traps, silt fencing, swales, settlement ponds, the avoidance of excavations in adverse weather conditions and the use of bunded hydrocarbon stores and refuelling areas. Mitigation by design has also been included in the project. The setback of proposed works from watercourses will reduce the potential for sediment reaching water courses.

Interaction	Description
	The use of clear-span bridges for on-site watercourse crossings and the use of horizontal directional drilling on the public road along the GCR will avoid instream works and reduce potential for the deterioration of water quality during the construction phase.
Noise & Vibration Land, Soils, Hydrogeology & Geology Air Quality & Climate Traffic & Transportation Population & Human Health	During the construction phase of the proposed project the construction works in combination with the projected increase in traffic has the potential to impact on human health and residential amenity by causing noise nuisance and dust emissions at nearby dwellings. The project's design includes a significant setback between nearby dwellings and proposed major infrastructure. Therefore, the project noise levels at the Site will not exceed guideline limits and the setback distance from the Site to nearby dwellings will reduce potential dust migration and avoid impact from soiling effects. The use of designated haul routes will control the spread of dust and noise as a result of the increased traffic movements. The proposed GCR works will result in elevated noise levels at nearby dwellings which may be above the guideline limits for short periods of time in some instances. Mitigation measures include the use of temporary barrier or screen to reduce noise impact and the use of a dust control plan to mitigate against the dispersal of dust. Vehicles and machinery in proximity to dwellings will not wait outside residential properties when idle to reduce impact of noise. Due to the rolling nature of these works, the impact is expected to be moderate short term impact. Potential impacts along the turbine delivery route (TDR) may occur due to the construction of temporary accommodation works to facilitate the delivery of large turbine components. Mitigation is set out in Chapter 6: Air Quality & Climate, Chapter 7: Noise & Vibration, Chapter 9: Land, Soils, Hydrogeology & Geology and Chapter 13: Traffic & Transportation to reduce the potential impact which these construction activities may have on residential amenity and human health.
Land, Soils, Hydrogeology & Geology Air Quality & Climate Biodiversity Traffic & Transport	During the construction and decommissioning phase of the proposed project there is potential for negative effects on biodiversity due to vegetation effects (saturation of vegetation from dust) and soiling effects as a result of construction activity. Vegetation effects can occur up to 15m from sources and soiling effects can occur up to 50m from sources. This is likely to occur as a result of excavation and the migration of dust, which can be exacerbated by increased traffic movements. This can impact on air quality, plant species and habitat. Mitigation has been set out in Chapter 6: Air Quality & Climate, Chapter 8: Biodiversity, Chapter 9: Land, Soils, Hydrogeology & Geology and Chapter 13: Traffic & Transportation in order to reduce potential soiling and vegetation affects including the covering of loads to minimise the potential for fugitive emissions during transport. Use of designated haul routes and appropriate storage of soils in accordance with the soils management plan will be utilised to control this potential impact.
Land, Soils, Hydrogeology and Geology Hydrology & Water Quality Population & Human Health	Construction activities associated with the proposed project have potential to result in the erosion of exposed soil which can lead to sediment and nutrient concentrations in surface water run-off. This has potential to impact on ground water and the water of the aquifer beneath the Site and GCR area. Similarly, the potential for spillage of hydrocarbons used on site has potential to impact on ground water quality.

