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CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

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

VOLUME 2 - MAIN EIAR

CHAPTER 18: INTERACTIONS OF THE FOREGOING

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18.1 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 amended 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).**"

This chapter adheres to guidance in the Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact interactions (European Commission, 1999)[1], the EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports 2022[2], and the European Commission's Guidance on the Preparation of the Environmental Impact Assessment Report (2017)[3]

This Chapter assesses the potential for interactions and inter-relationships between one aspect of the environment and another 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; Ornithology; Soils, Geology and Hydrogeology; Hydrology & Water Quality and FRA; Population and Human Health; Shadow Flicker; Traffic & Transportation; Archaeology, Architectural & Cultural Heritage; Landscape & Visual Impact; Material Assets, Telecommunications & Aviation as a result of the proposed project as described in Chapter 2 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.

Table 17-1, below, 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) and turbine delivery route (TDR).

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

[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.

Table 172 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 assessed the applicable interactions between different potential impacts. For example, Hydrology and Water Quality & FRA has assessed the potential impacts on Biodiversity; Ornithology, Land, Soils and Geology.

The project is made up of three 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**').

It should be noted that the forestry within the proposed wind farm site was originally planted as a commercial crop and will be felled and replanted in the coming years should the project not proceed.

Figure 18-1: Matrix of Interaction Between key Environmental Aspects

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

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

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

Table 17-1: Description of Actions Between Key Environmental Aspects

INTERACTION	DESCRIPTION
Soils, Geology and Hydrogeology; 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 GCR and TDR, 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. This potential impact is unlikely to occur at the Site due to the significant setback of the proposed construction site from nearby dwellings which in turn will have necessary mitigation measures applied. Some receptors have the potential for dust soiling due to tracks travelling along local routes. There is greater potential for this impact to occur along the GCR with a medium risk due to the number of residential dwellings located in close proximity to the GCR. Due to the rolling nature of the construction site along the GCR which are not concentrated in one area the dust and air pollutants are considered to be short-term, slight negative impacts on air quality on nearby dwellings. Mitigation measures have been set out in Chapter 6: Population and Human Health, Chapter 7: Air Quality & Climate, Chapter 11: Soils Geology & Hydrogeology and Chapter 14: Traffic & Transportation to avoid the impact of dust on nearby residential properties. Mitigation measures that will be implemented in full include the use of graded aggregates on internal access roads, use of a water bowser to spray work areas, Implementing a dust control plan as part of the CEMP, covering of loads that cause a dust nuisance, revegetation of earthworks and exposed areas/soil stockpiles, controlling of access and egress of construction vehicles and re-direction to designated locations, wheel washing at main entrance/exit point and, even though unlikely once the mitigation measures are implemented, identifying receptors with potential to experience dusting and taking measures to have the facades of their dwelling cleared. Further mitigation measures that will be implemented in full include the use of a specific haul route, diversions and speed limits to limit the spread of dust and the implementation of a Dust Management Plan where construction works will be in proximity to residential properties with road cleanliness for the GCR including the use of a road sweeper as part of the Traffic Management Plan.
Soils, Geology and Hydrogeology; Air Quality & Climate; Biodiversity; Ornithology; Traffic & Transport.	During the construction and decommissioning phase of the proposed project, there is potential for impact to biodiversity due to vegetation effects (soiling of vegetation from dust) as a result of construction activity which can occur up to 25m from vegetation sources and soiling effects which can occur up to 100m from watercourse sources. This is likely to occur as a result of excavation and the migration of dust, which can be exacerbated by traffic movements. This can impact on air quality, plant species and habitat. The deposition of dust on both the GCR/TDR is considered to have a short-term moderate reversible effect at a local scale in terms of vegetation effects due to a potential for reduction in photosynthesis and a short-term not significant reversible effect on the

