5. POPULATION AND HUMAN HEALTH

5.1 Introduction

This section of the Environmental Impact Assessment Report (EIAR) identifies, describes and assesses the potential effects of the Proposed Development on population and human health and has been completed in accordance with the EIA guidance and legislation set out in Chapter 1: Introduction. The full description of the Proposed Development is provided in Chapter 4 of this EIAR.

This chapter references the Wind Farm Site (15 no. turbines, access roads, onsite substation, borrow pit, temporary construction compound, forestry felling and all associated works), the Grid Connection Route (26km long underground grid connection route running from the Wind Farm Site to Mullingar substation where upgrade works are proposed) and the Study Area for the Population section of this EIAR which is defined in terms of the District Electoral Divisions (DEDs) where the Wind Farm Site is located.

Where the Proposed Development is referenced this includes all elements of the project (15 no. turbines, access roads, onsite substation, borrow pit, temporary construction compound, forestry felling and all associated works, 26km long underground grid connection route running from the Wind Farm Site to Mullingar substation where upgrade works are proposed). Other elements of the Proposed Development are referenced accordingly (i.e. replacement planting lands).

One of the principal concerns in the development process is that human beings, as individuals or communities, should experience no significant diminution in their quality of life from the direct, indirect or cumulative effects arising from the construction, operation and decommissioning of a development. Ultimately, all the impacts of a development impinge on human beings, directly and indirectly, positively and negatively. The key issues examined in this chapter of the EIAR include population, human health, employment and economic activity, land-use, residential amenity, community facilities and services, tourism, property values, shadow flicker, noise, and health and safety.

There are 18 no. occupied dwellings located within one kilometre of the proposed turbine locations. The closest occupied dwelling H14 (i.e. dwelling not involved with the Proposed Development) is located at a distance of approx. 700 metres from the nearest proposed turbine T11. There are two dwellings, H18 & H24 which are located at distances of 638m and 679m from T15 respectively however these are individuals involved with the Proposed Development.

5.1.1 Statement of Authority

This section of the EIAR has been prepared by Stephen Corrigan and Ellen Costello and reviewed by Eoin O'Sullivan and Michael Watson, of MKO. Stephen Corrigan is an experienced Environmental Scientist with 4 years of experience in private and public sector positions. Stephen holds a BSc. in Environmental Sciences. Stephen has been involved in a significant range of energy infrastructure projects, private/public development projects, hydrological monitoring projects and ecological monitoring projects. Within MKO Stephen has a role in site construction monitoring, database management and the preparation of EIARs. Ellen is an Environmental Scientist who joined the company in 2019 and has been involved in a number of wind energy EIAR applications. Ellen holds a BSc. in Earth Science and a MSc. in Climate Change: Integrated Environmental and Social Science Aspects where she focused on renewable energy development in Ireland and its implications on environment and society. Eoin is an experienced geo-environmental scientist and has over ten years' experience in the design, implementation and interpretation of all phases of geo-environmental and geotechnical site investigations. Eoin has also got extensive experience in the preparation of population and human health assessments and reports for EIAs. Michael Watson is a Project Director with MKO; with over 19 years' experience in the environmental sector. His project experience includes the management and productions of Environmental Impact Statements (EISs)/EIARs, particularly within the wind energy sector.

5.2 Population

5.2.1 Receiving Environment

This socio-economic study of the receiving environment included an examination of the population and employment characteristics of the area. Information regarding population and general socio-economic data were sourced from the Central Statistics Office (CSO), the Westmeath County Development Plan 2014-2020, Fáilte Ireland. The study included an examination of the population and employment characteristics of the area. This information was sourced from the Census of Ireland 2016, which is the most recent census for which a complete dataset is available, also the Census of Ireland 2011, the Census of Agriculture 2010 and from the CSO website (www.cso.ie). Census information is divided into State, Provincial, County, Major Town and District Electoral Division (DED) level.

The EIAR study boundary measures approximately 530 hectares and is located in north Co. Westmeath, approximately 2.4 kilometres north of Coole village. The town of Castlepollard is located approximately 5.9 kilometres southeast of the site, at its nearest point. The Grid Reference co-ordinates for the approximate centre of the site are E641172, N776072. The site is accessed via the R396 Regional Road, which travels in a southeast-northwest direction between Coole and Granard. From the R396, the L5755 local road traverses the site, linking to the R394 Regional Road, east of the Proposed Development site. The land-use on the Wind Farm Site is commercial peat harvesting works, forestry, and low-intensity pastoral agriculture. Please refer to Figure 1-1 of Chapter 1: Introduction, for the site location.

In order to assess the population in the vicinity of the Wind Farm Site, the Study Area for the Population section of this EIAR was defined in terms of the District Electoral Divisions (DEDs) where the Wind Farm Site is located, and where relevant, nearby DEDs which may be affected by the Wind Farm Site. The Wind Farm Site lies within three DEDs: Knockarrow, Glore and Coole of Co. Westmeath and borders Boherquil and Firry/Newgrove of Co. Longford, as shown in Figure 5-1. All five of these DEDs will collectively be referred to hereafter as the Study Area for this chapter.

The Study Area has a population of 878 persons, as of 2016 and comprises a total land area of 83.29 km^2 (Source: CSO Census of the Population 2016).

In order to assess the population along the Grid Connection Route, a review of properties and planning applications in the vicinity of the Grid Connection Route was carried out. Construction of the Grid Connection Route will be undertaken by two crews, one crew will start at one end of the Grid Connection Route with the other team starting approximately half way along the Grid Connection Route. Both teams will be constructing in the same direction maintaining a distance between the teams of approx. 13km. The active construction area for the Grid Connection Route will be small, ranging from 150 to 300 metres in length at any one time by each crew, and it will be transient in nature as it moves along the route. The findings of the population review indicated that where development occurs along the Grid Connection Route, the lands nearby comprise residential dwellings, farm dwellings and associated farm buildings. The land-use along the Grid Connection Route comprises public road, with a short section of underground cabling (approximately 660m) across commercial forestry at the northernmost end. Land-use in the wider landscape comprises a mix of agriculture, low density housing, and commercial forestry.

There are relatively minor works proposed at eleven junctions on the proposed turbine delivery and haul route. The works comprise : hardsurfacing at the N4 in the vicinity of its junction with the L1927 Local road in the townland of Joanstown; Temporary removal of the existing hedgerow and hardsurfacing before the railway line level crossing on the L1927; hardsurfacing and widening of the L1927 and L5828 junction in the townland of Boherquill; clearing of existing verge and vegetation and hardsurfacing at the gentle right turn from the L5828 onto the R395; hardsurfacing including clearance of vegetation and road verge to provide access and egress at proposed link road; hardsurfacing including clearance of vegetation and road verge at site access points off the R396, and at four points along the L5755. These junctions are not located within any main settlement, although there are some houses and a church near or adjacent to the proposed works locations. The land-use surrounding these junction works areas comprises mainly agriculture with some areas of peat harvesting, forestry and low-density housing. The works required at both junctions are minor, comprising hardsurfacing and/or widening.

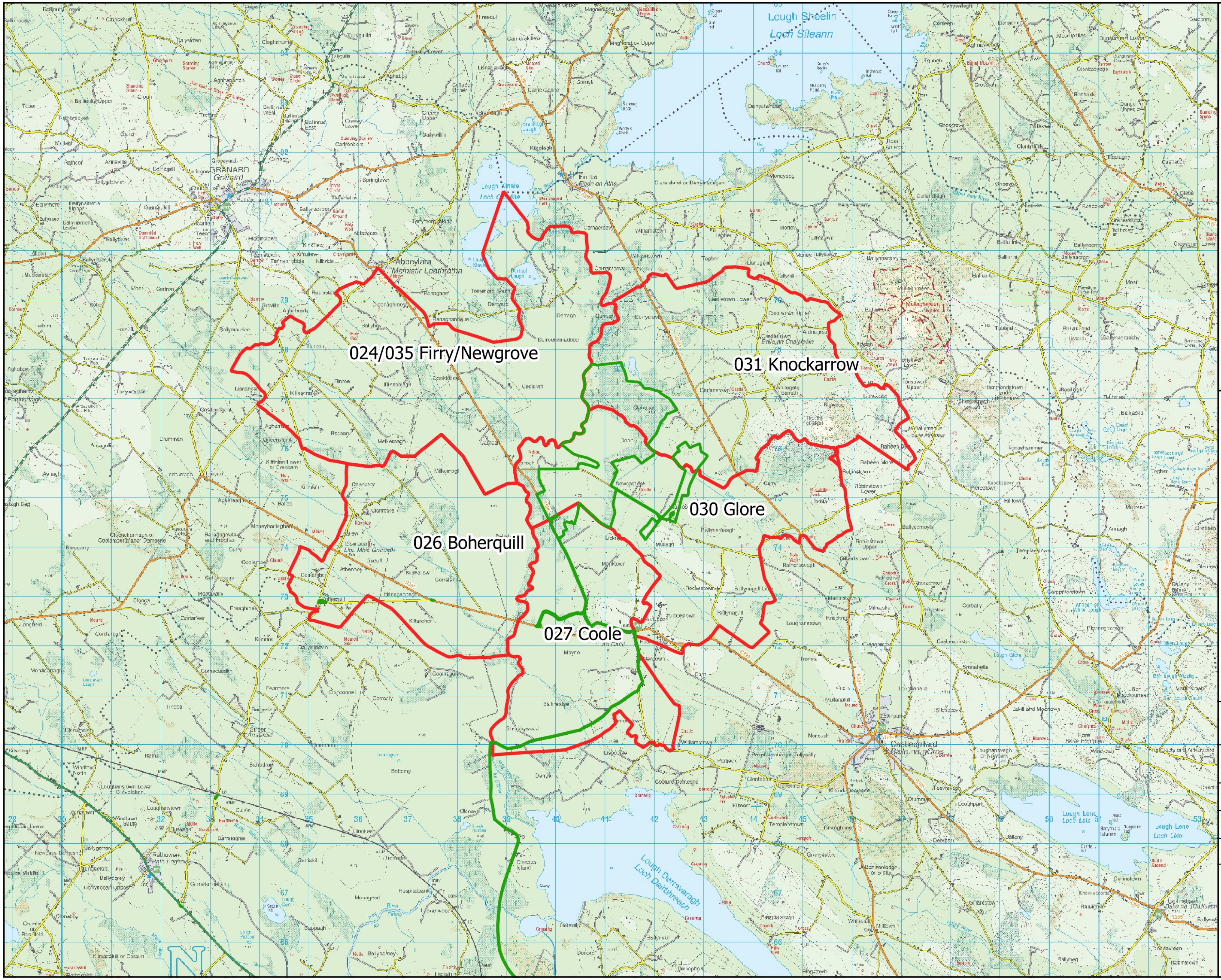
5.2.2 Population Trends

In the period between the 2011 and the 2016 Census, the population of Ireland increased by 3.8%. During this time, the population of County Westmeath grew by 3.0% to 88,770 persons and the population of County Longford grew by 4.8% to 40,873 persons. Other population statistics for the State, County Westmeath, County Longford and the Study Area have been obtained from the Central Statistics Office (CSO) and are presented in Table 5-1.

Table 5-1 Population 2011 – 2016 (Source: CSO)

Area	Population Change		% Population Change
	2011	2016	2011 - 2016
State	4,588,252	4,761,865	3.8%
County Westmeath	86,164	88,770	3.0%
County Longford	39,000	40,873	4.8%
Study Area	931	878	-5.7%

The data presented in Table 5-1 shows that the population of the Study Area decreased by 5.7% between 2011 and 2016. When the population data is examined in closer detail, it shows that the rate of population decrease within the Study Area is unevenly spread through the DEDs. Firry/Newgrove DED experienced the largest decrease in population, experiencing a 9.7% decrease in population while the four other DEDs experienced lesser declines in population. Boherquill (DED) experienced a population decline of 1.9%, Coole (DED) experienced a population decline of 5.5%, Glore (DED) experienced a population decline of 5.7% and Knockarrow (DED) experienced a population decline of 3.5%. Of the DEDs that make up the Study Area for this assessment, the highest population was recorded in Coole DED, with 239 persons recorded during the 2016 Census, while the population for Boherquill was 152, Firry/Newgrove was 196, Glore was 182 and Knockarrow was 109.



Map Legend

- EIAR Site Boundary
- Study Area DEDs

Drawing Title	Population Study Area
Project Title	Coole Wind Farm, Co. Westmeath
Drawn By: EC	Checked By: MW
Project No.: 200445	Drawing No.: Figure 5-1
Scale: 1:100000	Date: 12.02.2021

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5.2.3 Population Density

The population densities recorded within the State, County Westmeath, County Longford and the Study Area during the 2011 and 2016 Census are shown in Table 5-2.

Table 5-2 Population Density in 2011 and 2016 (Source: CSO)

Area	Population Density (Persons per square kilometre)	
	2011	2016
State	67.0	69.6
County Westmeath	47.0	48.5
County Longford	35.9	37.6
Study Area	11.9	10.50

The population density of the Study Area recorded during the 2016 Census was 10.50 persons per km^2. This figure is significantly lower than the national population density of 69.6 persons per km^2, the County Westmeath population density of 48.5 persons per km^2 and the County Longford population density of 37.6 persons per km^2. These findings indicate that the study area has a low population density.

Similar to the trends observed in population, the population density recorded across the Study Area varies between DEDs. Knockarrow DED has the lowest population density, at 6.04 persons per km^2, while Coole DED has the highest density at 19.62 persons per km^2, Boherquill DED has a population density of 10.63 persons per km^2 , Firry/Newgrove DED has a population density of 8.68 persons per km^2 and Glore DED has a population density of 11.02 persons per km^2.

5.2.4 Household Statistics

The number of households and average household size recorded within the State, County Westmeath, County Longford and the Study Area during the 2011 and 2016 Censuses are shown in Table 5-3.

Table 5-3 Number of Household and Average Household Size 2011 – 2016 (Source: CSO)

Area	2011		2016	
	No. of Households	Avg. Size (persons)	No. of Households	Avg. Size (persons)
State	1,654,208	2.8	1,697,665	2.8
County Westmeath	31,738	2.7	31,813	2.7
County Longford	14,748	2.6	15,767	2.6
Study Area	355	2.6	348	2.5

In general, the figures in Table 5-3 show that the number of households within the Study Area have slightly decreased, along with the average number of people per household, i.e. there are less people per house. While the number of households within the State and County have continued to increase, the average number of people per household has remained the same.

5.2.5 Age Structure

Table 5-4 presents the population percentages of the State, County Westmeath, County Longford and Study Area within different age groups as defined by the Central Statistics Office during the 2016 Census. This data is also displayed in Figure 5-2.

Table 5-4 Population per Age Category in 2016 (Source: CSO)

Area	Age Category				
	0 - 14	15 – 24	25 - 44	45 - 64	65 +
State	21.1%	12.1%	29.5%	23.8%	13.4%
County Westmeath	22.3%	12.4%	28.3%	24.2%	12.8%
County Longford	23.3%	11.1%	27.2%	24.2%	14.2%
Study Area	22.6%	11.3%	20.5%	29.3%	16.4%

The proportion of the Study Area population is broadly similar to those recorded at national and county level for most categories. For the Study Area, the highest population percentage occurs within the 45-64 age category.

