15 Interactions of the Foregoing and a Summary of Mitigation Measures

15.1 Interactions of the Foregoing

15.1.1 Introduction

The foregoing topics in earlier chapters do not exist in isolation from each other and consequently, any impact on one element of the environment may also impact on another. The Irish Environmental Protection Agency have developed a simple matrix to show the key interactions and interrelationships between the environmental aspects of a Development (**Table 15.1**). The interactions between impacts on different factors have been addressed as relevant throughout the EIAR (**Table15.2**). The cumulative slight impact on a number of topics may result in a significant impact on another topic.

15.1.2 Impact Interactions

Where any potential negative impacts have been identified during the assessment process, these impacts have been avoided by embedded design mitigation or at a minimum, reduced by the proposed mitigation measures.

15.2 Summary of Mitigation Measures

This chapter summaries mitigation measures proposed elsewhere in the EIAR. Chapter 5 to 14 of the EIAR outlines the findings of the assessment of the predicted effects of the Development on a topic by topic basis. The significance of these effects has been assessed using criteria defined in the topic chapters. In the context of The EPA Guidelines (2017), the significance of effects is categorised from imperceptible through to not significant, significant and profound with varying sub-categories.

15.2.1 Embedded Mitigation

Embedded mitigation includes design changes that were made in order to reduce or eliminate adverse effects, as well as normal good practice measures; these have avoided the majority of potentially significant effects. **Technical Appendix 15.1** summarises mitigation measures for all technical assessment chapters. Embedded mitigation is considered in the "Predicted Effect" column in **Table 1 and 2** of **Technical Appendix 15.1** and is not treated as "Mitigation" for these purposes. These are outlined in the following locations in the EIAR and details are not repeated here:

- **Technical Appendix 2.1** Outline Construction Environmental Management Plan (Outline CEMP)
- **Technical Appendix 6.7:** Draft Habitat Management Plan (HMP)

The process of applying the embedded mitigation is set out in **Chapter 2: Development Description**. The key design aspects comprising embedded mitigation include:

- Avoiding inconsistent turbine spacing, outliers and excessive turbine overlapping to minimise visual confusion and ensure a balanced/compact array of key views
- Achieving an appropriate scale of turbine, taking account of the landscape context
- Utilising existing infrastructure, reusing existing access tracks and the same general area/footprint of the Operational Barnesmore Windfarm
- Respecting and understanding the ground conditions and topography of the Site, including avoiding effects on active peat where possible
- Maximising the separation from residential dwellings
- Respecting other environmental constraints and associated buffer separations

15.2.2 Specific Mitigation Measures

In addition to mitigation proposed to address significant adverse effects (**Technical Appendix 15.1**), certain chapters have also proposed further measures to reduce effects that were assessed as 'Not Significant' before mitigation.

Table 15.2 outlines interactions between environmental aspects. Technical assessments have assessed pathways, both direct and indirect that can magnify effects through the interaction or accumulation of effects. Effects have been cross-referenced between chapter topics. An outline of potential interactions between chapters/topics is presented in **Table 15.1**.

Table 15.1: Summary matrix of Interactions of Impacts during Initial Decommissioning, Construction and Operational Phases (Source: Adapted from EIAR Guidelines, 2017)[1]

	Population & Human Health		Biodiversity		Ornithology		Soils & Geology		Hydrology and Hydrogeology		Noise		Landscape & Visual		Material Assets		Cultural Heritage		Traffic & Transportation	
	Const & Decom	Oper	Const & Decom	Oper	Const & Decom	Oper	Const & Decom	Oper	Const & Decom	Oper	Const & Decom	Oper	Const & Decom	Oper	Const & Decom	Oper	Const & Decom	Oper	Const & Decom	Oper
Population & Human Health																				
Biodiversity																				
Ornithology																				
Soils & Geology																				
Hydrology and Hydrogeology																				
Noise																				
Landscape & Visual																				
Material Assets																				
Archaeology and Cultural Heritage																				
Traffic & Transportation																				

Note: Const & Decom = Initial Decommissioning and Construction phase; Oper = Operational phase

Interaction or inter-relationship

No interaction or inter-relationship

[1]. Environmental Protection Agency (2017) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. Available online at: https://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf [Accessed on 22/11/2019]

Table 15.2: Interactions & Inter-relationships between Environmental Aspects of the Development