INTERACTION	DESCRIPTION
	hydrological network at a local scale. The nearest receptor is c. 850m. from the nearest turbine and c. 700m from the site boundary so is not expected to experience soiling, deposition or vegetation dusting effects. Mitigation has been set out in Chapter 7: Air Quality & Climate, Chapter 9: Biodiversity, Chapter 10: Ornithology, Chapter 11: Soils, Geology and Hydrogeology and Chapter 14: Traffic & Transportation in order to reduce potential soiling and vegetation affects including the use of graded aggregates on internal access roads, a water bowser to supress dust migration, provision of wheel washing facilities within the site, the implementation of a dust control plan, controlling of exhaust emissions from vehicles within site controlled by contractor ensuring the minimisation of emissions from vehicles, the revegetation of earthworks and exposed areas/soil stockpiles covering of loads which may be sources of dust migration, the carrying out of Road condition survey, road reinstatement, road sweeper as part of the Traffic management Plan, Route proofing, road cleanliness, temporary trench reinstatement on the GCR. A designated haul route and appropriate storage of soils in accordance with the soils management plan will be utilised to control this potential impact.
Noise & Vibration; Soils, Geology and Hydrogeology; 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 and dust nuisance at nearby dwellings. Project noise levels at the Site are not predicted to exceed construction noise and vibration effects which have been determined with reference to '*British Standard 5228:2009+A1:2014 Code of Practice for Noise and Vibration Control*' on Construction and Open Sites Part 1 Noise, with significant setback distance from the Site to nearby dwellings will avoid impact from soiling effects. The use of a designated haul route and restricting movements along the route to standard working hours 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 and will be above the '*British Standard 5228:2009+A1:2014 Code of Practice for Noise and Vibration Control*' guideline limits in some instances which would result in a temporary significant impact. However, these works will be for a short duration at a particular property. The predicted noise from the proposed wind farm meets the daytime and night-time noise limits at the closest locations to the Proposed Development, and therefore no mitigation is required. Mitigation measures that will be implemented in full include the fitting of all vehicles and mechanical plant with effective exhaust silencers. Any elevated noise at grid connection works will be for a short duration and a temporary barrier or screen to reduce noise impact will be installed whilst works are being carried out that give rise to an impact. The use of a Dust Management Plan, as set out in CEMP, will also be implemented to mitigation 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 significant, brief/temporary and localised. 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.

INTERACTION	DESCRIPTION
	In relation to Noise and Vibration construction and decommissioning on-site activities with a duration longer than one month will be below the construction noise limit of 65 dB LAeq,1hr at residential dwellings. Therefore the effect from decommissioning construction works will be temporary and range between not significant to slight effect. There is potential for elevated noise levels due to the grid connection works resulting in a temporary significant effect. However, these works will be for a short duration at a particular property (i.e. typically less than 3 days at any particular receptor). Where the works are to occur over an extended period at a given location, a temporary barrier or screen will be used to reduce noise level below the noise limit and reduce any potential effect resulting in a moderate short-term residual effect. The operational wind farm noise levels meet the daytime and night-time noise limits derived using the Wind Energy Development Guidelines 2006. As detailed in the criteria section this is considered to be a current best practice approach. For some receptors a new source of noise will be introduced into the soundscape, and it is expected that there will be a slight to moderate significance of effect, with dwellings closest to the project with a long-term moderate significance of effect. Mitigation is set out in Chapter 7: Air Quality & Climate, Chapter 8: Nosie & Vibration, Chapter 11: Soils, Geology and Hydrogeology and Chapter 14: Traffic & Transportation to reduce the potential impact these construction activities may have on residential amenity and human health.
Hydrology and Water Quality & FRA; Soils, Geology and Hydrogeology; Biodiversity; Ornithology; Traffic & Transportation.	The construction phase of the proposed project has potential to impact on water quality, aquatic biodiversity, ornithology 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 and the inappropriate disposal during the construction phase may result in suspended solids and chemicals reaching watercourse, having notable adverse consequences affecting surface run-off water quality and biodiversity. Furthermore, 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. The runoff of sediments during engineering works causing an increase in nutrients in receiving stream. Additionally, the use and subsequent release of concrete, cement, or lean mix during construction phase for excavation dewatering, Horizontal Directional Drilling, GCR installation can lead to changes in water pH, with the increased concentrations of sulphates and other constituents found in concrete impacting water quality This has potential to migrate to roadside drains. This is in addition to issues such as Slope failure resulting in an influx of acidic and/or peat laden waters into surface water decreasing PH value. Furthermore, where both wind farm construction and agricultural activities occur at the same time, this has the potential to affect water quality i.e. from Conifer Forestry and peat extraction during winter months/ heavy rainfall.