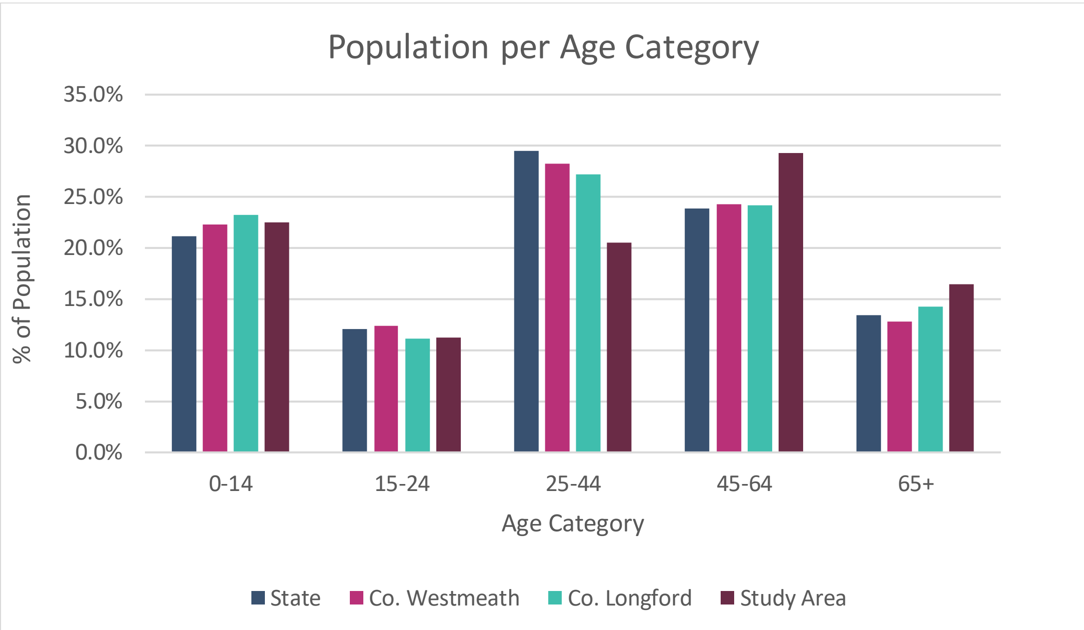


Figure 5-2 Population Age Category in 2016 (Source: CSO)

5.2.6 Employment and Economic Activity

5.2.6.1 Economic Status of the Study Area

The labour force consists of those who are able to work, i.e. those who are aged 15+, out of full-time education and not performing duties that prevent them from working. In 2016, there were 2,304,037 persons in the labour force in the State. Table 5-5 shows the percentage of the total population aged 15+ who were in the labour force during the 2016 Census. This figure is further broken down into the percentages that were at work or unemployed. It also shows the percentage of the total population aged 15+ who were not in the labour force, i.e. those who were students, retired, unable to work or performing home duties.

Table 5-5 Economic Status of the Total Population Aged 15+ in 2016 (Source: CSO)

Status		State	County Westmeath	County Longford	Study Area
% of population aged 15+ who are in the labour force		**61.4%**	**60.8%**	**60.2%**	**55.1%**
% of which are:	At work	87.1%	84.1%	80.4%	86.7%
	First time job seeker	1.4%	1.7%	2.0%	1.1%
	Unemployed	11.5%	14.2%	17.6%	12.3%
% of population aged 15+ who are not in the labour force		**38.6%**	**39.2%**	**39.8%**	**44.9%**
% of which are:	Student	29.4%	29.0%	24.5%	24.6%
	Home duties	21.1%	22.5%	23.0%	24.3%
	Retired	37.6%	35.5%	38.3%	35.7%
	Unable to work	10.9%	11.4%	13.3%	14.8%
	Other	1.0%	1.6%	0.9%	0.7%

Overall, the principal economic status of those living in the Study Area is broadly similar to that recorded at State and County level. During the 2016 Census, the percentage of people over the age of 15 who were in the labour force was similar at both state and county level, but lower within the study area with only 55.1% in the labour force. Of those who were not in the labour force during the 2016 Census, the highest percentage of the Study Area population were 'Retired' individuals, similar to state and county populations.

5.2.6.2 Employment by Socio-Economic Group

Socio-economic grouping divides the population into categories depending on the level of skill or educational attainment required. The 'Higher Professional' category includes scientists, engineers, solicitors, town planners and psychologists. The 'Lower Professional' category includes teachers, lab technicians, nurses, journalists, actors and driving instructors. Skilled occupations are divided into manual skilled such as bricklayers and building contractors; semi-skilled such as roofers and gardeners; and unskilled, which includes construction labourers, refuse collectors and window cleaners. Figure 5-3 shows the percentages of those employed in each socio-economic group in the State, County Westmeath, County Longford and the Study Area during 2016.

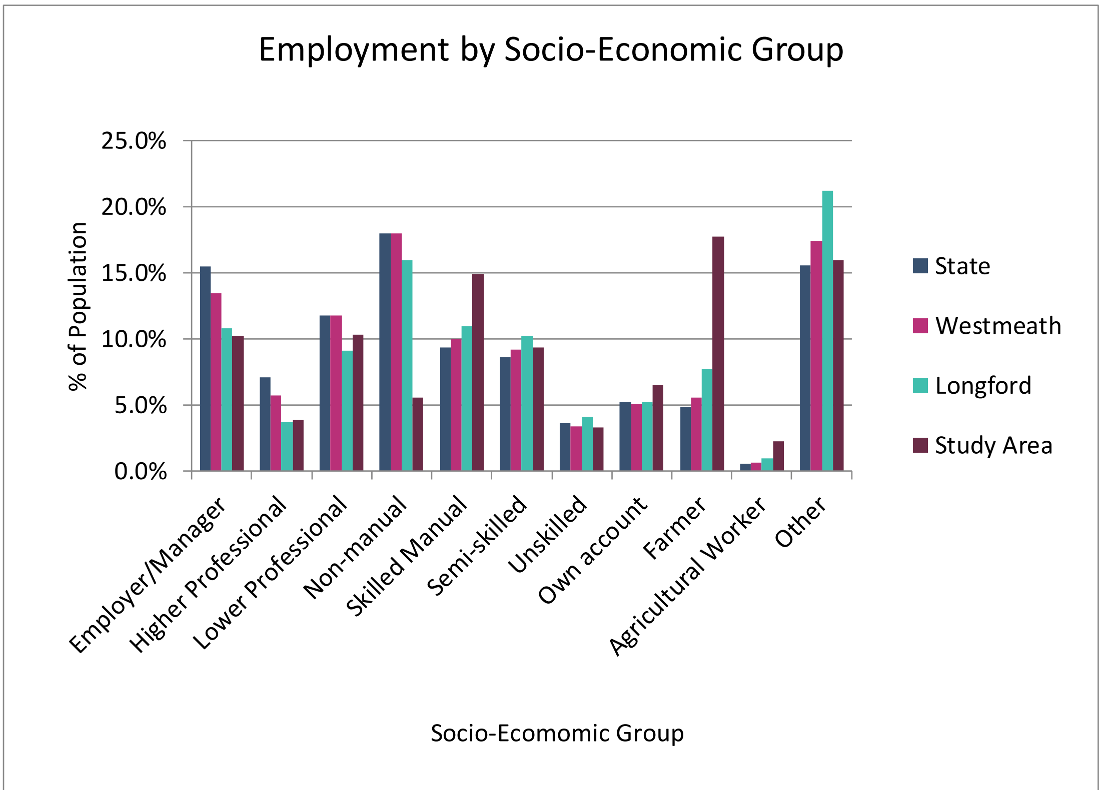


Figure 5-3 Employment by Socio-Economic Group in 2016 (Source: CSO).

The highest level of employment within the Study Area was recorded in the Farmer category. The levels of employment within the Employer/Manager, Non-Manual and Un-skilled categories in the Study Area were lower than those recorded for the State, County Westmeath and County Longford. Levels of employment recorded within the Skilled Manual, Own Account, Farmer and Agricultural Worker categories were higher. The level of employment in the Higher Professional, Lower Professional and category were lower than those recorded for the State and County Westmeath and the broadly similar to those recorded for County Longford. The level of employment in the Semi-skilled category was broadly similar across State, Counties and the Study Area.

The CSO employment figures grouped by socio-economic status includes the entire population for the Study Area, Counties and State in their respective categories. As such, the socio-economic category of 'Other' is skewed to include those who are not in the labour force.

5.2.6.3 Employment and Investment Potential in the Irish Wind Energy Industry

5.2.6.3.1 *Background*

A report entitled '*Jobs and Investment in Irish Wind Energy – Powering Ireland's Economy*' was published in 2009 by Deloitte, in conjunction with the Irish Wind Energy Association (IWEA). This report focused on the ability of the Irish wind energy industry to create investment and jobs. In terms of the overall economic benefit to be obtained from wind energy, the report states in its introduction:

> *"Ireland is fortunate to enjoy one of the best wind resources in the world. Developing this resource will reduce and stabilise energy prices in Ireland and boost our long-term competitiveness as an economy. It will also significantly reduce our dependence on imported fossil fuels."*

More recently, a report published in 2014 by Siemens entitled '*An Enterprising Wind - An economic analysis of the job creation potential of the wind sector in Ireland*', also in conjunction with the Irish Wind Energy Association (IWEA), concluded that, *'a major programme of investment in wind could have a sizeable positive effect on the labour market, resulting in substantial growth in employment.'* The results of the research indicate that the majority of jobs created as a result of wind energy development in Ireland are likely to be in the industry category, followed by grid jobs and finally potential manufacturing jobs. The creation of jobs would be as a result of a major programme of investment in wind energy.

5.2.6.3.2 *Energy Targets*

The Climate Action Plan 2019 (CAP) was published on the 1st August 2019 by the Department of Communications, Climate Action and Environment. The CAP sets out an ambitious course of action over the coming years to address the impacts which climate may have on Irelands environment, society, economic and natural resources. The CAP includes a commitment that 70% of Ireland's electricity needs will come from renewable sources by 2030 with 8.2GW of onshore wind required to achieve this target which is almost double the 4.2GW of onshore wind currently achieved. It is envisaged that wind energy will provide the largest source of renewable energy in achieving this target.

5.2.6.3.3 *Employment Potential*

The Deloitte report (2009) estimated at the time of its publication that the Island of Ireland's installed wind energy capacity would need to reach 7,800 Megawatts (MW) by 2020, in order to meet the Government's renewable energy targets. Based on these estimates, the Deloitte report stated that the Irish wind energy sector to 2020 would be capable of supporting more than 10,760 jobs through direct and indirect involvement in the sector. This number includes construction, operation and maintenance of all wind farms and assumes a steady growth in the industry over the period to 2020. It also encompasses planning and financing of wind farms, and support services such as administration, payroll and marketing/communications. There are also further employment opportunities available in other areas of the wind energy sector relating to policy, Research and Development, support services and other, which total to 935 jobs across Ireland.

Of the 10,760 jobs estimated to be created through the development of the wind energy sector, the Deloitte report states the majority of these would be provided within the construction industry:

> *"The wind sector offers great opportunities to a sector such as construction, which is currently facing downturn and rising unemployment. It is estimated that approximately 7,258 jobs will be supported by the construction element of wind farms."*

The Deloitte study on employment and investment potential assumed that there would be a steady growth in the amount of wind power rolled out between 2009 and 2020. The report states:

> *"It is crucial that the industry expands at a sustainable rate. If Ireland's increase in installed capacity is rolled out at a steady growth rate over the next eleven years then Irish companies will have sufficient time to adapt and build up their companies in order to cope with the increasing number of MW being added every year."*

The Sustainable Energy Authority of Ireland[1] estimates, in their '*Wind Energy Roadmap 2011-2050*', that onshore and offshore wind could create 20,000 direct installation and operation/maintenance jobs by 2040 and that the wind industry would also have an annual investment potential of €6-12 million by the same year.

The 2014 report '*The Value of Wind Energy to Ireland*', published by Pőyry, stated that growth of the wind sector in Ireland could support 23,850 jobs (construction and operational phases) by 2030. If Ireland instead chooses to not develop any more wind, then by 2030 the country will be reliant on natural gas for most of our electricity generation, at a cost of €671 million per annum in fuel import costs.

As of January 2021, there were 5,510 Megawatts (MW) of wind energy capacity installed on the island of Ireland[2]. Of this, 4,235 MW was installed in the Republic of Ireland, with 1,276MW installed in Northern Ireland. The majority of the Republic of Ireland's installed wind energy capacity is located in Counties Donegal, Galway, Cork and Kerry, contributing to employment potential on the Island of Ireland.

5.2.7 Land-Use

As previously noted in Section 5.1, the Proposed Development is used for commercial peat harvesting works, forestry, low-intensity pastoral agriculture and public roads. Land-use in the wider landscape comprises a mix of agriculture, low density housing, and commercial forestry.

The total area of farmland within the five DEDs around the Wind Farm Site measures approximately 4,072 hectares, comprising approximately 48.9% of the Study Area, according to the CSO Census of Agriculture 2010. There are 119 farms located within the five DEDs, with an average farm size of 34.2 hectares. This is smaller than the 37.1 hectare average farm size for Co. Westmeath but larger than the 28 hectare average for Co. Longford.

Within the Study Area, farming employs 218 people, and the majority of farms are family-owned and run. Table 5-6 shows the breakdown of farmed lands within the Study Area. Pasture accounts for the largest proportion of farmland, which is followed by silage, hay and grazing. Smaller amount of farmland are given over to the production of crops followed by cereals with no farmland used by potato production.

Table 5-6 Farm Size and Classification within the Study Area in 2010 (Source: CSO)

Characteristic	Value
Size of Study Area	8,369 hectares
Total Area Farmed within Study Area	4,072 hectares
Farmland as % of Study Area	48.9%
Breakdown of Farmed Land	**Area (hectares)**
Total Pasture	2,433 ha
Total Silage	1,128 ha
Total Hay	298 ha

[1] *SEAI (2019), https://www.seai.ie/publications/Wind_Energy_Roadmap_2011-2050.pdf*
[2] *IWEA – Facts and Stats, https://www.iwea.com/about-wind/facts-stats*

Total Grazing	219 ha
Total Crops	23 ha
Total Cereals	7 ha
Total Potatoes	0 ha

5.2.7.1 Equine Industry

The Westmeath County Development Plan 2014 – 2020 acknowledges that the equine industry is important economically and culturally in Westmeath (Section 3.38 of the Plan on Equine Industry). There are no equestrian facilities on the lands associated with the Proposed Development and there are no equestrian centres or public horse trails within 1 kilometre of a proposed turbine.

There have been no known studies carried out in Ireland on the impacts of wind farms on the equine industry. In 2008, on granting of permission for the Kill Hill Wind Farm in South Tipperary (PL. PL23.221656) the Inspector noted there was not sufficient evidence to demonstrate that the proposal would have a significant negative impact on the equine industry.

In 2014 Marshall Day Acoustics published a document entitled 'Summary of research of noise effects on Animals'. The Marshall Day study specifically assessed the impacts of varying levels of noise on horses in three differing behavioural settings. The three behavioural settings studied included horses in stables, breeding mares and racing horses.

Horses in Stables

The study by Marshall Day Acoustics found that horses, stabled at the Flemington Racecourse Australia at the same time as a music concert on the site, when exposed to LAeq,15min of 54-70 dB showed little response to the music noise unless the noise was particularly impulsive.