Interaction	Description
Population and Human Health & Hydrology and Hydrogeology	Impacts could be observed through flood risk polluting waters supply and also recreational fisheries; **Chapter 9: Hydrology and Hydrogeology** considers these aspects.
Population and Human Health & Noise	The noise assessment inherently covers any interaction as the methodology used and limits applied are designed to protect health and amenity.
Population and Human Health & Landscape and Visual	The initial decommissioning and construction phase of the Development will see a temporary introduction of machinery and the erection of 13 turbines into a natural but already modified landscape. **Chapter 11: Landscape and Visual Amenity** assessed the landscape effects, the visual effects and the cumulative effects of the Development, including assessment from recreational scenic viewpoints, and was also informed by the findings of the Residential Visual Amenity Assessment. The interactions between the environmental aspects were carefully considered in the EIAR, particularly in the design of the turbine layout. Detailed zone of theoretical visibility maps (ZTVs), route screening analysis and photomontages were prepared to assess the level of impact. Based on the findings of the collective assessments it is considered that the Development will not give rise to any significant effects, either singly or in combination. Tourists to Ireland have become accustomed to the vision of turbines on the landscape and given the scenario where more windfarms will be built in Ireland in the future, the most widely held view is that this will not impact their likelihood to visit the area again.
Population and Human Health & Material Assets: 1. Air and Climate 2. Shadow Flicker 3. Air Navigation 4. Telecommunications 5. Socio-economic 6. Cultural Heritage	1. Impacts on air quality during the initial decommissioning and construction phase may occur due to dust emissions from construction activities onsite and through increased traffic and associated exhaust emissions from construction traffic. These interactions have been considered as part of the EIAR, without significant effects being predicted and suitable mitigation measures provided to further reduce potential impacts. During the operational phase, the energy generated by the Development will offset energy and the associated emission of greenhouse gases from electricity-generating stations dependent on fossil fuels, thereby having a net positive effect on climate. In doing so, there will likely be reduced effects from climate change on human beings. The cumulative effect of the Development with other Irish renewable generation is considered to be a fundamental change in the climate effects of Ireland's energy supply, which is a **major, positive effect,** that is **Significant** (beneficial) under the EIA Regulations and will contribute to Ireland's binding emission reduction targets. 2. Shadow flicker could potentially impact on residences. However, the results from the shadow flicker assessment show the projected total hours of shadow flicker occurrences per year in the absence of sunlight satisfy the recommended 30-hour guidance limit for all houses except for one property, located 1.3 km from the proposed turbine 13. The property is an abandoned house which is currently used for livestock, the front and back of the house do not face the turbines and there is a row of trees/vegetation on the eastern side of the house. The assessment identified no significant effects, given that shadow flicker is unlikely to cause a nuisance to nearby inhabited dwellings which are greater

Interaction	Description
	than ten rotor diameters from the turbines. It also notes that the function to stop the turbine if required to do so, is available. The potential effects of the Development from shadow flicker are considered to be **Not Significant**. 3. Operating windfarms have the potential to cause a variety of adverse effects on aviation. Rotating wind turbine blades may have an impact on certain aviation operations, particularly those involving radar. The physical height of turbines can cause obstruction to aviation and the overall performance of communications, navigation and surveillance equipment. All structures over 150m in height are required to have lighting to warn aviation traffic. No significant impacts are predicted in terms of human beings and air navigation. In adherence to IAA Safety Regulations and ICAO Annex 15, aeronautical obstacle warning light schemes will be installed as requested by IAA, co-ordinates of ground and tip height elevations at each wind turbine location as constructed delivered, and the identification of the provision of the intention to commence crane operations provided within a minimum of 30 days prior to erection. 4. During operation, wind turbines have the potential to interfere with electromagnetic signals passing above the ground due to the nature and size of the windfarm. During the initial decommissioning and construction phase activity, signals may be passed below ground via existing infrastructure. Impacts may include overground or underground communication cables, microwave links, telecommunication links, business radio and television reception. Embedded measures were undertaken in the design phase and Turbine 6 was relocated to a distance accepted by telecommunications operator '*Three*'. Link buffers have been maintained (as per the Operational Barnesmore Windfarm). As a precautionary measure, Turbine 5 was moved further north-east during the design process to avoid potential conflict in any case. In the operational phase, all electrical components, equipment, apparatus and systems will be required by Irish and European law to comply with the EMC Directive 2014/30/EU. Compliance with this Directive will mean that the electromagnetic emissions from these devices will not cause interference to other equipment. Turbine and substation control electronics will be typical of any circuits used by industry or a conventional generating station. There is no potential for interference with the links from other windfarms in combination with the Development. Based on the remote location of the Development and a distance of 1.8 km to the nearest residential dwelling, no effects are predicted on telecommunications or radio reception as a result of the Development. 5. The Development will provide opportunities for local suppliers to be engaged in the initial decommissioning and construction phase. This will be a minor beneficial impact. SPR will seek to secure positive benefits for the local/regional economy by encouraging the use of local labour, manufacture and suppliers where possible. SPR will hold 'Meet the Developer' days prior to construction to allow local contractors to engage with the process and maximise opportunities. 6. Damaging a cultural asset could affect tourism; this has been considered in **Chapter 13: Cultural Heritage** and outlined not to be an issue.