INTERACTION	DESCRIPTION
	Mitigation measures have been set out in Chapter 9: Biodiversity, Chapter 10: Ornithology, Chapter 11: Soils, Geology and Hydrogeology, Chapter 12: Hydrology and Water Quality & FRA and Chapter 14: Traffic and Transportation, to reduce potential impact on watercourses and biodiversity. This includes the use of silt fencing, 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 including the implementation of a proposed Surface Water Management Plan and a Surface Water Quality Monitoring Programme prior to construction in avoiding siltation, erosion, surface water run-off and accidental pollution events. Furthermore, steps will be put in place for the Control of Accidental Spills and Leaks, the control of concrete runoff, control of sediment runoff. The setback of proposed works from watercourses will reduce potential sediments from reaching water courses. The use of a Road Sweeper, maintaining existing drainage outside the immediate site area as well as the installation of site drainage and settlement ponds, strict provisions for works in or adjacent to waters and the implementation of Oil spill protection measures and emergency spill response procedures will all reduce potential sediments reaching watercourses. Mitigation by avoidance has been incorporated and means that the GCR selection limits the number of watercourse crossings, and the use a clear-span bridge at the main watercourse crossing at the Site and use of horizontal directional drilling on the public road along the GCR to avoid instream works. Furthermore, traffic management plan includes a road condition survey, the use of a road sweeper and for the GCR, measures of road cleanliness and surface overlay post trench reinstatement.
Soils, Geology and Hydrogeology; Hydrology & Water Quality and FRA; Population & Human Health.	Construction activities associated with the Proposed Development have the potential to result in the erosion of soil which can lead to hydrocarbons, sediment and nutrient concentrations release in surface water run-off. Furthermore, soil infiltration to groundwater and soil erosion may represent a potential impact to underlying groundwater aquifer. This has potential to impact on ground water and the water of the aquifer beneath the Site and GCR area. Furthermore, erosion or degradation of soil by increased vehicular movements has the potential for the carrying of suspended solids carried by surface water runoff which would disrupt established drainage networks. Thus, this proposal has the potential to create new pathways for runoff causing erosion of soils and construction materials and the entrainment of solids during runoff. Similarly, the potential for spillage of hydrocarbons used on site has potential to impact on ground water quality. Proposed tree-felling has the potential to cause the exposure of underlying soils to surface water-runoff resulting in soil erosion resulting in increased sediment and nutrient concentrations. Additionally, soil compaction from construction traffic and could lead to an increase in erosion of overburden deposits. All these factors have the potential to impact groundwater/drinking water which can impact on human health. Measures are set out in Chapter 11: Soils, Geology and Hydrogeology and Chapter 12: Hydrology and Water Quality & FRA to avoid potential impact on ground water. Infrastructure is located so that it is set back as far as practicable from hydrological features. A surface water Management plan will be implemented with the collection of surface water runoff from the proposed development and redistribution of clean collected runoff and discharge diffusely to protect water quality.