Breeding Mares

A study by Le Blanc eat al (1991) and summarised by Marshall Day studied the effects of simulated aircraft noise over 100 dB and visual stimuli on pregnant mares. The study focused on pregnancy success, behaviour, cardiac function, hormonal production and rate of habitation. Le Blanc concluded the following:

Le Blanc et al (1991) found that birth success of pregnant mares was not affected by F-14 jet aircraft noise. While the 'fright-flight' reaction was initially observed, the mares did adapt to the noise.

Racehorses

Marshall Day Acoustics concluded the following in relation to their study on the impacts of noise on race horses:

> *Marshall Day Acoustics have observed horses grazing in paddocks directly under the main approach path of the Christchurch International Airport where noise levels are in excess of 90 dB (LAmax) during an aircraft flyover. Although these horses are arguably "used to" the noise, there was generally little recognition by them of an aircraft passing, let alone any sign of disturbance. This tends to support the conclusions by Le Blanc et al (1991).*

5.2.7.1.2 *Guidance*

In the absence of national policy or guidance in relation of the development of wind farms near stud farms/equestrian centres, MKO have reviewed the British Horse Society's Advice on Wind Turbines and Horses – Guidance for Planners and Developers. A copy of the guidance document is included in Appendix 5-1.

The British Horse Society policy statement states the following in relating to the siting of wind turbines in the vicinity of equine businesses:

The BHS strongly recommends that the views and concerns of local equestrians should be recognised and taken into account when determining separation distances and that normally a minimum separation distance of 200m or three times blade tip height (whichever is greater) will be required between a turbine and any route used by horses or a business with horses.

As mentioned previously, there is no stud farm/equestrian facility within 1 kilometre from the nearest proposed turbine location and is therefore exceeds the BHS recommended separation distance as noted above.

5.2.8 Services

The Wind Farm Site is located in north Co. Westmeath, approximately 2.4 kilometres north of Coole village. The town of Castlepollard is located approximately 6.7 kilometres southeast of the site, at its nearest point. Access to the site is via regional and local roads. The site is accessed via the R396 Regional Road, which travels in a southeast-northwest direction between Coole and Granard. From the R396, the L5755 local road traverses the site, linking to the R394 Regional Road, east of the proposed development site. The main services for the Study Area are located within Coole which is classified as a village and Castlepollard, which is also classified as a village. The town of Mullingar is located approximately 1 kilometre south of the southern end of the Grid Connection Route at the existing Mullingar substation. The Grid Connection Route also passes through the villages of Coole and Multyfarnham.

5.2.8.1 Education

The primary schools located closest to the Wind Farm Site are in Coole and Castletown, located approximately 4.1 kilometres south and 3.5 kilometres northeast of the Wind Farm Site respectively. The primary schools located closest to the Grid Connection Route are at Coole village and Mullingar town, located approximately 150 metres north and 1.3km southwest (at the closest point) of the Grid Connection Route respectively. The secondary school located closest to the Wind Farm Site is Castlepollard Community College, which lies approximately 8 kilometres southeast of the Wind Farm Site. The secondary school located closest to the Grid Connection Route is St. Finians College, Mullingar, which lies approximately 0.9 kilometres east of the Grid Connection Route at its closest point.

The third-level institution of Athlone Institute of Technology is located approximately 50 kilometres to the southwest of the Wind Farm Site.

5.2.8.2 Access and Public Transport

The Wind Farm Site is accessed via the R394, R395 and R396 Regional Roads and via local roads off each of these. The R394 and R396 travel generally in northwest-southeast direction, east and west of the site respectively, while the R395 runs in an east-west direction south of the site.

There are Bus Eireann connections from Coole to Castlepollard, Granard, Cavan and Dublin, from which most destinations may be reached. The nearest train station to the Wind Farm Site is in Edgeworthstown, located approximately 14 kilometres southwest of the Wind Farm Site.

The nearest train station to the Grid Connection Route is in Mullingar, located approximately 2.4 kilometres south-west of the most southern section of the Grid Connection Route.

The Grid Connection Route crosses an existing railway line approximately 3.4 kilometres north of Mullingar train station in the townland of Farranistick, Co. Westmeath. Detailed design and construction methodology approval will be obtained from Irish Rail, Córas Iompair Éireann (CIÉ) and the local authority at the road opening licence stage, prior to any work being carried out in the vicinity of the railway line, and works will endeavour to avoid any impacts to the operation of the railway during either the construction or operational phases.

5.2.8.3 Amenities and Community Facilities

Most of the amenities and community facilities, including GAA and other sports clubs, youth clubs and recreational areas, available in the area are in Castlepollard and the nearby settlements of Edgeworthstown and Granard. The church located closest to the Wind Farm Site is in Coole. There are a wide range of services available in the area. Retail and personal services are centered in Castlepollard, and there are other shops and businesses located in Coole, Edgeworthstown and Granard. Westmeath County Council has a branch library at Castlepollard.

A large number of local available amenities and community facilities, including numerous GAA clubs, other sports clubs and recreational areas, churches and a library are located in Mullingar town which is the nearest town to the Grid Connection Route at its most southern point. Midland Regional Hospital is also located in Mullingar town.

The varied environment of this area of Co. Westmeath provides many opportunities for walking and cycling. The Mullaghmeen Multi-Access Trail walking route is a relatively short looped trail found in this part of the county. At its closest point, the route passes within 7 kilometres northeast of the Wind Farm Site. The Mullingar Cycle Hub (loop 1) passes within approximately 14 kilometres to the south of the site.

Community Benefit proposals, which would enhance local amenities and community facilities are described in Chapter 4: Description of the Proposed Development.

5.3 Tourism

5.3.1 Tourism Numbers and Revenue

Tourism is one of the major contributors to the national economy and is a significant source of full time and seasonal employment. During 2018, total tourism revenue generated in Ireland was approximately €9.4 billion, an increase on the €8.8 billion revenue recorded in 2017. Overseas tourist visits to Ireland in 2018 grew by 6.5% to 9.6 million ('*Tourism Facts 2018*, Fáilte Ireland, September 2019).

Ireland is divided into seven tourism regions. Table 5-7 shows the total revenue and breakdown of overseas tourist numbers to each region in Ireland during 2018 ('*Tourism Facts 2018*, Fáilte Ireland, September 2019).

Table 5-7 Overseas Tourists Revenue and Numbers 2018 (Source: Fáilte Ireland)

Region	Total Revenue (€m)	Total Number of Overseas Tourists (000s)
Dublin	€2,095m	6,309
Mid-East/Midlands	**€ 393m**	**1,030**
South-East	€261m	1,028
South-West	€987m	2,512
Mid-West	€511 m	1,497
West	€727m	1,963
Border	€244m	752
Total	**€5,218 m**	**15,091**

The Proposed Development is located within the Mid-East/Midlands region. According to '*Regional tourism performance in 2018'* (Fáilte Ireland, September 2019) the Mid-East/Midlands Region which comprises Counties Kildare, Louth, Laois, Longford, Meath, Offaly, Westmeath and Wicklow, benefited from approximately 6.83% of the total number of overseas tourists to the country and approximately 7.53% of the associated tourism income generated in Ireland in 2018.

Although the data for 2018 is not available, Table 5-8 presents the breakdown of overseas tourist numbers and revenue to the Midlands region during 2017 ('*2017 Topline Tourism Performance by Region,* Fáilte Ireland, August 2018). As can be observed in Table 5-8, County Westmeath had the highest number of overseas tourists visiting the Region during 2017 and had tourism revenue at €46 million.

Table 5-8 Overseas Tourism to Mid-West Region during 2017 (Source: Fáilte Ireland)

Region	Total Revenue (€m)	Total Number of Overseas Tourists (000s)
Westmeath	46	103
Offaly	16	52
Laois	14	43
Longford	10	24

5.3.2 Tourist Attractions

There are no key identified tourist attractions pertaining specifically to the site of the Proposed Development itself.

Key tourist attractions within County Westmeath and Longford include Tullynally Castle and Gardens and Fore Abbey. With Co. Westmeath, Co. Offaly and the surrounding counties many additional tourist attractions are found in Ballyjamesduff, Edgeworthstown, Granard, Fore, Finnea, Longford and Mullingar all of which lie within 20 kilometres of the Proposed Development. Within 20km of the site the following tourist attractions can also be found:

- Lough Kinale & Derragh Lough which is located 2km to the north-west, Lough Sheelin which is located 3.9km to the north and Lough Derravaragh which is located 5.5km north of the Proposed Development are all fishing destinations and protected areas
- Mullaghmeen forest, which is located 4.6km north-east of the Proposed Development.
- Tullynally Castle and Gardens is located 5.2km southeast of the Proposed Development.
- Granard Motte and Bailey located 8km west of the Proposed Development.
- Lough Sheever is located 9.9km to the south-east and Lough Owel which is located 13.67km south of the Proposed Development are fishing destinations.
- Fore Abbey is located 11km east of the Proposed Development.
- The Maria Edgeworth Centre is located 13.3km west of the Proposed Development.
- Loughcrew Cairns is located 15.4km east of the Proposed Development.
- Cavan County Museum 16km north-east of the Proposed Development. As the County Hub, Mullingar has many outdoor recreational and tourist amenities within its vicinity, including: Golf Courses; Hotels; Walking Trails and Parkland, and is located south of the Proposed Development.

5.3.3 Tourist Attitudes to Wind Farms

5.3.3.1 Scottish Tourism Survey 2016

BiGGAR Economics undertook an independent study in 2016, entitled '*Wind Farms and Tourism Trends in Scotland*', to understand the relationship, if any, that exists between the development of onshore wind energy and the sustainable tourism sector in Scotland. In recent years, the onshore wind sector and sustainable tourism sector have grown significantly in Scotland. However, it could be argued that if there was any relationship between the growth of onshore wind energy and tourism, it would be at a more local level. This study therefore considered the evidence at a local authority level and in the immediate vicinity of constructed wind farms.

Eight local authorities had seen a faster increase in wind energy deployment than the Scottish average. Of these, five also saw a larger increase in sustainable tourism employment than the Scottish average, while only three saw less growth than the Scottish average. The analysis presented in this report shows that, at the Local Authority level, the development of onshore wind energy does not have a detrimental impact on the tourism sector. It was found that in the majority of cases (66%) sustainable tourism employment performed better in areas surrounding wind farms than in the wider local authority area. There was no pattern emerging that would suggest that onshore wind farm development has had a detrimental impact on the tourism sector, even at the very local level.

Overall, the conclusion of this study is that published national statistics on employment in sustainable tourism, demonstrate that there is no relationship between the development of onshore wind farms and tourism employment at the level of the Scottish economy, at local authority level, nor in the areas immediately surrounding wind farm development. However the report also concluded that *'Although this study does not suggest that there is any direct relationship between tourism sector growth and wind farm development, it does show that wind farms do not cause a decrease in tourism employment either at a local or a national level.'*

5.3.3.2 Fáilte Ireland Surveys 2007 and 2012

In 2007, Fáilte Ireland in association with the Northern Ireland Tourist Board carried out a survey of domestic and overseas holidaymakers to Ireland in order to determine their attitudes to wind farms. The purpose of the survey was to assess whether the development of wind farms impacts on the enjoyment of the Irish scenery by holidaymakers. The survey involved face-to-face interviews with 1,300 tourists (25% domestic and 75% overseas). The results of the survey are presented in the Fáilte Ireland Newsletter 2008/No.3 entitled 'Visitor Attitudes on the Environment: Wind Farms'.

The Fáilte Ireland survey results indicate that most visitors are broadly positive towards the idea of building wind farms in Ireland. There exists a sizeable minority (one in seven) however who are negative towards wind farms in any context. In terms of awareness of wind farms, the findings of the survey include the following:

- Almost half of those surveyed had seen at least one wind farm on their holiday to Ireland. Of these, two thirds had seen up to two wind farms during their holiday.
- Typically, wind farms are encountered in the landscape while driving or being driven (74%), while few have experienced a wind farm up close.
- Of the wind farms viewed, most contained less than ten turbines and 15% had less than five turbines.

Regarding the perceived impact of wind farms on sightseeing, the Fáilte Ireland report states:

> *"Despite the fact that almost half of the tourists interviewed had seen at least one wind farm on their holiday, most felt that their presence did not detract from the quality of their sightseeing, with the largest proportion (45%) saying that the presence of the wind farm had a positive impact on their enjoyment of sightseeing, with 15% claiming that they had a negative impact."*

In assessing the perceived impact of wind farms on beauty, visitors were asked to rate the beauty of five different landscapes types: Coastal, Mountain, Farmland, Bogland and Urban Industrial, and then rate on a scale of 1-5 the potential impact of a wind farm being sited in each landscape. The survey found that each potential wind farm must be assessed on its own merits. Overall however, in looking at wind farm developments in different landscape types, the numbers claiming a positive impact on the landscape due to wind farms were greater than those claiming a negative impact, in all cases.

Regarding the perceived impact of wind farms on future visits to the area, the Fáilte Ireland survey states:

> *"Almost three quarters of respondents claim that potentially greater numbers of wind farms would either have no impact on their likelihood to visit or have a strong or fairly strong positive impact on future visits to the island of Ireland. Of those who feel that a potentially greater number of wind farms would positively impact on their likelihood to visit, the key driver is their support for renewable energy and potential decreased carbon emissions."*

The report goes on to state that while there is a generally positive disposition among tourists towards wind development in Ireland, it is important also to take account of the views of the one in seven tourists who are negatively disposed towards wind farms. This requires good planning on the part of the wind farm developer as well as the Local Authority. Good planning has been an integral component of the Proposed Development throughout the site design and assessment processes. Reference has been made to the '*Planning Guidelines on Wind Energy Development 2006*' and cognisance of the '*Draft Revised Wind Energy Development Guidelines December 2019*' in addition to IWEA best practice guidance, throughout all stages, including pre-planning consultation and scoping.

The 2007 survey findings are further upheld by a more recent report carried out by Fáilte Ireland on tourism attitudes to wind farms in 2012. The results of the updated study were published in the 'Fáilte Ireland Newsletter 2012/No.1 entitled 'Visitor Attitudes on the Environment: Wind Farms – Update on 2007 Research'. The updated survey found that of 1,000 domestic and foreign tourists who holidayed in Ireland during 2012, over half of tourists said that they had seen a wind turbine while travelling around the country. Of this number of tourists, 21% claimed wind turbines had a negative impact on the landscape. However, 32% said that it enhanced the surrounding landscape, while 47% said that it made no difference to the landscape. Almost three quarters of respondents claim that potentially greater numbers of wind farms would either have no impact on their likelihood to visit or have a strong or fairly strong positive impact on future visits to the island of Ireland.

Further details regarding the general public perception of wind energy, including those living in the vicinity of a wind farm, are presented in Section 5.4 below.

5.4 Public Perception of Wind Energy

5.4.1 Sustainable Energy Ireland Survey 2003

5.4.1.1 Background

The results of a national survey entitled *'Attitudes Towards the Development of Wind Farms in Ireland'* were published by the Sustainable Energy Authority of Ireland (SEAI) in 2003. A catchment area survey was also carried out by SEAI (formerly SEI) in order to focus specifically on people living with a wind farm in their locality or in areas where wind farms are planned.

5.4.1.2 Findings

The SEAI survey found that the overall attitude to wind farms is very positive, with 84% of respondents rating it positively or very positively. One percent rates it negatively and 14% had no opinion either way. Approximately two thirds of respondents (67%) were found to be positively disposed to having a wind farm in their locality. Where negative attitudes were voiced towards wind farms, the visual impact of the turbines on the landscape was the strongest influence. The report also notes however that the findings obtained within wind farm catchment areas showed that impact on the landscape is not a major concern for those living near an existing wind farm.