Interaction	Description
Population and Human Health & Traffic and Transport	The initial decommissioning and construction phase will give rise to traffic movements of abnormal loads and is likely to create some short-term inconvenience for road users. A Traffic Management Plan (TMP) will be in place and minimise disruption insofar as possible. Suitable mitigation measures to reduce dust emissions have been outlined in **Chapter 14: Traffic and Transportation**, Section 14.6.
Biodiversity & Ornithology	All interactions for any habitat or species including those associated with Special Protection Areas (SPA) or Special Areas of Conservation (SAC) are considered in the Natura Impact Statement and not considered further here.
Biodiversity & Hydrology and Hydrogeology	Contamination of surface water and groundwater could occur from many elements including wastewater sanitation contamination, hydrocarbon contamination, watercourse crossings construction, entrainment of suspended solids during earth works, increased entrainment of contaminants and other impacts arising due to localised stability issues, amongst other potential sources. Contamination of water quality could impact both flora and fauna including fisheries, otter, lizards and amphibians (loss of breeding ponds) amongst others. Lagoon-type sediment traps and plant filtration beds will be installed in watercourses to protect the freshwater pearl mussel. These interactions have been considered as part of the EIAR, with suitable mitigation measures provided to minimise potential impacts.
Biodiversity & Soils and Geology	Potential impacts on biodiversity during the initial decommissioning and construction phase could include disturbance to birds and mammals from loss / changes in habitat. Loss of Annex I peatland habitat will be mitigated where possible. Restoration will be undertaken in line with the Draft Habitat Management Plan.
Ornithology & Noise	The ornithology assessment considers general disturbance to sensitive bird species, including that caused by the sources likely to occur during the construction and decommissioning of the Development.
Soils and Geology & Hydrology and Hydrogeology and Landscape and Visual	The hydrogeological balance of the Site could be impacted by the amount of earth materials excavated. Adopting good practices, planning ahead and real time monitoring in more sensitive (>1m peat depth) areas will ensure that any excavations associated with the Development will have minimal impact. These interactions have been considered as part of the EIAR, with suitable mitigation measures provided to minimise potential impacts. Application of the mitigation measures will reduce the risk of stability issues and impacts on hydrology and hydrogeology arising at a localised scale.
Soils and Geology & Landscape and Visual	The unavoidable residual impacts on the soils and geology environment as a function of the Development is that there will be a change in ground conditions at the Site with the replacement of natural materials such as peat, subsoil and bedrock by concrete, subgrade and surfacing materials. Stability issues and slope failure arising from vehicular movement could cause significant local or at worst-case scenario landslide issues. Where suitable mitigation measures are applied and proper precautions and planning are executed effectively, the risk of such potential impacts can be significantly reduced or are considered avoidable. No new impacts are anticipated during the operational phase of the Development.
Soils and Geology, Landscape and Visual & Archaeology and Cultural Heritage	The initial decommissioning and construction phase pertaining to the Development will involve significant ground reduction and topsoil removal throughout the design layout footprint. Proposed areas for turbines one and two are located within the environs of recorded crannog sites and T4, T10, T11, T12 and T13 are located within largely undisturbed, bog-covered ground surface areas. There is a possibility of encountering

Interaction	Description
	archaeological finds/features throughout these areas, during the initial decommissioning and construction phase and increasing the area of disturbed soil. These interactions were considered in the EIAR, both in the design of turbine layout and in the design of mitigation measures. Monitoring, including a watching brief in undisturbed portions of the footprint will be carried out. All records will be preserved where found. The operational phase is considered to have no likely or significant direct effects on the cultural heritage resource.
Hydrology & Material Assets	Fisheries may be impacted by a disturbance or contamination of watercourses. Mitigation measures to protect watercourses are outlined in several chapters and include monitoring of Site water run-off during all phases of the Development.
Noise & Traffic and Transport	Traffic and Transport will create noise onsite and along the access road to the Site. Site contractors will be required to employ the best practicable means of reducing noise emissions from plant, machinery and activities, as advocated in BS 5228.
Landscape and Visual & Material Assets	The Irish Aviation Authority (IAA) has outlined criteria regarding tall structures and the installation of an aeronautical obstacle warning light scheme for the Development. This has been addressed in Chapter 12: Material Assets and Other Issues and is not considered further here.
Traffic and Transport & Material Assets: Fisheries	During the initial decommissioning and construction phase, increased traffic could lead to increased sedimentation/pollution of watercourses. The interactions between these aspects were considered in the EIAR and mitigation has been embedded in the design and recommended for the implementation of the Development. This assessment has identified no potentially significant residual effects on Fisheries from Traffic & Transport, from the Development.