INTERACTION	DESCRIPTION
	Furthermore, an Environmental/ Ecological Clerk of works will monitor the site in preventing negative effects on hydrology and monthly water quality grab samples and checked in situ in protecting water quality. Daily visual monitoring of the surface water network will monitor the visible signs of construction impacts on surface water network. Excavations associated with the temporary construction compound substations and grid connection trenches will not extend into the underlying bedrock aquifer. Mitigation measures have been set out in Chapter 6: Population and Human Health, Chapter 11: Soils, Geology and Hydrogeology, Chapter 12: Hydrology and Water Quality & FRA and Chapter 14: Traffic & Transportation in order to reduce the potential for the migration of soil to the public road, the implantation of a Traffic Management Plan including the use of Road sweeping vehicles, reduce potential for soil compaction, control of sediment runoff , the establishment of silt fences to control contaminated runoff to reduce the occurrence of standing water and maintain best practice health and safety standards on-site and off-site during construction.
Hydrology & Water Quality; Biodiversity; Ornithology.	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, biodiversity and ornithology if mishandled or disposed of inappropriately. As set out in the Construction Environmental Management Plan (CEMP) included in Appendix 2.1, all on-site waste will be stored appropriately, will be removed from site via a licensed waste disposal contractor and disposed of at an appropriate licenced waste facility. Furthermore, all waste movements will be recorded which records will be held by the waste manager on-site.
Population & Human Health; Biodiversity; Ornithology; Landscape and Visual Impact.	The construction of the project will result in the felling of c. 5.4ha. of coniferous forestry, with all forestry removed subject to forest replanting provisions. Tree felling will result in a modest physical impact on the landscape within the site and a change of land use from coniferous forest to renewable energy. Mitigation measures will ensure the prevention of excessive visual impact or unnecessary land use or habitat alterations impacting the landscape, or the biodiversity contained within. The CEMP will set out how to best to avoid undue impacts to adjacent land uses on site, the GCR and TDR. 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.
Soil, Geology and Hydrogeology; Noise & Vibration; Biodiversity; Ornithology; Hydrology & Water Quality and FRA.	During the construction phase there is potential for impact to biodiversity and ornithology such as impacts on bird species during felling, vegetation clearance and movement of soil and operating machinery. These activities will generate noise with potential to displace species and impact on foraging and nesting habitats at the Wind Farm, Grid Route and TDR. Secondary habitat degradation may occur through a deterioration in water quality as a result of earthworks. Prior to mitigation, it is considered that the main potential impacts on ornithology are through the construction of the wind farm with habitat loss/alteration, particularly during the construction of the wind farm tracks, access roads, turbine foundations and hardstandings, the substation compound, temporary site compound and excavation of the on-site borrow. However, it is considered that the proposed effect of habitat loss will be a '*Permanent Imperceptible*' to '*Not Significant Effect*' in a local context, with impacts considered reversible.

INTERACTION	DESCRIPTION
	The trimming of vegetation, removal of scrub or felling of trees during the nesting could result in a '*Localised Temporary Significant Reversible Effect*' to nesting birds during the nesting season (1st March – 31st of August). Further indirect impacts from construction such as laying of cables, underground cabling placement, reworking structures such as bridges and material excavations, it is envisioned that there will be a slight to significant effect impact of indirect construction works. For Bats, it is considered that there will be no direct impacts on bats during the construction phase, due to no impacts on trees that contain bat roosts. For indirect impacts, it is considered that there will be *'Long-term Slight'* and '*Reversible'* impacts to bats due to vegetation removal (i.e. hedgerows, treelines).For other mammal species it is considered that the direct impacts will not result in a '*Short-term Imperceptible Reversible effect'* due to the relatively small-scale loss of habitat and indirectly result in a short-term significant reversible effect due to mammal migration during any disturbance. For aquatic ecology, potential direct construction phase effects are assessed as being *Significant, Negative, Short-Term, Reversible* due to releasing of suspended solids and pollutants, engineering works in proximity to streams, erosion of streams linked to 'Improved' drainage and indirect are significant negative, short term and local due to releases of silt laden runoff, spillage of cement/hydrocarbon and sediment run-off. Effects on the GCR/TDR are considered negative, *Short Term Reversible* and in the local context for aquatic ecology. Mitigation measures have been set out in Chapter 11: Soils, Geology and Hydrogeology and Chapter 12: Hydrology and Water Quality & FRA in order to avoid impact on water quality and aquatic species and habitat. These measures include avoiding impact on species and habitats including avifauna and mammals during construction. Measures that will be implemented in full 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 50m bat felling buffers and lighting restrictions will be put in place to avoid impact on bats. Mitigation species for bird species that will be implemented in full include construction works taking place during daylight hours and habitat re-enhancement for local species of conservation importance Pre-construction mammal surveys will take place to reconfirm existing environment. All works within watercourses carried out in accordance with IFI biosecurity protocols, the implementation of a Surface Water Management Plan, an Emergency Erosion and Silt Control Response Plan and the installation of silt fences. 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 that will be implemented in full have been set out 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 and temporary.
Air Quality & Climate; Population & Human Health.	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.