With regards to the economic and environmental impacts of wind farm development, the national survey reveals that attitudes towards wind energy are influenced by a perception that wind is an attractive source of energy:

> *"Over 8 in 10 recognise wind as a non-polluting source of energy, while a similar number believe it can make a significant contribution to Ireland's energy requirements."*

The study reveals uncertainty among respondents with regards to the issues of noise levels, local benefits and the reliability or otherwise of wind power as an energy source. It goes on to state however that the finding that people who have seen wind farms rate these economic and environmental factors more favourably is a further indication that some experience of the structures tends to translate into positive attitudes towards wind energy.

Similar to the national survey, the surveys of those living within the vicinity of a wind farm also found that the findings are generally positive towards wind farms. Perceptions of the impact of the development on the locality were generally positive, with some three-quarters of interviewees believing it had impacted positively.

In areas where a wind farm development had been granted planning permission but was not yet under construction, three quarters of the interviewees expressed themselves in favour of the wind farm being built in their area. Four per cent were against the development. The reasons cited by those who expressed themselves in favour of the wind farm included the fact that wind energy is clean (78%), it would provide local jobs (44%), it would help develop the area (32%) and that it would add to the landscape (13%). Those with direct experience of a wind farm in the locality are generally impressed with it as an additional feature in the landscape. The report states:

> *"It is particularly encouraging that those with experience of wind turbines are most favourable to their development and that wind farms are not solely seen as good in theory, but are also seen as beneficial when they are actually built."*

Few of those living in proximity either to an existing wind farm or one for which permission has been granted believe that the development damages the locality, either in terms of damage to tourism potential or to wildlife. The survey found that there is a clear preference for larger turbines in smaller numbers over smaller turbines in larger numbers.

5.4.1.3 Survey Update 2017

Additionally, a survey carried out by Interactions in October 2017, published by the SEAI, show 47% of Irish adults polled said they are strongly in favour of wind power in Ireland while a further 38% favour it. Overall this is a 4% increase in favourable attitudes towards wind power compared with similar research in 2013.

The SEAI survey found that the overall attitude to wind farms is very positive, with 84% of respondents in favour of the use of wind energy in Ireland. Approximately two thirds of respondents (70%) would prefer to power their home with renewable energy over fossil fuels, and 45% would be in favour of a wind farm development in their area.

The survey also captured the perceived benefits of wind power among the public. Of those surveyed three quarters selected good for the environment and reduced Carbon Dioxide emissions while fewer people, just over two in three, cited cheaper electricity.

5.4.1.4 Conclusions

The main findings of the SEAI survey indicate that the overall attitude to wind farms is "almost entirely positive". The study highlights that two-thirds of Irish adults are either very favourable or fairly favourable to having a wind farm built in their locality, with little evidence of a "Not In My Back Yard" (NIMBY) effect. The final section of the 2017 report states:

> *"The overwhelming indication from this study is that wind energy enjoys great support and, more specifically, that the development of wind farms is supported and welcomed. The single most powerful indicator of this is to be found among those living in proximity to an existing wind farm: over 60% would be in favour of a second wind farm or an extension of the existing one. This represents a strong vote in favour of wind farm developments – especially important since it is voiced by those who know from direct experience about the impact of such developments on their communities."*

5.4.2 Public Perceptions of Wind Power in Scotland and Ireland Survey 2005

5.4.2.1 Background

A survey of the public perception of wind power in Scotland and Ireland was carried out in 2003/2004 by researchers at the School of Geography & Geosciences, University of St. Andrews, Fife and The Macaulay Institute, Aberdeen ('*Green on Green: Public Perceptions of Wind Power in Scotland and Ireland*', Journal of Environmental Planning and Management, November 2005). The aims of the study were to ascertain the extent to which people support or oppose wind power, to investigate the reasons for these attitudes and to establish how public attitudes relate to factors such as personal experience of operational wind farms and their proximity to them.

5.4.2.2 Study Area

Surveys were carried out at two localities in the Scottish Borders region, one surrounding an existing wind farm and one around a site at which a wind farm had received planning permission but had not yet been built. Surveys were also carried out in Ireland, at two sites in Counties Cork and Kerry, each of which has two wind farms in proximity.

5.4.2.3 Findings

The survey of public attitudes at both the Scottish and Irish study sites concluded that large majorities of people are strongly in favour of their local wind farm, their personal experience having engendered positive attitudes. Attitudes towards the concept of wind energy were described as "overwhelmingly positive" at both study sites in Scotland, while the Irish survey results showed almost full support for renewable energy and 92% support for the development of wind energy in Ireland.

The results of the survey were found to agree with the findings of previous research, which show that positive attitudes to wind power increase through time and with proximity to wind farms. With regards to the NIMBY effect, the report states that where NIMBY-ism does occur, it is much more pronounced in relation to proposed wind farms than actual wind farms. The Scottish survey found that while positive attitudes towards wind power were observed among those living in proximity to both the proposed and existing wind farm sites, people around the proposed site were less convinced than those living in proximity to the existing site. Retrospective questioning regarding pre- and post-construction attitudes at the existing site found that attitudes remained unchanged for 65% of respondents. Of the 24% of people who altered their attitudes following experience of the wind farm, all but one became more positive. The report states:

> *"These results support earlier work which has found that opposition to wind farms arises in part from exaggerated perceptions of likely impact, and that the experience of living near a wind farm frequently dispels these fears. Prior to construction, locals typically expect the landscape impacts to be negative, whereas, once in operation, may people regard them as an attractive addition."*

The reasons that people gave for their positive attitude to the local wind farm were predominantly of a global kind, i.e. environmental protection and the promotion of renewable energy, together with opposition to a reliance on fossil fuels and nuclear power. Problems that are often cited as negative impacts of wind farms, such as interference with telecommunications and shadow flicker were not mentioned at either site. With regards to those who changed to a more positive attitude following construction of the wind farm, the reasons given were that the wind farm is *"not unattractive (62%), that there was no noise (15%), that community funding had been forthcoming (15%) and that it could be a tourist attraction (8%)".*

The findings of the Irish survey reinforce those obtained at the Scottish sites with regards to the increase in positive attitudes to wind power through time and proximity to wind farms. The survey of public attitudes at the sites in Cork and Kerry found that the highest levels of support for wind power were recorded in the innermost study zone (0 – 5 kilometres from a point in between the pair of wind farms). The data also suggests that *"those who see the wind farms most often are most accepting of the visual impact".* The report also states that a previous Irish survey found that most of those with direct experience of wind farms do not consider that they have had any adverse impact on the scenic beauty of the area, or on wildlife, tourism or property values. Overall, the study data reveals *"a clear pattern of public attitudes becoming significantly more positive following personal experience of operational wind farms".*

With regards to wind farm size, the report notes that it is evident from this and previous research that wind farms with small numbers of large turbines are generally preferred to those with large numbers of smaller turbines.

5.4.2.4 Conclusions

The overall conclusions drawn from the survey findings and from the authors' review of previous studies show that local people become more favourable towards wind farms after construction, that the degree of acceptance increases with proximity to them, and that the NIMBY-ism effect does not adequately explain variations in public attitudes due to the degree of subjectivity involved.

5.4.3 IWEA Interactions Opinion Poll on Wind Energy

Published in January 2020, IWEA undertook a national opinion poll on Wind Energy November 2019 with the objective to "*measure and track public perceptions and attitudes around wind energy amongst Irish adults*." Between November 20th – 30th 2019, a nationally represented sample of 1,019 adults and a booster sample of 200 rural residents participated in an online survey. The 2019 results indicate that 79% of both the nationally represented sample and rural sample strongly favour or favour wind power while 16% of both samples neither favour or oppose it. Amongst those in favour of wind power, the majority cited environmental and climate concerns as their main reasons for supporting such developments. Other reasons cited for supporting wind energy developments include: "economic benefits," "reliable/efficient," "positive experience with wind energy" and recognise it as a "safe resource." When questioned about wind developments in their local area, 55% of nationally represented sample favour or tend to favour such proposals and 51% of the rural population reported the same. Reasons cited for supporting wind developments in their local area include: "good for the environment," "social responsibility," "create jobs," "good for the community." In the same survey, 30 to 31% neither favour/opposed, 6 to 7% tended to oppose and 9 to 11% strongly opposed.

The IWEA November 2019 survey follows previous national opinion polls asking the same questions on wind energy undertaken in October 2017 and November 2018. The 2019 survey results are consistent with the 2017 and 2018 figures and thus indicate that approximately 4 out of 5 Irish adults have continued to support for wind energy in recent years.

5.5 Health Impacts of Wind Farms

5.5.1 Health Impact Studies

While there are anecdotal reports of negative health effects on people who live very close to wind turbines, peer-reviewed research largely does not support these statements. There is currently no published credible scientific evidence to positively link wind turbines with adverse health effects. The main publications supporting the view that there is no evidence of any direct link between wind turbines and health are summarised below.

1. ***'Wind Turbine Sound and Health Effects – An Expert Panel Review', American Wind Energy Association and Canadian Wind Energy Association, December 2009***

This expert panel undertook extensive review, analysis and discussion of the large body of peer-reviewed literature on sound and health effects in general, and on sound produced by wind turbines in particular. The panel assessed the plausible biological effects of exposure to wind turbine sound. Following review, analysis, and discussion of current knowledge, the panel reached consensus on the following conclusions:

- *"There is no evidence that the audible or sub-audible sounds emitted by wind turbines have any direct adverse physiological effects.*
- *The ground-borne vibrations from wind turbines are too weak to be detected by, or to affect, humans.*
- *The sounds emitted by wind turbines are not unique. There is no reason to believe, based on the levels and frequencies of the sounds and the panel's experience with*

sound exposures in occupational settings, that the sounds from wind turbines could plausibly have direct adverse health consequences."

The report found, amongst other things, that:

- *"Wind Turbine Syndrome" symptoms are the same as those seen in the general population due to stresses of daily life. They include headaches, insomnia, anxiety, dizziness, etc.*
- *Low frequency and very low-frequency 'infrasound' produced by wind turbines are the same as those produced by vehicular traffic and home appliances, even by the beating of people's hearts. Such 'infrasounds' are not special and convey no risk factors;*
- *The power of suggestion, as conveyed by news media coverage of perceived 'wind-turbine sickness', might have triggered 'anticipatory fear' in those close to turbine installations."*

2. ***'Wind Turbine Syndrome – An independent review of the state of knowledge about the alleged health condition', Expert Panel on behalf of Renewable UK, July 2010***

This report consists of three reviews carried out by independent experts to update and understand the available knowledge of the science relating to infrasound generated by wind turbines. This report was prepared following the publication of a book entitled '*Wind Turbine Syndrome*', in 2009 by Dr. Pierpont, which received significant media attention at the time. The report discusses the methodology and assessment carried out in the 2009 publication and assessed the impact of low-frequency noise from wind turbines on humans. The independent review found that:

- *"The scientific and epidemiological methodology and conclusions drawn (in the 2009 book) are fundamentally flawed;*
- *The scientific and audiological assumptions presented by Dr Pierpont relating infrasound to WTD are wrong; and*
- *Noise from Wind Turbines cannot contribute to the symptoms reported by Dr. Pierpont's respondents by the mechanisms proposed."*

Accordingly, the consistent and scientifically robust conclusion remains that there is no evidence to demonstrate any significant health effects in humans arising from noise at the levels of that generated by wind turbines.

3. ***'A Rapid Review of the Evidence', Australian Government National Health and Medical Research Council (NHMRC) Wind Turbines & Health, July 2010***

The purpose of this paper was to review evidence from current literature on the issue of wind turbines and potential impacts on human health and to validate the finding of the *'Wind Turbine Sound and Health Effects - An Expert Panel Review'* (see Item 2 above) that:

- *"There are no direct pathological effects from wind farms and that any potential impact on humans can be minimised by following existing planning guidelines."*
- *There is currently no published scientific evidence to positively link wind turbines with adverse health effects.*
- *'This review of the available evidence, including journal articles, surveys, literature reviews and government reports, supports the statement that: There are no direct pathological effects from wind farms and that any potential impact on humans can be minimised by following existing planning guidelines."*

4. 'Position Statement on Health and Wind Turbines', Climate and Health Alliance, February 2012

The Climate and Health Alliance (CAHA) was established in August 2010 and is a coalition of health care stakeholders who wish to see the threat to human health from climate change and ecological degradation addressed through prompt policy action. In its Position Statement in February 2012, CAHA states that:

> *"To date, there is no credible peer reviewed scientific evidence that demonstrates a direct causal link between wind turbines and adverse health impacts in people living in proximity to them. There is no evidence for any adverse health effects from wind turbine shadow flicker or electromagnetic frequency. There is no evidence in the peer reviewed published scientific literature that suggests that there are any adverse health effects from infrasound (a component of low frequency sound) at the low levels that may be emitted by wind turbines."*

The Position Statement explores human perceptions of wind energy and notes that some people may be predisposed to some form of negative perception that itself may cause annoyance. It states that:

> *"Fear and anxious anticipation of potential negative impacts of wind farms can also contribute to stress responses, and result in physical and psychological stress symptoms... Local concerns about wind farms can be related to perceived threats from changes to their place and can be considered a form of "place-protection action", recognised in psychological research about the importance of place and people's sense of identity."*

CAHA notes the existence of *"misinformation about wind power"* and, in particular, states that:

> *"Some of the anxiety and concern in the community stems originally from a self-published book by an anti-wind farm activist in the United States which invented a syndrome, the so-called "wind turbine syndrome". This is not a recognised medical syndrome in any international index of disease, nor has this publication been subjected to peer review."*

CAHA notes that:

> *"Large scale commercial wind farms however have been in operation internationally for many decades, often in close proximity to thousands of people, and there has been no evidence of any significant rise in disease rates."*

This, it states, contrasts with the health impacts of fossil fuel energy generation.

5. 'Wind Turbine Health Impact Study -Report of Independent Expert Panel' – Massachusetts Departments of Environmental Protection and Public Health (2012)

An expert panel was established with the objective to, inter alia, evaluate information from peer-reviewed scientific studies, other reports, popular media and public comments and to assess the magnitude and frequency of any potential impacts and risks to human health associated with the design and operation of wind energy turbines. In its final report, the expert panel set out its conclusions under several headings, including noise and shadow flicker.

In relation to noise, the panel concluded that there was limited or no evidence to indicate any causal link between noise from wind turbines and health effects, including the following conclusions:

> *"There is no evidence for a set of health effects, from exposure to wind turbines that could be characterized as a "Wind Turbine Syndrome."*
>
> *The strongest epidemiological study suggests that there is not an association between noise from wind turbines and measures of psychological distress or mental health problems. There*

were two smaller, weaker, studies: one did note an association, one did not. Therefore, we conclude the weight of the evidence suggests no association between noise from wind turbines and measures of psychological distress or mental health problems.

None of the limited epidemiological evidence reviewed suggests an association between noise from wind turbines and pain and stiffness, diabetes, high blood pressure, tinnitus, hearing impairment, cardiovascular disease, and headache/migraine."

In relation to shadow flicker, the expert panel found the following:

"Scientific evidence suggests that shadow flicker does not pose a risk for eliciting seizures as a result of photic stimulation.

There is limited scientific evidence of an association between annoyance from prolonged shadow flicker (exceeding 30 minutes per day) and potential transitory cognitive and physical health effects."