Interaction	Description
	This has potential to impact on drinking water of nearby wells which can impact on human health. Mitigation measures are set out in Chapter 9: Land, Soils, Hydrogeology & Geology and Chapter 10: Hydrology & Water Quality to avoid potential impact on ground water. It is assumed that all dwellings within 1km of the Site have groundwater wells, with the closest dwelling located approximately 800m from the nearest proposed turbine. There are no recorded or assumed groundwater supply wells in proximity to the turbine locations where potential for impact to ground water is highest. Excavations associated with the substations, tracks, compound and grid connection will not extend into the underlying bedrock aquifer.
Hydrology & Water Quality Biodiversity	During the construction and decommissioning phases of the proposed project, sanitary waste and material waste accumulated at the Site has potential to impact on water quality and biodiversity if mishandled or disposed of inappropriately. As set out in the Construction Environmental Management Plan (CEMP) included in Appendix 3.1, all on-site waste will be stored appropriately and disposed of at a licenced waste facility.
Land, Soils, Hydrogeology and Geology Hydrology & Water Quality Traffic & Transportation Population & Human Health	The activities associated with the construction and decommissioning of the proposed project has potential to result in soil compaction due to use of heavy machinery and construction traffic at the Site. Soil compaction can reduce the infiltration of runoff and may result in areas of standing water which pose potential health and safety issues to construction workers and the general public. There is potential for silt to be carried from the construction site to the public road on the wheels of construction traffic which can cause the soiling of the public road, reducing skid resistance and causing a potential traffic hazard. Mitigation measures have been set out in Chapter 9: Land, Soils, Hydrogeology & Geology, Chapter 10: Hydrology & Water Quality, Chapter 11: Population, Human Health & Material Assets and Chapter 13: Traffic & Transportation in order to reduce the potential for the migration of soil to the public road, reduce potential for soil compaction, reduce the occurrence of standing water and maintain best practice health and safety standards on-site and off-site during construction.
Land, Soil, Hydrogeology & Geology, Noise & Vibration, Biodiversity Hydrology & Water Quality	During the construction phase there is potential for impact to biodiversity including bird species during felling, vegetation clearance and movement of soil and the operation of machinery. These activities will generate noise with potential to displace species and impact on foraging and nesting habitats at the Site, GCR and TDR. Secondary habitat degradation may occur through a deterioration in water quality as a result of earthworks. Prior to mitigation, potential impacts on avifauna are considered temporary and imperceptible to slight and potential impacts on aquatic species and habitats are considered to range between moderate negative to significant negative during the construction period. Mitigation measures have been set out in Chapter 9: Land, Soils, Hydrogeology & Geology and Chapter 10: Hydrology & Water Quality in order to avoid impact on water quality and aquatic species and habitat. Mitigation measures have been set out in Chapter 8: Biodiversity to avoid impact on species and habitats including avifauna and mammals during construction. Measures include all felling and clearing of vegetation will be carried out outside of the breeding season for birds, badgers and red squirrel, where possible, and night-time works will be limited to avoid impact on bats.

Interaction	Description
	A buffer zone between turbines and treelines will be applied to minimize risk to bat populations. Pre-construction monitoring surveys will be undertaken, and an Ecological Clerk of Works will be present to oversee the construction works and vegetation clearing. Mitigation measures have been set out in Chapter 7: Noise & Vibration to reduce noise where possible during the construction phase of the project. Following implementation of mitigation measures, the potential impact to species and habitat as a result of this potential interaction is considered non-significant to slight negative and short-term.
Air Quality & Climate Population & Human Health (Human Health) Material Assets	The operational phase of the proposed project will result in the production of clean sustainable electricity which will offset the burning of fossil fuels and carbon emissions, resulting in positive benefit to air quality. This will result in an overall benefit to human health. The renewable electricity generated will provide greater energy security to the national grid, reducing the nation's dependency on fossil fuel and reducing the costs associated with fossil fuel importation. Therefore, this will have a positive impact on both material assets and a positive impact on air quality, displacing between 132,414 and 148,125 tonnes of CO2 per annum which would otherwise be released to the atmosphere as a result of the burning of fossil fuels. This will also benefit in reducing climate change.
Population & Human Health (Land Use) Biodiversity Material Assets	The construction of the project will result in the felling of 70 hectares of coniferous forestry. This will result in a change of land use from commercial forestry to renewable energy production, a loss in habitat which will impact on biodiversity and a loss in renewable material assets (trees). The impact on biodiversity is expected to be slight to imperceptible following mitigation and the impact on material assets will be neutral due to the requirement to provide replant lands elsewhere. The replant lands will provide the required area of commercial forestry which will be felled at the Site during the construction of the proposed Ballinagree Wind Farm. In addition to the wind farm infrastructure felling, 18 ha of coniferous forestry will be felled as part of the proposed BEMP measures. This is expected to have a positive impact on biodiversity. Similarly, the 18 ha of felled forestry at the BEMP lands will be replanted elsewhere pursuant to the Forestry Act resulting in a neutral impact on material assets (commercial forestry).
Noise & Vibration Landscape & Visual Shadow Flicker Population & Human Health	The operation phase of the proposed project has potential to impact on residential amenity and human health as a result of a combination of noise, visual impact and the potential effects of shadow flicker on nearby residential receptors. These impacts have been considered in Chapter 7: Noise & Vibration, Chapter 11: Population, Human Health & Material Assets, Chapter 12: Shadow Flicker and Chapter 15: Landscape & Visual. Mitigation has been set out in each chapter. The predicted noise limits will fall within the guideline noise limits at the Site as described in Chapter 7. With mitigation measures, cumulative operational noise levels of the proposed wind farm and adjacent wind farms will meet the daytime and night-time noise limit derived using the Wind Energy Development Guidelines 2006 and current best practice guidance as set out in Chapter 7: Noise & Vibration.