INTERACTION	DESCRIPTION
	Therefore, this will have a positive impact on both material assets and a positive impact on air quality, where it is estimated that 3,176,680 - 3,814,600 tonnes of CO2 will be displaced over the proposed forty-year lifetime of the wind farm, which equates to c. 79,417 – c. 95,365 tonnes of CO2 per annum, which would otherwise be released to the atmosphere as a result of the burning of fossil fuels. Furthermore, this proposed wind farm will act cumulatively with other renewable energy projects in reducing CO2 emissions by displacing fossil fuel in the production of electricity, resulting in a slight-moderate positive impact on climate. Overall, this will also benefit in reducing climate change.
Noise & Vibration; Landscape & Visual Impact; Shadow Flicker; Population & Human Health.	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 effects of shadow flicker. These impacts have been considered in Chapter 6: Population and Human Health, Chapter 8: Nosie & Vibration, Chapter 13: Shadow Flicker and Chapter 16: Landscape and Visual Impact. With regard to noise, Chapter 8: Nosie & Vibration describes where mitigation has been set out where noise limits may create an effect on dwellings, most notably during construction. The predicted noise from the proposed wind farm during the operational phase meets the daytime and night-time noise limits at the closest locations to the proposed development as set out in '*British Standard 5228:2009+A1:2014 Code of Practice for Noise and Vibration Control*', so no mitigation is required. A significant setback distance has been applied between the proposed turbines and nearby residential dwellings. In total, 15 no. properties have been identified within 10 rotor diameters (1,620m) of the turbines, and are therefore considered potential shadow flicker receptors. There are no receptors within 500 m of the proposed wind turbines. A scheme of mitigation will be implemented into the turbine control software to cease turbine operation during periods when shadow flicker effects are predicted to occur. These mitigation measures will be applied to ensure that there will be zero shadow flicker effects occur, which aims to maintain the residential amenity of nearby dwellings and to reduce noise and potential occurrences of shadow flicker impact.
Population and Human Health; Landscape and Visual Impact; Material Assets, Telecommunications and Aviation; 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 15: Archaeology, Architectural and Cultural Heritage, the operational phase will likely result in a range of indirect, negative effects of a visual nature on the wider settings of extant archaeological sites within the 1km study area around the Site. These effects will range from imperceptible to slight in significance, with proposed biodiversity enhancement measures implemented such as planting of hedgerows providing positive effects on the visual impact and biodiversity. While the turbines will be visible from various other cultural heritage assets within the surrounding landscape, no likely significant, indirect effects on examples with notable visual or amenity sensitivities are predicted during the operational phase. Furthermore, there a number of tourist attractions in close proximity to the proposed wind farm site whose amenity may be impacted during the operational phase by the proposal including the Comeragh mountains, Nire Valley and Mahon Falls. For the impact on landscape, the magnitude of the landscape impact is deemed to be High-Medium within the site and its immediate environs (c. 1km) reducing to Medium for the remainder of the central Study Area.