6. ***Wind Turbines and Health, A Critical Review of the Scientific Literature, Massachusetts Institute of Technology (Journal of Occupational and Environmental Medicine Vol. 56, Number 11, November 2014)***

This review assessed the peer-reviewed literature regarding evaluations of potential health effects among people living in the vicinity of wind turbines. The review posed a number of questions around the effect of turbines on human health, with the aim of determining if stress, annoyance or sleep disturbance occur as a result of living in proximity to wind turbines, and whether specific aspects of wind turbine noise have unique potential health effects. The review concluded the following with regard to the above questions:

- Measurements of low-frequency sound, infrasound, tonal sound emission, and amplitude-modulated sound show that infrasound is emitted by wind turbines. The levels of infrasound at customary distances to homes are typically well below audibility thresholds.
- No cohort or case–control studies were located in this updated review of the peer-reviewed literature. Nevertheless, among the cross-sectional studies of better quality, no clear or consistent association is seen between wind turbine noise and any reported disease or other indicator of harm to human health.
- Components of wind turbine sound, including infrasound and low frequency sound, have not been shown to present unique health risks to people living near wind turbines.
- Annoyance associated with living near wind turbines is a complex phenomenon related to personal factors. Noise from turbines plays a minor role in comparison with other factors in leading people to report annoyance in the context of wind turbines.

A further 25 reviews of the scientific evidence that universally conclude that exposure to wind farms and the sound emanating from wind farms does not trigger adverse health effects, were compiled in September 2015 by Professor Simon Chapman, of the School of Public Health and Sydney University Medical School, Australia, and is included as Appendix 5-2 of this EIAR. Another recent publication by Chapman and Crichton (2017) entitled '*Wind turbine syndrome; A communicated disease'* critically discusses why certain health impacts might often be incorrectly attributed to wind turbines.

7. ***Position Paper on Wind Turbines and Public Health: HSE Public Health Medicine Environment and Health Group, February 2017***

The Health Service Executive (HSE) position paper on wind turbines and public health was published in February 2017 to address the rise in wind farm development and concerns regarding potential impacts on public health. The paper discusses previous observations and case studies which describe a broad range of health effects that are associated with wind turbine noise, shadow flicker and electromagnetic radiation.

A number of comprehensive reviews conducted in recent years to examine whether these health effects are proven has highlighted the lack of published and high-quality scientific evidence to support adverse effects of wind turbines on health.

The HSE position paper determines that current scientific evidence on adverse impacts of wind farms on health is weak or absent. Further research and investigative processes are required at a larger scale in order to be more informative for identifying potential health effects of exposure to wind turbine effects. They advise developers on making use of the Wind Energy Development Guidelines (2006), as a means of setting noise limits and set back distances from the nearest dwellings.

8. ***Environmental Noise Guidelines for the European Region: World Health Organisation Regional Office for Europe, 2018.***

The WHO *Environmental Noise Guidelines for the European Region* (2018) provide guidance on protecting human health from exposure to environmental noise. They set health-based recommendations based on average environmental noise exposure of several sources of environmental noise, including wind turbine noise. Recommendations are rated as either 'strong' or 'conditional'. A strong recommendation, "*can be adopted as policy in most situations*" whereas a conditional recommendation, "*requires a policy-making process with substantial debate and involvement of various stakeholders. There is less certainty of its efficacy owing to lower quality of evidence of a net benefit, opposing values and preferences of individuals and populations affected or the high resource implications of the recommendation, meaning there may be circumstances or settings in which it will not apply*".

The objective of the World Health Organisation (WHO) Environmental Noise Guidelines for the European Region that was published in October 2018 is to provide recommendations for protecting human health from exposure to environmental noise from transportation, wind farm and leisure sources of noise. The guidelines present recommendations for each noise source type in terms of L_{den} and L_{night} levels above which there is risk of adverse health risks.

In relation to wind turbine noise, the WHO Guideline Development Group (GDG) state the following:

> "*For average noise exposure, the GDG conditionally recommends reducing noise levels produced by wind turbines below 45 dB* L_{den}*, as wind turbine noise above this level is associated with adverse health effects.*
>
> *No recommendation is made for average night noise exposure* L_{night} *of wind turbines. The quality of evidence of night-time exposure to wind turbine noise is too low to allow a recommendation.*
>
> *To reduce health effects, the GDG conditionally recommends that policymakers implement suitable measures to reduce noise exposure from wind turbines in the population exposed to levels above the guideline values for average noise exposure. No evidence is available, however, to facilitate the recommendation of one particular type of intervention over another.*"

The quality of evidence used for the WHO research is stated as being 'Low', the recommendations are therefore conditional.

The WHO Environmental Noise Guidelines aim to support the legislation and policy-making process on local, national and international level, thus shall be considered by Irish policy makers for any future revisions of Irish National Guidelines.

There is potential increased uncertainty due to the parameter used by the WHO for assessment of exposure (i.e. L_{den}), which it is acknowledged may be a poor characterisation of wind turbine noise and may limit the ability to observe associations between wind turbine noise and health outcomes, as stated below.

> "*Even though correlations between noise indicators tend to be high (especially between LAeq-like indicators) and conversions between indicators do not normally influence the correlations between the noise indicator and a particular health effect, important assumptions remain when exposure to wind turbine noise in L_{den} is converted from original sound pressure level values. The conversion requires, as variable, the statistical distribution of annual wind speed at a particular height, which depends on the type of wind turbine and meteorological conditions at a particular geographical location. Such input variables may not be directly applicable for use in other sites. They are sometimes used without specific validation for a particular area, however, because of practical limitations or lack of data and resources. This can lead to increased uncertainty in the assessment of the relationship between wind turbine noise exposure and health outcomes. Based on all these factors, it may be concluded that the acoustical description of wind turbine noise by means of L_{den} or L_{night} may be a poor characterization of wind turbine noise and may limit the ability to observe associations between wind turbine noise and health outcomes...*
>
> *...Further work is required to assess fully the benefits and harms of exposure to environmental noise from wind turbines and to clarify whether the potential benefits associated with reducing exposure to environmental noise for individuals living in the vicinity of wind turbines outweigh the impact on the development of renewable energy policies in the WHO European Region.*"

Based upon the review set out above, it is concluded that the conditional WHO recommended average noise exposure level (i.e. 45dB L_{den}) should not currently be applied as target noise criteria for an existing or proposed wind turbine development in Ireland.

9. ***Infrasound Does Not Explain Symptoms Related to Wind Turbines:*** *Finnish Government's Analysis, Assessment and Research Activities (VN TEAS), 2020*

The study targeted to adverse health effects of wind turbine infrasound and was funded by the Finnish Government's Analysis, Assessment and Research Activities (VN TEAS).

It was found that the low-frequency, inaudible sounds made by wind turbines are not damaging to human health despite fears that they cause unpleasant symptoms. The project, which was carried out over two years, examined the impact of low-frequency—or infrasound—emissions which cannot be picked up by the human ear.

People in many countries have blamed the infrasound waves for symptoms ranging from headaches and nausea to tinnitus and cardiovascular problems, researchers said.

Interviews, sound recordings and laboratory tests were used to explore possible health effects on people living within 20 kilometres (12 miles) of the generators.

The report notes:

> *'...the behavioral findings of the current study suggest that wind turbine infrasound cannot be reliably perceived and it does not result in increased annoyance. Participants that showed health effects did not show signs of increased infrasound sensitivity and did not rate wind turbine sounds more annoying.*

As a result:

'These findings do not support the hypothesis that infrasound is the element in turbine sound that causes annoyance. Instead, they suggest that people who have health symptoms which they associate with wind turbine sound are not likely to have these symptoms because they perceive turbine sound more annoying than controls, at least in laboratory settings. It is more likely that these symptoms are triggered by other factors such as symptom expectancy'.

5.5.2 Turbine Safety

Turbines pose no threat to the health and safety of the general public. The Department of the Environment, Heritage and Local Government (DoEHLG)'s '*Wind Energy Development Guidelines for Planning Authorities 2006*' and the '*Draft Revised Wind Energy Development Guidelines'* (Department of Housing, Planning and Local Government (DoHPLG), December 2019) (currently under consultation), iterate that there are no specific safety considerations in relation to the operation of wind turbines. Fencing or other restrictions are not necessary for safety considerations and should be kept to a minimum. People or animals can safely walk up to the base of the turbines.

The adopted 2006 Guidelines and the Draft 2019 Guidelines state that there is a very remote possibility of injury to people from flying fragments of ice or from a damaged blade. However, most blades are composite structures with no bolts or separate components and the danger is therefore minimised. The build-up of ice on turbines is unlikely to present problems. The wind turbines will be fitted with anti-vibration sensors, which will detect any imbalance caused by icing of the blades. The sensors will cause the turbine to wait until the blades have been de-iced prior to resuming operation.

Turbine blades are manufactured of glass reinforced plastic which will prevent any likelihood of an increase in lightning strikes within the site of the Proposed Development or the local area. Lightning protection conduits will be integral to the construction of the turbines. Lightning conduction cables, encased in protection conduits, will follow the electrical cable run, from the nacelle to the base of the turbine. The conduction cables will be earthed adjacent to the turbine base. The earthing system will be installed during the construction of the turbine foundations.

5.5.3 Electromagnetic Interference

The provision of underground electric cables of the capacity proposed is common practice throughout the country and installation to the required specification does not give rise to any specific health concerns.

The extremely low frequency (ELF) electric and magnetic fields (EMF) associated with the operation of the proposed cables fully comply with the international guidelines for ELF-EMF set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP), a formal advisory agency to the World Health Organisation, as well as the EU guidelines for human exposure to EMF. Accordingly, there will be no operational impact on properties (residential or other uses) as the ICNIRP guidelines will not be exceeded at any distances even directly above the cables.

The EirGrid document '*EMF & You: Information about Electric & Magnetic Fields and the electricity transmission system in Ireland'* (EirGrid, 2014) provides further practical information on EMF and is included as Appendix 5-3 of this EIAR.

Further details on the potential impacts of electromagnetic interference to telecommunications and aviation are presented in Section 14.2 of Chapter 14 Material Assets.

5.5.4 Assessment of Effects on Human Health

As set out in the Department of Housing, Planning, Community and Local Government '*Key Issues Consultation Paper on the Transposition of the EIA Directive 2017*' and the guidance listed in Section

1.2.1 of Chapter 1: Introduction, the consideration of the effects on populations and on human health should focus on health issues and environmental hazards arising from the other environmental factors, for example water contamination, air pollution, noise, accidents, disasters.

A wind farm is not a recognised source of pollution. It is not an activity that falls within any thresholds requiring Environmental Protection Agency licensing under the Environmental Protection Agency Licensing Act 1992, as amended. As such, a wind farm is not considered to have ongoing significant emissions to environmental media and the subsequent potential for human health effects during construction, operation or decommissioning for the reasons explained below in this section and on the basis of published research discussed in Section 5.5.

Chapter 8: Land, Soils and Geology, Chapter 9: Hydrology & Hydrogeology, Chapter 10: Air and Climate, Chapter 11: Noise and Vibration and Chapter 14: Material Assets (Traffic and Transport) provide an assessment of the effects of the Proposed Development on these areas of consideration. There is the potential for negative effects on human health during the wind farm construction phase related to potential emissions to air of dust, potential emissions to land and water of hydrocarbons, release of potentially silt-laden runoff into watercourses and noise emissions. The assessments however show that the residual impacts are not significant and do not have the potential to cause negative health effects for human beings. On this basis, the potential for negative health effects associated with the Proposed Development is imperceptible.

The proposed project is for the development of a renewable energy project, capable of offsetting carbon emissions associated with the burning of fossil fuels. During the operational stage the wind farm will have a long term, significant, positive effect on air quality as set out in Chapter 10 Air and Climate which will contribute to positive effects on human health.

The proposed site design and mitigation measures outlined in Chapter 8 Land, Soils and Geology and Chapter 9 Hydrology & Hydrogeology ensures that the potential for impacts on the water environment are not significant. No impacts on local water supplies are anticipated.

As set out in Chapter 9 Hydrology & Hydrogeology, potential health effects are associated with negative impacts on public and private water supplies and potential flooding. There are no mapped public or group groundwater scheme protection zones in the area of the Proposed Development.

The Flood Risk Assessment has also shown that the risk of the Proposed Development contributing to downstream flooding is also very low, as the long-term plan for the site is to retain and slow down drainage water within the existing bog basins. Drainage measures on the site will include swales, silt traps, settlement ponds, field drains and headland drains as described earlier in the chapter.

5.5.5 Vulnerability of the Project to Natural Disasters and Major Accidents

As outlined in Section 5.5.4 above, a wind farm is not a recognised source of pollution. Should a major accident or natural disaster occur, the potential sources of pollution onsite during the construction, operational and decommissioning phases, are limited. Sources of pollution with the potential to cause significant environmental pollution and associated negative effects on health, such as bulk storage of hydrocarbons or chemicals, storage of wastes etc., are limited.

There is limited potential for significant natural disasters to occur at the Proposed Development site. Ireland is a geologically stable country with a mild temperate climate. The potential natural disasters that may occur are therefore limited to peat instability, flooding and fire. The risk of peat instability is addressed in Chapter 8: Soils and Geology and the Geotechnical Peat Stability Assessment Report included in Appendix 8-1. The findings of the geotechnical assessment showed that the Proposed Development has an acceptable margin of safety, is considered to be at low risk of peat failure and is suitable for wind farm development. The risk of flooding is addressed in Chapter 9: Hydrology and

Hydrogeology. It is considered that the risk of significant fire occurring, affecting the wind farm and causing the wind farm to have significant environmental effects is limited and therefore a significant effect on human health is similarly limited. As described earlier, there are no significant sources of pollution in the wind farm with the potential to cause environmental or health effects. Also, the spacing of the turbines and distance of turbines from any properties limits the potential for impacts on human health. The issue of turbine safety is addressed in Section 5.5.2.

Major industrial accidents involving dangerous substances pose a significant threat to humans and the environment; such accidents can give rise to serious injury to people or serious damage to the environment, both on and off the site of the accident. The Wind Farm Site is not regulated or connected to or close to any site regulated under the Control of Major Accident Hazards Involving Dangerous Substances Regulations i.e. SEVESO sites and so there are no potential effects from this source.

5.6 Property Values

In the absence of any Irish studies on the effect of wind farms on property values, this section provides a summary of the largest and most recent studies from the United States and Scotland.

The largest study of the impact of wind farms on property values has been carried out in the United States. '*The Impact of Wind Power Projects on Residential Property Values in the United States: A multi-Site Hedonic Analysis*', December 2009, was carried out by the Lawrence Berkley National Laboratory (LBNL) for the U.S Department of Energy. This study collected data on almost 7,500 sales of single-family homes situated within ten miles of 24 existing wind farms in nine different American states over a period of approximately ten years. The conclusions of the study are drawn from eight different pricing models including repeat sales and volume sales models. Each of the homes included in the study was visited to demonstrate the degree to which the wind facility was visible at the time of the sale, and the conclusions of the report state that "The result is the most comprehensive and data rich analysis to date on the potential impacts of wind energy projects on nearby property values."