Interaction	Description
	The occurrence of shadow flicker will be eliminated through the use of shadow flicker detection systems on each wind turbine which will identify the conditions where shadow flicker can occur and cease operation until the conditions for shadow flicker are no longer present. A significant setback distance has been applied between the proposed turbines and nearby residential dwellings. The closest dwelling to the turbine locations is 809m. This provision will provide adequate setback in order to maintain residential amenity at nearby dwellings. The setback will also reduce noise and potential occurrences of shadow flicker impact, reducing potential for this interaction to occur.
Population & Human Health (Recreation, Amenity & Tourism) Landscape & Visual Archaeological, Architectural & Cultural Heritage	The operational phase of the proposed development has potential to impact on landscape and cultural heritage which may have an effect on tourism in the area. As outlined in Chapter 11, there are no major tourism attractions in proximity to the Site. The most significant recreation activity/attractions at the proposed Ballinagree Wind Farm site is trail walking and hiking and the Duhallow Way which traverses the site. Sequential cumulative impacts are highly likely to occur along the Duhallow Way route as it passes through the northern turbine cluster and immediately north of the southern cluster. Nevertheless, wind energy development is a well-established feature along this section of this waymarked trail where existing turbines are already prominently visible at a near distance. The proposed Ballinagree wind turbines can be viewed in the context of existing and permitted wind energy developments in the western half of the study area. Views of these developments in combination with the proposed Ballinagree development are most likely to occur only from elevated locations within the study area and in the context of considerable separation distances so that they will be viewed as distinctly separate developments and therefore is not considered to notably contribute to a sense of wind farm proliferation. There are 14 no. known archaeological sites in close proximity to the wind farm site and 5 no. national monuments located within approximately 12km from the proposed wind farm. The design of the proposed wind farm has considered the cultural heritage assets and the alignments of nearby monuments. Separation distances have been applied to avoid potential impact. Therefore, there are no expected significant, adverse impacts to recreation, amenity and tourism or archaeological, architectural and cultural heritage assets in the area of the proposed wind farm. As further outlined in Chapter 11: Population, Human Health & Material Assets, wind farm development does not have a significant bearing on Tourism as concluded from studies conducted by Fáilte Ireland. Therefore, the impacts associated with landscape and visuals during the operational phase of the proposed development will not have a significant impact on Population & Human Health (Recreation, Amenity & Tourism) and Archaeological, Architectural & Cultural Heritage.

Interaction	Description
	A residual permanent significant, positive impact on recreation, amenity and tourism is expected as a result of the provision of new and improved recreation facilities at the proposed wind farm site which will interact with cultural heritage assets, providing public access to stone circles and other monuments at the wind farm site.
Land, Soils, Hydrogeology & Geology Hydrology & Water Quality Population & Human Health Material Assets Biodiversity Architectural & Cultural Heritage	The potential susceptibility of the proposed project to major accidents and natural disasters is considered in Chapter 11: Population, Human Health & Material Assets. This assessment considers the potential impact of landslides/slope failure, forest fire and flooding. These events have potential to impact on soils and geology, hydrological regimes, water quality, human health and safety of construction workers, forestry workers and the general public, material assets including property and renewable energy projects, roads, infrastructure and natural resources, biodiversity and archaeological monuments. Slope stability has been considered in Chapter 9: Land, Soils and Geology and turbines have been sited to avoid steep slopes and areas of peat. The magnitude of the potential impacts, prior to mitigation, is considered to be negligible and no slope stability issues are anticipated across the site. Flood risk is considered in Chapter 10: Hydrology & Water Quality and has regard to the potential impact flooding might have on slope stability. The flood risk assessment concludes that the wind farm site is unlikely to be susceptible to flooding and will have a negligible impact on flood risk in the surrounding area. This was also assessed with a 20% increase predicted run-off flow to account for potential future climate change. Safety measures have been built into the design of the proposed development to avoid potential for fire and avoid potential for the spreading of fire as set out in Chapter 11: Population, Human Health & material Assets, including significant setback between infrastructure and treelines, and significant setback of the proposed wind farm from nearby residential and agricultural structures.

17.3 Conclusion

The proposed Ballinagree Wind Farm project has potential to impact on various environmental aspects as detailed throughout this EIAR. As outlined in this Chapter, there are interactions and inter-relationships between these aspects as described above. The EIAR has considered these interactions and inter-relationships throughout the assessment, firstly through the design of the wind farm site, grid connection route, turbine delivery route and the location of biodiversity enhancement lands, to avoid impacts where possible and also in the definition of suitable mitigation measures to minimise potential impacts. It is therefore considered that the potential significant impacts associated with the interactions of environmental effects outlined in this chapter will be avoided due to the implementation of mitigation measures as detailed throughout this EIAR.

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