INTERACTION	DESCRIPTION
	Overall, the impact on the landscape is deemed to reduce to Low and Negligible at increasing distances as the wind farm becomes a proportionately smaller and integrated component of the overall landscape fabric. The operational phase is considered to be *Substantial to moderate / Negative / Long-term* within and immediately around the Site, with the significance reducing to Moderate and Slight at increasing distances as the development becomes a progressively smaller component of the wider landscape fabric in higher sensitivity landscape units / features such as the Uplands to the east and west and the coastline in the southeast quadrant of the Study Area. Cumulatively, the Proposed Development is considered to contribute to a cumulative impact no greater than **Low** with other existing and permitted developments and no greater than **Medium** with existing permitted and proposed wind farm developments. Mitigation measures include avoidance in design in containing the proposed development within the horse shoe ridge landscape of the area and also the buffering of residential receptors.
Soils, Geology and Hydrogeology; Hydrology & Water Quality; Population & Human Health; Biodiversity; Ornithology; Archaeology, Architectural & Cultural Heritage; Material Assets, Telecommunications and Aviation.	The potential susceptibility of the proposed project to major accidents and natural disasters are considered in Chapter 6: Population and Human Health. This assessment considers the proposed developments vulnerability to major accidents and natural disasters, potential adverse impacts on human health and the environment, the magnitude of potential impacts, the likelihood of potential impacts and considers the preparedness of the project in case of accident, disaster or emergency. 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 11: Soils, Geology and Hydrogeology. In order to reduce the impacts on geology, hydrogeology and slope stability, the Project and proposed infrastructure locations are generally located within areas of 'Low' to 'Moderate High' susceptibility, with localised areas classified as 'High'. The remaining turbines, substation, met mast, Colligan river crossing point, construction compound areas and borrow pit are all located in areas mapped as having a 'Moderately Low' to 'Low' landslide susceptibility. The magnitude of impact on soils and geology receptors is considered 'Moderate Adverse' in nature, with a medium importance and moderate significance with negative, short term, direct and having unlikely effects. The magnitude of impact on soils and geology receptors is considered 'Moderate Adverse' in nature, with a medium importance and moderate significance with negative, short term, direct and having unlikely effects. In order to reduce the impacts on soils, geology, hydrogeology and slope stability, infrastructure has been primarily located within areas of thinner peat/soft ground and lower slope gradients. Extensive work has already been undertaken at the preliminary design stage to apply risk avoidance by design, which include: • Peat probing, site walkover surveys and intrusive ground investigation to identify geotechnical constraints (e.g. peat deposits and evidence of historic landslip) likely to adversely affect the design of the Site.

INTERACTION	DESCRIPTION
	• Relocation and micro-siting of turbines, hardstanding's and access roads based on the site assessments and geotechnical assessments in order to reduce ground risk associated with the Site. • The works have been designed and checked by geotechnical and civil engineers, who are suitably qualified and experienced in excavation and earthworks design and construction methodologies. Details of experience and competence is included in Chapter 1 of Chapter 11 – Soils, Geology and Hydrogeology. The magnitude of impacts on soils and groundwater receptors is considered Small Adverse, with a medium importance with slight significance with negative, short-term, direct and having unlikely effects. Flood risk is considered in Chapter 12: Hydrology and Water Quality & FRA. An online Catchment Flood Risk Assessment and Management (CFRAM) fluvial flood mapping shows that the proposed development site is not located in an area with a High, Medium or Low probability of fluvial flooding with the extent of the fluvial flood risk in the Mid-Range and High-End future scenarios generally follows the present-day flood extents, and the site is not affected. The Geological Survey Ireland (GSI) Groundwater Flooding Probability Maps show that the Site is not located in an area with an increased level of groundwater flooding. The GCR has a medium probability of flooding in grounds adjacent to Skeehans Stream and is not located in an area with increased groundwater flooding. Thus overall, it is considered that the Site is at a very low risk of flooding from fluvial sources, surface water runoff or groundwater. The risk of surface water and groundwater flooding is considered to be low during the installation of the underground GCR cable. The risk of flooding from all sources is also considered to be very low along the turbine delivery route. 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 put in Chapter 6: Population and Human Health. Consideration has been included regarding Material Assets, Telecommunications and Aviation through including significant setback between infrastructure and treelines, and significant setback of the proposed wind farm from nearby residential and agricultural structures.

18.2 Conclusions

The Proposed Development 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 Proposed Development, to avoid impacts where possible and also in the definition of suitable mitigation measures to minimise potential impacts. It is therefore considered that the 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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