The main conclusion of this study is as follows:

> *"Based on the data and analysis presented in this report, no evidence is found that home prices surrounding wind facilities are consistently, measurably, and significantly affected by either the view of wind facilities or the distance of the home to those facilities. Although the analysis cannot dismiss the possibility that individual or small numbers of homes have been or could be negatively impacted, if these impacts do exist, they are either too small and/or too infrequent to result in any widespread and consistent statistically observable impact."*

This study has been recently updated by LBNL who published a further paper entitled '*A Spatial Hedonic Analysis of the Effects of Wind Energy Facilities on Surrounding Property Values in the United States*', in August 2013. This study analysed more than 50,000 home sales near 67 wind farms in 27 counties across nine U.S. states, yet was unable to uncover any impacts to nearby home property values. The homes were all within 10 miles of the wind energy facilities - about 1,100 homes were within 1 mile, with 331 within half a mile. The report is therefore based on a very large sample and represents an extremely robust assessment of the impacts of wind farm development on property prices. It concludes that:

> *"Across all model Specifications, we find no statistical evidence that home prices near wind turbines were affected in either the post-construction or post announcement/pre-construction periods."*

Both LBNL studies note that their results do not mean that there will never be a case of an individual home whose value goes down due to its proximity to a wind farm – however if these situations do exist, they are considered to be statistically insignificant. Therefore, although there have been claims of significant property value impacts near operating wind turbines that regularly surface in the press or in local communities, strong evidence to support those claims has failed to materialise in all the major U.S. studies conducted thus far.

A further study was commissioned by RenewableUK and carried out by the Centre for Economics and Business Research (Cebr) in March 2014. Its main conclusions are:

- Overall the analysis found that the county-wide property market drives local house prices, not the presence or absence of wind farms.
- The econometric analysis established that construction of wind farms at the five sites examined across England and Wales has not had a detectable negative impact on house price growth within a five-kilometre radius of the sites.

A relatively new study issued in October 2016 '*Impact of wind Turbines on House Prices in Scotland'* (2016) was published by Climate Exchange. Climate Exchange is Scotland's independent centre of expertise on climate change which exists to support the Scottish Governments policy development on climate and the transition to a low carbon economy. A copy of the report is included as Appendix 5-4 of this EIAR.

The report presents the main findings of a research project estimating the impact on house prices from wind farm developments. It is based on analysis of over 500,000 property sales in Scotland between 1990 and 2014. The key findings from the study are:

- **No evidence of a consistent negative effect on house prices**: Across a very wide range of analyses, including results that replicate and improve on the approach used by Gibbons (2014), we do not find a consistent negative effect of wind turbines or wind farms when averaging across the entire sample of Scottish wind turbines and their surrounding houses. Most results either show no significant effect on the change in price of properties within 2km or 3km or find the effect to be positive.
- **Results vary across areas**: The results vary across different regions of Scotland. Our data does not provide sufficient information to enable us to rigorously measure and test the underlying causes of these differences, which may be interconnected and complex.

Although there have been no empirical studies carried out in Ireland on the impacts of wind farms on property prices, the literature described above demonstrates that at an international level, wind farms have not impacted property values in the local areas. It is a reasonable assumption based on the available international literature, that the provision of a wind farm at the proposed location would not impact on the property values in the area.

5.7 Shadow Flicker

5.7.1 Background

Shadow flicker is an effect that occurs when rotating wind turbine blades cast shadows over a window in a nearby property. Shadow flicker is an indoor phenomenon, which may be experienced by an occupant sitting in an enclosed room when sunlight reaching the window is momentarily interrupted by a shadow of a wind turbine's blade. Outside in the open, light reaches a viewer (person) from a much less focused source than it would through a window of an enclosed room, and therefore shadow flicker assessments are typically undertaken for the nearby adjacent properties around a proposed wind farm site.

The frequency of occurrence and the strength of any potential shadow flicker impact depends on several factors, each of which is outlined below.

1. *Whether the sunlight is direct and unobstructed or diffused by clouds:*

If the sun is not shining, shadow flicker cannot occur. Reduced visibility conditions such as clouds, haze, and fog greatly reduce the chance of shadow flicker occurring.

"*Cloud amounts are reported as the number of eights (okta) of the sky covered. Irish skies are completely covered by cloud for over 50% of the time. The mean cloud amount for each hour is between five and six okta. This is due to Ireland's geographical position off the northwest of Europe, close to the path of Atlantic low-pressure systems which tend to keep the country in humid, cloudy airflows for much of the time. A study at 12 stations over a 25-year period showed that the mean cloud amount was at a minimum in April and maximum in July. Cloud amounts were less at night than during the day, with the mean minimum occurring roughly between 2100 and 0100 GMT and the mean maximum occurring between 1000 and 1500 GMT at most stations.*" (Source: Met Éireann, www.met.ie).

2. *The presence of intervening obstructions between the turbine and the observer:*

For shadow flicker to occur, the windows of a potentially affected property must have direct visibility of a wind turbine, with no physical obstructions such as buildings, trees and hedgerows, hills or other structures located on the intervening land between the window and the turbine.

Any obstacles such as trees or buildings located between a property and the wind turbine will reduce or eliminate the occurrence and/or intensity of the shadow flicker.

3. *How high the sun is in the sky at a given time:*

At distances of greater than approximately 500m between a turbine and a receptor, shadow flicker generally occurs only at sunrise or sunset when the shadow cast by the turbine is longer. The current adopted 'Wind Energy Development Guidelines for Planning Authorities' published by the Department of Environment, Heritage and Local Government (DoEHLG) in 2006, iterates that at distances greater than ten rotor diameters from a turbine, the potential for shadow flicker is very low (*'Wind Energy Development Guidelines for Planning Authorities'*, DoEHLG, 2006).

Figure 5-4 illustrates the shadow cast by a turbine at various times during the day; the red shading represents the area where shadow flicker may occur. When the sun is high in the sky, the length of the shadow cast by the turbine is significantly shorter.

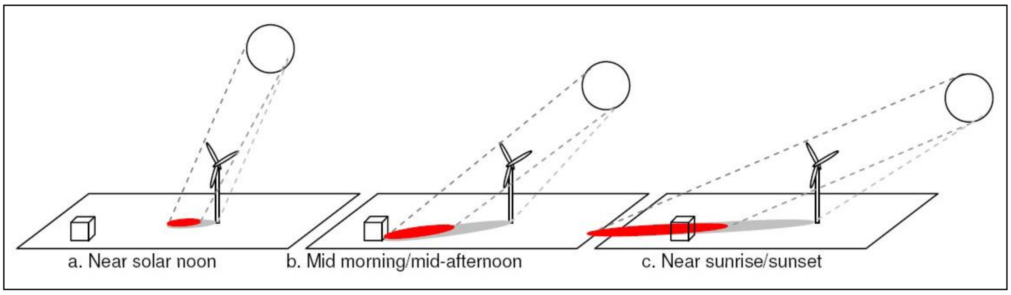


Figure 5-4 Shadow-Prone Area as Function of Time of Day (Source: Shadow Flicker Report, Helimax Energy, Dec 2008)

4. *Distance and bearing, i.e. where the property is located relative to a turbine and the sun:*

The further a property is from the turbine the less pronounced the impact will be. There are several reasons for this: there are fewer times when the sun is low enough to cast a long shadow; when the sun is low it is more likely to be obscured by either cloud on the horizon or intervening buildings and vegetation; and the centre of the rotor's shadow passes more quickly over the land reducing the duration of the impact.

At a distance, the turbine blades do not cover the sun but only partly mask it, substantially weakening the shadow. This impact occurs first with the shadow from the blade tip, the tips being thinner in section than the rest of the blade. The shadows from the tips extend the furthest and so only a very weak impact is observed at distance from the turbines. (Source: Update of Shadow Flicker Evidence Base, UK Department of Energy and Climate Change, 2010).

5. ***Property usage and occupancy:***

Where shadow flicker is predicted to occur at a specific location, this does not imply that it will be witnessed. Potential occupants of a property may be sleeping or occupying a room on another side of the property that is not subject to shadow flicker, or completely absent from the location during the time of shadow flicker events. As shadow flicker usually occurs only when the sun is at a low angle in the sky, i.e. very early in the morning after sunrise or late in the evening before sunset, even if there is a bedroom on the side of the property affected, the shadow flicker may not be witnessed if curtains or blinds in the bedroom are closed.

6. ***Wind direction, i.e. position of the turbine blades:***

The direction of wind turbine blades changes according to wind direction, as the turbine rotor turns to face the wind. In order to cast a shadow, the turbine blades must be facing directly toward or away from the sun, so they are moving across the source of the light relative to the observer. This is demonstrated in Figure 5-5 below.

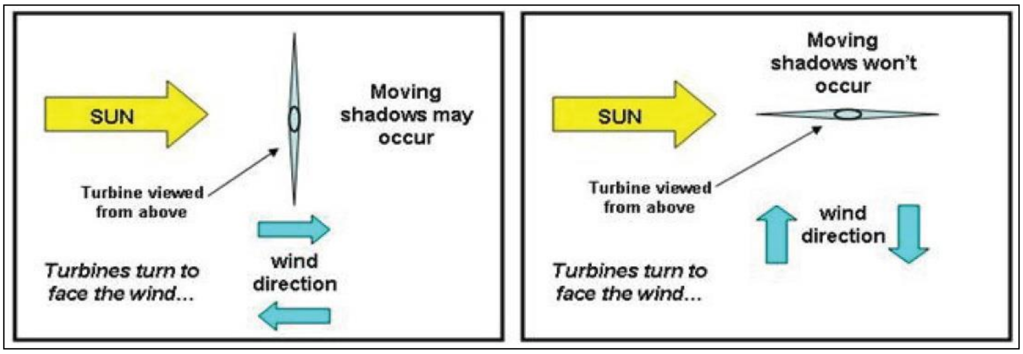


Figure 5-5 Turbine Blade Position and Shadow Flicker Impact (Source: Wind Fact Sheet: Shadow Flicker, Noise Environment Power LLC)

7. ***Rotation of turbine blades:***

Shadow flicker occurs only if there is sufficient wind for the turbine blades to be continually rotating. Wind turbines begin operating at a specific wind speed referred to as the 'cut-in speed', i.e. the speed at which the turbine produces a net power output, and they cease operating at a specific 'cut-out speed'. Therefore, even during the sunlight hours when shadow flicker has been predicted to occur, if the turbine blades are not turning due to insufficient wind speed, no shadow flicker will occur.

5.7.2 Guidance

The current, adopted guidance for shadow flicker in Ireland is derived from the '*Wind Energy Development Guidelines for Planning Authorities 2006'* (DoEHLG), and the '*Best Practice Guidelines for the Irish Wind Energy Industry'* (Irish Wind Energy Association, 2012). The 2006 DoEHLG Guidelines state that at distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low.

The DoEHLG 2006 wind energy guidelines recommend that shadow flicker at dwellings within 500 metres of a proposed turbine location should not exceed a total of 30 hours per year or 30 minutes per day. There are no occupied dwellings within 500 metres of any proposed turbine location. The closest occupied dwelling H14 (i.e. dwelling not involved with the Proposed Development) is located at a distance of approx. 700 metres from the nearest proposed turbine T11. There are 2 no. dwellings, H18 & H24 which are located at distances of 638m and 679m from T15 respectively however these are individuals involved with the proposed development. Refer to Section 5.2.

The DoEHLG guidelines state that shadow flicker lasts only for a short period of time and occurs only during certain specific combined circumstances, as follows:

- the sun is shining and is at a low angle in the sky, i.e. just after dawn and before sunset, **and**
- the turbine is located directly between the sun and the affected property, **and**
- there is enough wind energy to ensure that the turbine blades are moving, **and**
- the turbine blades are positioned so as to cast a shadow on the receptor.

Although the DoEHLG thresholds apply to properties located within 500 metres of a proposed turbine location, for the purposes of this assessment, the guideline thresholds of 30 hours per year or 30 minutes per day have been applied to all properties located within ten rotor diameters (i.e. assumed at 1.55 kilometres as a worst-case scenario) of the proposed turbines within the Proposed Development (as per IWEA guidelines, 2012). The DoEHLG Guidelines state that at distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low.

The adopted 2006 DoEHLG guidelines are currently under review. The DoHPLG released the *'Draft Revised Wind Energy Development Guidelines'* in December 2019 for public consultation. The Draft 2019 guidelines recommend local planning authorities and/or An Bord Pleanála impose conditions to ensure that:

> *"no existing dwelling or other affected property will experience shadow flicker as a result of the wind energy development subject of the planning application and the wind energy development shall be installed and operated in accordance with the shadow flicker study submitted to accompany the planning application, including any mitigation measures required."*

The Draft 2019 Guidelines are based on the recommendations set out in the *'Proposed Revisions to Wind Energy Development Guidelines 2006 – Targeted Review'* (December 2013) and the *'Review of the Wind Energy Development Guidelines 2006 – Preferred Draft Approach'* (June 2017).

The applicant is aware that the Department of the Environment, Heritage and Local Government (DoEHLG) Wind Energy Development Planning Guidelines (2006) are currently being revised. The assessment herein is based on compliance with the DoEHLG Guidelines limit (30 hours per year or 30 minutes per day), however in line with the commitment made for the permitted development and following continuing engagement with the local community requirements Coole Wind Farm Ltd. is committing to zero shadow flicker at occupied residential receptors within 10 rotor diameters of the Proposed Development.

5.7.3 Scoping

Section 2.6 in Chapter 2 of this EIAR describes the scoping and consultation exercise undertaken for the Proposed Development. A scoping response from the Health Service Executive was received on the 16th October 2020 which stated the following in relation to shadow flicker:

"It is recommended that a shadow flicker assessment is undertaken to identify any dwellings and sensitive receptors which may be impacted by shadow flicker. The assessment must include all proposed mitigation measures."

5.7.4 Shadow Flicker Prediction Methodology

Shadow flicker occurs only under certain, combined circumstances, as detailed above. Where shadow flicker does occur, it is generally short-lived. The DoEHLG guidelines state that careful site selection, design and planning, and good use of relevant software can help avoid the possibility of shadow flicker, all of which have been employed at the site of the Proposed Development. Proper siting of wind turbines is key in eliminating shadow flicker.

The occurrence of shadow flicker can be precisely predicted using specialist computer software programmes specifically developed for the wind energy industry, such as WindFarm (ReSoft) or WindFarmer (DNV.GL) or AWS OpenWind. The computer modelling of the occurrence and magnitude of shadow flicker is made possible by the fact that the sun rises and sets in the same position in the sky on every day each year.

Any potential impact can be precisely modelled to give the start and end time (accurate to the second) of any incidence of shadow flicker, at any location, on any day or all days of the year when it might occur. Where a shadow flicker impact is predicted to occur, the total maximum daily and annual durations can be predicted, along with the total number of days. Any incidence of predicted shadow flicker can be attributed to a particular turbine or group of turbines to allow effective mitigation strategies to be planned and proposed as detailed further below.

For the purposes of this shadow flicker assessment, the software package ReSoft WindFarm Version 5.0.1.2 has been used to predict the level of shadow flicker associated with the proposed wind farm development. WindFarm is a commercially available software tool that enables developers to analyse, design and optimise proposed wind farms. It allows proposed turbine layouts to be optimised for maximum energy yield whilst taking account of environmental, planning and engineering constraints.

5.7.5 Shadow Flicker Assessment Criteria

5.7.5.1 Turbine Dimensions

Planning permission is sought for a turbine size envelope with a tip height of up to 175 metres. For the purposes of this assessment, a turbine with a rotor diameter of 155m is modelled in order to assess the worst-case scenario. While these dimensions have been used for the purposes of this assessment, the actual turbine to be installed on the site will be the subject of a competitive tender process and could include turbines with a shorter rotor diameter and hence a higher hub height configuration while remaining within the design envelope (i.e. a tip height of up to175-metres and a rotor diameter of up to 155-metres, with variable hub-heights). The worst case scenario is modelled in this assessment and it is considered that any configuration of blade/hub height within the overall tip height of up to 175-metres will not lead to any additional impacts above those assessed herein.

Regardless of the make or model of the turbine eventually selected for installation on site, it will have a maximum tip height of up to 175 metres and the potential shadow flicker impact it will give rise to will be no more than that predicted in this assessment. With the benefit of the mitigation measures outlined in this section, any turbine to be installed onsite will be able to comply with the DoEHLG 2006 guidelines thresholds of 30 minutes per day or 30 hours per year, or with any revised guidelines if required, through the use of turbine control software.

Any references to the turbine dimensions in this shadow flicker assessment should be considered in the context of the above and should not be construed as pre-determining the dimensions of the wind turbine to be used on the site.

5.7.5.2 Study Area

The study area for the shadow flicker assessment is ten times rotor diameter from each turbine as set out in the *'Wind Energy Development Guidelines for Planning Authorities'*, DoEHLG, 2006. All residential properties located within ten rotor diameters which is assumed to be 1.55 kilometres have been included in the assessment. A planning history search to identify properties that may have been granted planning permission, but not yet been constructed, was carried out. Any property with a valid planning permission for a dwelling house was also added to the sensitive receptors' dataset.

There is a total of 63 properties located within the shadow flicker study area, of which 47 are dwellings, 8 are derelict, and 8 are commercial/agricultural buildings. There are no occupied dwellings within 500 metres of any proposed turbine location. The closest occupied dwelling H14 (i.e. dwelling not involved with the Proposed Development) is located at a distance of 700 metres from the nearest proposed turbine T11. There are 2 no. dwellings, H18 & H24 which are located at distances of 638m and 679m from T15 respectively however these are individuals involved with the Proposed Development. The shadow flicker study area and sensitive receptor locations are shown in Figure 5-6.

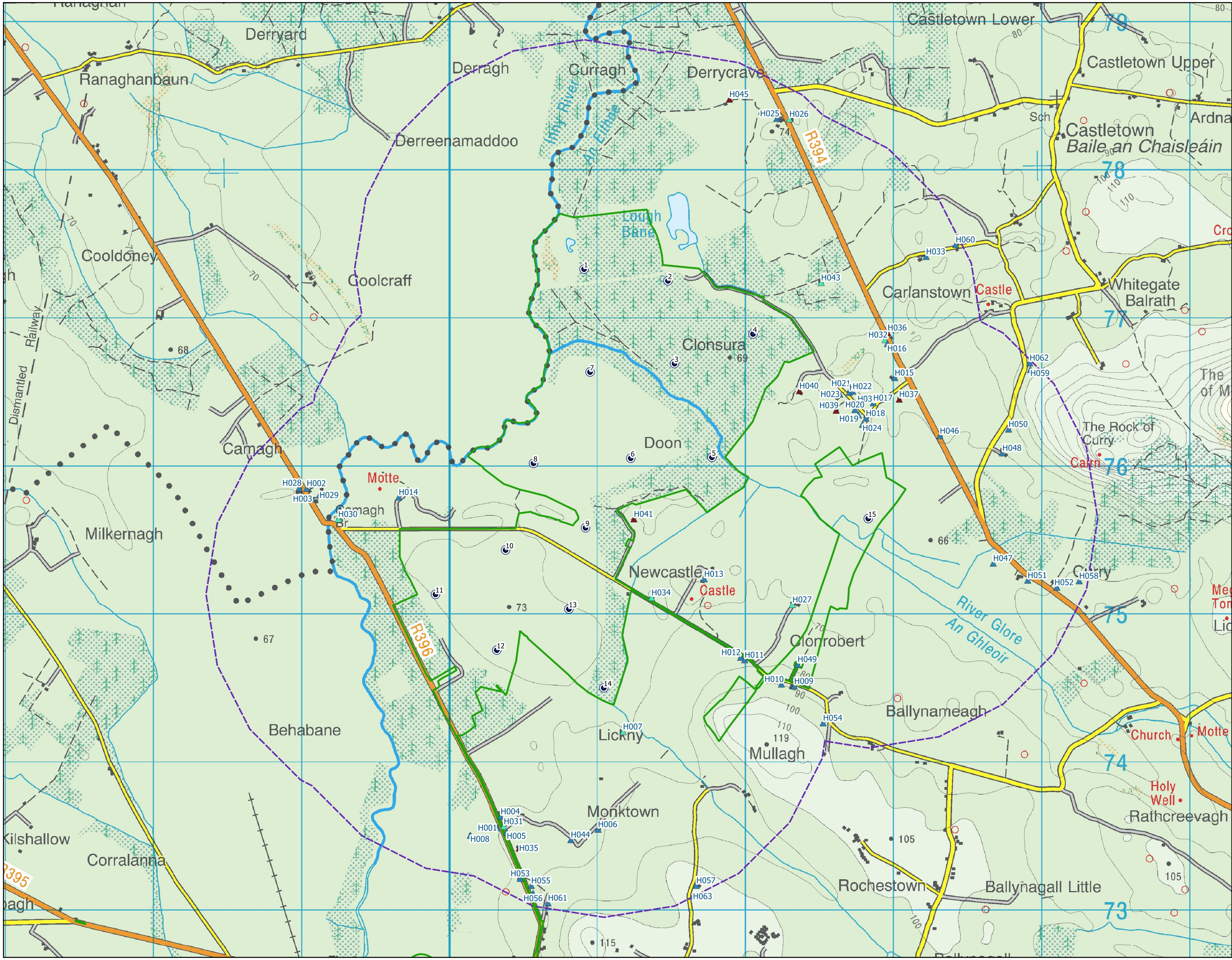
5.7.5.3 Assumptions and Limitations

Due to the latitude of Ireland and the UK, shadow flicker impacts are only possible at properties 130 degrees either side to the north as turbines do not cast shadows on their southern side (ODPM Annual Report and Accounts 2004: Housing, Planning, Local Government and the Regions Committee; Planning Policy Statement 22; Draft Revised Wind Energy Development Guidelines 2019). As such properties located outside of this potential shadow flicker zone will not be impacted. However, in this assessment, all 63 no. properties within 360 degrees of the Proposed Development within the study area were assessed for shadow flicker impact.

At each property, shadow flicker calculations were carried out based on 4 no. notional windows facing north, east, south and west, labelled Windows 1, 2, 3 and 4 respectively. The degrees from north value for each window is:

- Window 1: 0 degrees from North
- Window 2: 90 degrees from North
- Window 3: 180 degrees from North
- Window 4: 270 degrees from North

Each window measures one-metre-high by one-metre-wide, and tilt angle is assumed to be zero. The centre height of each window is assumed to be two metres above ground level and no screening due to trees or other buildings or vegetation is assumed. It was not considered necessary or practical to measure the dimensions of every window on every property in the study area. While the actual size of a window will marginally influence the incidence and duration of any potential shadow flicker impact, with larger windows resulting in slightly longer shadow flicker durations, any incidences or durations or shadow flicker can be countered by the measures outlined in Section 5.9.3.9 below.



Map Legend

- Proposed Turbine Layout
- EIAR Site Boundary
- Shadow Flicker Study Area (10 x Rotor Diameter 10 x 77.5m = 1,550 metres)

Properties

- Dwelling
- Derelict
- Commercial / Agricultural

Drawing Title	Shadow Flicker Study Area
Project Title	Coole Wind Farm, Co. Westmeath
Drawn By: EC	Checked By: MW
Project No.: 200445	Drawing No.: Figure 5-6
Scale: 1:22500	Date: 12/02/2021

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The use of computer models to predict the amount of shadow flicker that will occur is known to produce an over-estimate of possible impact, referred to as the 'worst-case impact', due to the following limitations:

- The sun is assumed to be shining during all daylight hours such that a noticeable shadow is cast. This will not occur in reality.
- The wind is always assumed to be within the operating range of the turbines such that the turbine rotor is turning at all times, thus enabling a periodic shadow flicker. Wind turbines only begin operating at a specific 'cut-in speed', and cease operating at a specific 'cut-out speed'. In periods where the wind is blowing at medium to high speeds, the probability of there being clear or partially clear skies where the sun is shining and could cast a shadow, is low.
- The wind turbines are assumed to be available to operate, i.e. turned on at all times. In reality, turbines may be switched off during maintenance or for other technical or environmental reasons.
- The turbine rotor is considered (as a sphere) to present its maximum aspect to observers in all directions. In reality, the wind direction and relative position of the turbine rotor would result in a changing aspect being presented by the turbine. The rotor will actually present as ellipses of varying sizes to observers from different directions. The time taken for the sun to pass across the sky behind a highly elliptical rotor aspect will be shorter than the modelled maximum aspect.

The total annual shadow flicker calculated for each property assumes 100% sunshine during daytime hours, as referred to above. However, weather data for this region shows that the sun shines on average for 30.1% of the daylight hours per year. This percentage is based on Met Eireann data recorded at Mullingar over the 30-year period from 1981 to 2010 (www.met.ie). The actual sunshine hours at the Wind Farm Site and therefore the percentage of time shadow flicker could actually occur is 30.1%.

The shadow flicker model does not consider that the turbine will not always be yawed such that the rotor is in the worst-case orientation. In order to include the probability of the rotor being orientated within the sun turbine vector, a wind directionality factor has also been applied. Three-years wind direction frequency distribution has been collected from the Coole met mast (Pl ref 18/1624) and correlated with MERRA 5 node data from a 20 year period to produce an estimate of the long-term wind direction frequency in the region of the Wind Farm Site. Using this data, it is possible to estimate the probability of the rotor being orientated within 30 degrees of a vector parallel to the sun turbine vector. This probability is estimated at a reduction of 37% based on the most onerous wind direction.

Table 5-9 therefore lists the annual shadow flicker calculated for each property when corrected for the regional average of 30.1% sunshine and wind reduction factor of 37%, to give a more accurate annual average shadow flicker prediction.

Table 5-9 outlines whether a shadow flicker mitigation strategy is required for any property within the study area which may be impacted by shadow flicker.

5.7.6 Shadow Flicker Assessment Results

5.7.6.1 Daily and Annual Shadow Flicker

The WindFarm computer software was used to model the predicted daily and annual shadow flicker levels in significant detail, identifying the predicted daily start and end times, maximum daily duration and the individual turbines predicted to give rise to shadow flicker.

The model results assume worst-case conditions, including

- 100% sunshine during all daylight hours throughout the year,

- An absence of any screening (vegetation or other buildings),
- That the sun is behind the turbine blades,
- That the turbine blades are facing the property, and
- That the turbine blades are moving.

The maximum daily shadow flicker model assumes that daylight hours consist of 100% sunshine. This is a conservative assumption which represents a worst-case scenario. Following the detail provided above on sunshine hours, a sunshine factor of 30.1% has been applied and following the detail provided above on wind frequency, a wind reduction factor of 37% has been applied. Taking these probabilities into consideration, an approximation of the 'estimated actual' annual shadow flicker occurrence has been calculated and is presented in Table 5-9.

The estimated annual levels are then considered in the context of the *'Wind Energy Development Guidelines for Planning Authorities',* DoEHLG, 2006.

As stated in Section 5.7.5.2, there is a total of 63 properties located within the shadow flicker study area, of which 47 are dwellings, 8 are derelict, and 8 are commercial/agricultural buildings. There are no occupied dwellings within 500 metres of any proposed turbine location. The closest occupied dwelling H14 (i.e. dwelling not involved with the Proposed Development) is located at a distance of approximately 700 metres from the nearest proposed turbine T11. There are 2 no. dwellings, H18 & H24 which are located at distances of 638m and 679m from T15 respectively however these are individuals involved with the Proposed Development. The shadow flicker study area and sensitive receptor locations are shown in Figure 5-6. For the purpose of this assessment, a buffer zone of 1.55km has been applied and all properties that are classified as a dwelling or as derelict (i.e. 55 no. properties) within this zone were assessed for any potential shadow flicker impacts from the proposed turbine locations. The 8 commercial/agricultural buildings have been excluded in the property list for shadow flicker modelling.

The 55 No. properties have been modelled as part of the shadow flicker assessment, the results of which are presented in Table 5-9.

Of the 55 No. properties modelled, 33 No. properties may experience daily shadow flicker in excess of the DoEHLG guideline threshold of 30 minutes per day. This prediction is assuming worst-case conditions (i.e. 100% sunshine on days where the shadow of the turbines passes over a house, wind blowing in the correct direction, no screening present, etc.). These conditions are therefore likely to occur only very rarely, if ever. Of these:

- 28 No. properties are occupied dwellings, four of which are occupied by individuals involved with the Proposed Development.
- The remaining 5 No. properties are derelict properties (to clarify following the request by the HSE as discussed in Section 5.7.3 above, these are formerly residential buildings) and therefore do not require any shadow flicker mitigation strategy.

Of the 55 No. properties modelled, when the regional sunshine average (i.e. the mean amount of sunshine hours throughout the year) of 30.1% and wind direction reduction factor (37%) is taken into account, the DoEHLG total annual guideline limit of 30 hours is predicted to be exceeded at 3 No. properties. Additionally, it is worth nothing that the 'estimated actual' shadow flicker listed in Table 5-9 is considered conservative and in reality, the occurrence and/or duration of shadow flicker at these properties is likely to be eliminated or significantly reduced as the following items are not considered by the model:

Table 5-9 Maximum Potential Daily and Annual Shadow Flicker

Building No.	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Turbine	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine and Wind Direction (hrs:min:sec)	Turbine(s) Giving Rise to Exceedance	Mitigation Strategy Required?
1	640265	773572	Dwelling	1189	14	00:00:00	0:00:00	0:00:00	-	No
2	638979	775866	Dwelling	1127	11	00:35:24	52:42:00	10:59:22	8, 10, 11	Yes
3	639016	775795	Dwelling	1054	11	00:37:12	55:18:00	11:31:54	8, 10, 11	Yes
4	640289	773649	Dwelling	1113	14	00:00:00	0:00:00	0:00:00	-	No
5	640330	773542	Dwelling	1175	14	00:00:00	0:00:00	0:00:00	-	No
6	640947	773562	Dwelling	956	14	00:00:00	0:00:00	0:00:00	-	No
7	641116	774222	Derelict	323	14	00:40:12	44:42:00	9:19:17	12	No
8	640084	773521	Dwelling	1264	12	00:00:00	0:00:00	0:00:00	-	No
9	642272	774530	Dwelling	1237	15	00:30:00	13:00:00	2:42:39	14	No
10	642185	774543	Dwelling	1200	14	00:31:48	26:30:00	5:31:34	13, 14	Yes
11	641937	774707	Dwelling	970	14	00:39:00	52:18:00	10:54:22	9, 13, 14	Yes
12	641910	774724	Dwelling	948	14	00:39:36	54:06:00	11:16:53	9, 13, 14	Yes
13	641664	775254	Dwelling	822	5	01:14:24	217:24:00	**45:20:04**	8, 9, 10, 12, 13, 14, 15	Yes
14	639601	775807	Dwelling	703	11	01:17:24	190:18:00	**39:41:00**	7, 8, 9, 10, 11, 12, 13	Yes
15	642951	776614	Dwelling	970	15	00:39:00	55:06:00	11:29:24	3, 4, 5	Yes
16	642901	776844	Dwelling	910	4	00:47:24	67:36:00	14:05:48	2, 3, 4, 5	Yes
17	642806	776444	Dwelling	784	15	00:43:12	91:12:00	19:01:05	3, 4, 5, 15	Yes
18	642756	776340	Dwelling	679	15	00:39:36	89:24:00	18:38:33	3, 4, 5	Yes
19	642706	776361	Dwelling	703	15	00:39:00	87:06:00	18:09:47	3, 4, 5	Yes

Building No.	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Turbine	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine and Wind Direction (hrs:min:sec)	Turbine(s) Giving Rise to Exceedance	Mitigation Strategy Required?
20	642682	776398	Dwelling	743	15	00:54:36	98:18:00	20:29:55	2, 3, 4, 5, 6, 15	Yes
21	642653	776542	Dwelling	754	4	00:53:24	115:42:00	24:07:37	2, 3, 4, 5	Yes
22	642667	776522	Dwelling	776	4	00:51:36	109:36:00	22:51:18	2, 3, 4, 5	Yes
23	642579	776502	Dwelling	713	4	00:58:12	109:12:00	22:46:17	2, 3, 4, 5, 6	Yes
24	642733	776298	Dwelling	638	15	00:46:12	88:00:00	18:21:02	3, 4, 5	Yes
25	642155	778365	Dwelling	1322	2	00:25:48	13:42:00	2:51:25	2	No
26	642239	778362	Derelict	1368	2	00:27:36	18:48:00	3:55:13	2	No
27	642260	775081	Derelict	774	15	00:28:12	38:30:00	8:01:42	6, 9, 13, 14	No
28	638928	775869	Dwelling	1169	11	00:34:12	37:42:00	7:51:42	10, 11	Yes
29	639065	775820	Dwelling	1032	11	00:38:24	61:36:00	12:50:44	8, 10, 11	Yes
30	639192	775658	Derelict	831	11	00:46:12	81:42:00	17:02:13	8, 10, 11, 12	No
31	640310	773582	Derelict	1154	14	00:00:00	0:00:00	0:00:00	-	No
32	642886	776870	Derelict	893	4	00:45:00	68:48:00	14:20:49	2, 3, 4, 5	No
33	643163	777432	Dwelling	1282	4	00:30:36	15:36:00	3:15:11	4	Yes
34	641308	775128	Derelict	564	13	01:27:36	193:18:00	**40:18:32**	10, 11, 12, 13, 14	No
42	642644	776514	Dwelling	761	4	00:55:48	117:00:00	24:23:53	2, 3, 4, 5, 6	Yes
43	642454	777256	Derelict	577	4	01:27:36	123:48:00	25:48:58	2, 3, 4, 5	No
44	640763	773492	Dwelling	1049	14	00:00:00	0:00:00	0:00:00	-	No
46	643256	776221	Dwelling	740	15	00:49:12	109:48:00	22:53:48	4, 5, 15	Yes

Building No.	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Turbine	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine and Wind Direction (hrs:min:sec)	Turbine(s) Giving Rise to Exceedance	Mitigation Strategy Required?
47	643616	775360	Dwelling	896	15	00:43:12	45:18:00	9:26:47	15	Yes
48	643678	776105	Dwelling	1009	15	00:37:48	25:36:00	5:20:18	15	Yes
49	642295	774677	Dwelling	1094	15	00:29:24	13:00:00	2:42:39	14	No
50	643720	776266	Dwelling	1125	15	00:34:48	23:06:00	4:49:01	15	Yes
51	643849	775245	Dwelling	1155	15	00:34:12	26:24:00	5:30:19	15	Yes
52	644046	775197	Dwelling	1356	15	00:29:24	17:36:00	3:40:12	15	No
53	640421	773230	Dwelling	1406	14	00:00:00	0:00:00	0:00:00	-	No
54	642467	774281	Dwelling	1414	15	00:25:48	8:00:00	1:40:06	14	No
55	640496	773182	Dwelling	1422	14	00:00:00	0:00:00	0:00:00	-	No
56	640508	773129	Dwelling	1468	14	00:00:00	0:00:00	0:00:00	-	No
57	641611	773183	Dwelling	1474	14	00:00:00	0:00:00	0:00:00	-	No
58	644197	775241	Dwelling	1486	15	00:27:00	13:00:00	2:42:39	15	No
59	643867	776669	Dwelling	1489	15	00:28:12	22:18:00	4:39:01	15	No
60	643363	777513	Dwelling	1497	4	00:26:24	11:24:00	2:22:38	4	No
61	640609	773065	Dwelling	1500	14	00:00:00	0:00:00	0:00:00	-	No
62	643862	776714	Dwelling	1516	15	00:27:36	24:12:00	5:02:47	15	No
63	641588	773109	Dwelling	1532	14	00:00:00	0:00:00	0:00:00	-	No

- Receivers may be screened by topography, cloud cover and/or vegetation/built form i.e. adjacent buildings, farm buildings, garages or barns;
- Each receiver will not have windows facing in all directions onto the wind farm.
- At distances, greater than 500-1000m *'the rotor blade of a wind turbine will not appear to be chopping the light but the turbine will be regarded as an object with the sun behind it. Therefore, it is generally not necessary to consider shadow casting at such distances'* (Danish Wind Industry Association, accessed 2010).

Section 5.9.3.9 below outlines the mitigation strategies which may be employed at the potentially affected properties to ensure Coole Wind Farm Ltd.'s commitment to zero shadow flicker at occupied residential receptors within 10 rotor diameters of the Proposed Development.

5.7.6.2 Cumulative Shadow Flicker

For the assessment of cumulative shadow flicker, any other existing, permitted or proposed wind farms are considered where they are located within 2 kilometres of the shadow flicker study area. In this case, the closest wind farm is an existing turbine in Ballyjamesduff, Co. Cavan located a distance of 16.4 km from the Wind Farm Site at its closest point. At this distance, there is no potential for shadow flicker in combination with the Proposed Development and therefore no cumulative shadow flicker assessment is required.

5.8 Residential Amenity

Residential amenity relates to the human experience of one's home, derived from the general environment and atmosphere associated with the residence. The quality of residential amenity is influenced by a combination of factors, including site setting and local character, land-use activities in the area and the relative degree of peace and tranquillity experienced in the residence.

As previously noted, the Proposed Development is used for commercial peat-harvesting, forestry, low-intensity pastoral agriculture and public roads, therefore a certain level of industrial activity and traffic movements are already associated with the site, which will assist in the assimilation of the Proposed Development into the receiving environment. The closest occupied dwelling (i.e. dwelling not involved with the Proposed Development) is located at a distance of approx. 700 metres from the nearest proposed turbine. When considering the amenity of residents in the context of a proposed wind farm, there are three main potential impacts of relevance: 1) Shadow Flicker, 2) Noise, and 3) Visual Amenity. Shadow flicker and noise are quantifiable aspects of residential amenity while visual amenity is more subjective. Detailed shadow flicker and noise modelling have been completed as part of this EIAR (Section 5.7 above refers to shadow flicker modelling, Chapter 11 addresses noise). A comprehensive landscape and visual impact assessment have also been carried out, as presented in Chapter 12 of this EIAR. Impacts on population and human health during the construction, operational and decommissioning phases of the Proposed Development is assessed in relation to each of these key issues and other environmental factors such as noise, traffic and dust; see Impacts in Section 5.9 below. The impact on residential amenity is then derived from an overall judgement of the combination of impacts due to shadow flicker, changes to land-use and visual amenity, noise, traffic, dust and general disturbance.

5.9 Likely Significant Impacts and Associated Mitigation Measures

5.9.1 'Do-Nothing' Scenario

An alternative land-use option to developing the Proposed Development would be to leave the site as is under its current planning permission. As detailed in Section 2.5.1 of Chapter 2 a wind energy project comprising of 13 turbines and all associated infrastructure has current planning permission on the Proposed Development site. Where land-use practices of commercial peat-harvesting and forestry continue in conjunction with the permitted wind energy project, the wind farm has been designed to co-exist and operate independently of these land-uses to minimise impacts. Whilst there would be a change of land use within the footprint of the Proposed Development, to facilitate the wind turbines and infrastructure, this was found to be an acceptable part of the permitted development.

This EIAR assesses the potential for peat extraction works on the site to continue as a worst-case scenario. The Proposed Development has been designed to operate on this site should peat extraction continue or cease during the lifetime of the project. Where peat extraction ceases, a site rehabilitation plan will be required which would be likely to encourage revegetation of bare peat areas, with targeted active management being used to enhance re-vegetation and the creation of small wetland areas. Due to the small footprint of the Proposed Development in the context of the entirety of the commercial peat extraction area, a rehabilitation plan where required would take account of the wind farm infrastructure. In doing so, the environmental effects in terms of emissions are likely to be neutral.

The section of the Proposed Development site that does not form part of the currently permitted wind energy development site has a current-land use practice of low-intensity pastoral agriculture. An alternative land-use option to developing a renewable energy project at this section of the Proposed Development site would be to leave the site as it is, with no changes made to the current land-use practices of low intensity pastoral agriculture. The environmental effects of this are considered to be neutral.

A second potential Do -Nothing scenario exists for this project i.e. assuming that the permitted development is not constructed. In this scenario the existing baseline environment will evolve in one of two potential ways, either the peat extraction ceases prior to construction and a rehabilitation plan is developed or the peat extraction continues and then a rehabilitation plan is developed.

In implementing the 'Do-Nothing' alternative, however, the opportunity to capture an additional part of Westmeath's valuable renewable energy resource would be lost, as would the opportunity to contribute in a more meaningful way to meeting Government and EU targets for the production and consumption of electricity from renewable resources and the reduction of greenhouse gas emissions. The opportunity to generate additional local employment and investment would also be lost. It is likely that the trends of population decline and rural deprivation that have been recorded within the Study Area would continue in the absence of investment, as discussed in Section 5 of this EIAR on Population and Human Health. Overall, the potential impact of this is considered to be long term, negative and slight.

The commercial peat harvesting works, forestry, low-intensity pastoral agriculture and public road use can continue in conjunction with this proposed use of the site.

5.9.2 Construction Phase

5.9.2.1 Health and Safety

Pre-Mitigation Impacts

Construction of the Proposed Development will necessitate the presence of a construction site. Construction sites and the machinery used on them pose a potential health and safety hazard to construction workers if site rules are not properly implemented. This will have a short-term potential significant negative impact.

The civil works for the Grid Connection Route involves the construction of joint bays, excavation of trenches, installation of ducting, backfilling and re-instatement of excavated ground for the proposed underground cable. The grid connection works will require the use of machinery along the public road, which in the absence of mitigation or health and safety plans poses a potential hazard to construction workers and members of the public. This will have a short-term potential significant negative impact.

Proposed Mitigation Measures

The Proposed Development will be constructed, operated and decommissioned in accordance with all relevant Health and Safety Legislation, including:

- Safety, Health and Welfare at Work Act 2005 (No. 10 of 2005);
- Safety, Health and Welfare at Work (General Application) Regulations 2007 (S.I. No. 299 of 2007), as amended;
- Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. 291 of 2013), as amended; and
- Safety, Health and Welfare at Work (Work at Height) Regulations 2006 (S.I. No. 318 of 2006).

During construction of the Proposed Development, all staff will be made aware of and adhere to the Health & Safety Authority's '*Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2006'.* This will encompass the use of all necessary Personal Protective Equipment, Risk Assessment and Method Statements and adherence to the site Health and Safety Plan.

Fencing will be erected in areas of the site where uncontrolled access is not permitted. Appropriate health and safety signage will also be erected on this fencing and at locations around and along the site.

Construction traffic will be subject to standard construction health and safety requirements which will ensure traffic speeds are limited to 15 mph/25 kmph.

All works will be carried out in a safe manner and members of the public will be informed through the provision of advance notification and advised in relation to any temporary localised traffic management protocols (e.g. local stop-go traffic control systems etc.). Works areas will be marked and segregated from the general public, through the use of temporary fencing or cones and tape.

Residual Impact

With the implementation of the above, there will be a short-term potential slight negative residual impact on health and safety during the construction phase of the Proposed Development.

Significance of Effects

Based on the assessment above there will be no significant direct and indirect effects on health and safety during the construction phase of the Proposed Development.

5.9.2.2 Employment and Investment

The design, construction and operation of the wind farm will provide employment for technical consultants, contractors and maintenance staff. Up to approximately 135[3] jobs could be created during the construction, operation and maintenance phases of the Proposed Development. The construction phase of the wind farm will last between approximately between 12 – 18 months. Most construction workers and materials will be sourced locally, thereby helping to sustain employment in the construction trade. This will have a short-term significant positive impact.

The injection of money in the form of salaries and wages to those employed during the construction phase of the project has the potential to result in an increase in household spending and demand for goods and services in the local area. This would result in local retailers and businesses experiencing a short-term positive impact on their cash flow. This will have a short-term slight positive indirect impact.

The Proposed Development will result in an influx of skilled people into the area, bringing specialist skills for both the construction and operational phases that could result in the transfer of these skills into the local workforce, thereby having a long-term positive impact on the local skills base. Up-skilling and training of local staff in the particular requirements of the wind energy industry is likely to lead to additional opportunities for those staff as additional wind farms are constructed in Ireland. This will have a long-term moderate positive indirect impact. According to the Irish Wind Energy Association there are over 4,400 jobs related to wind energy in Ireland in 2019, a figure which is projected to grow to over 6,000 by 2020.

Rates payments in the region of €540,000 per annum for the Proposed Development will contribute significant funds to Westmeath County Council, which will be redirected to the provision of public services within Co. Westmeath. These services include provisions such as road upkeep, fire services, environmental protection, street lighting, footpath maintenance etc. along with other community and cultural support initiatives.

Proposed Community Benefit Scheme

An important part of wind farm development is the Community Benefit Scheme. The concept of directing benefits from wind farms to the local community is promoted by the DCCAE through the new Renewable Electricity Support Scheme (RESS), the National Economic and Social Council (NESC) and the Wind Energy Ireland (WEI) among others. The new RESS in particular promotes the concept of directing benefits from locally generated electricity, back to the local area and local community. It also seeks to maximise local community involvement in decision making regarding how community benefit funds could deliver real and tangible benefits of the local area. This is a concept that Coole Wind Farm has incorporated in its community engagement since the development of the CLS in 2016.

While it may be simpler and easier to put a total fund aside for a wider community area, Coole Wind Farm is endeavouring to develop new ways to direct increased gain towards the local community with particular focus on those living closest to the wind farm. Given that local people understand the needs and requirements of the local community best, consultation with those in the local community on the form that the community benefit package should take has formed an integral part of developing this

[3] *Deloitte & IWEA, Jobs and Investment in Irish Wind Energy – Powering Ireland's Economy.*

proposal. The Proposed Development has the potential to have significant benefits for the local economy, by means of job creation, landowner payments and commercial rate payments.

As part of the permitted 13 turbine project, commitments were made in relation to Community Benefit Proposals. These proposals will continue to be honored as part of the project now proposed. The level of community funding associated with this proposal has significantly increased (from an initial €1.25M to c.€7.5M) as a result of the proposed design changes and requirements of the new RESS scheme. Based on the permitted 13 turbine project, a Community Benefit Fund in the region of up to €1.25 million was proposed over the lifetime of the project with the value of the fund directly proportional to the level of installed MW's on the wind farm. Based on the current 15 turbine layout and design, should the Coole Wind Farm be developed under RESS, it would attract an increased community contribution above this of in the region of approx. €500,000/year for the local community for the lifetime this support. Further information is provided in the RESS Community Benefit Fund section below.

Community Benefit Proposals are directed by feedback from ongoing consultation with the local community and through feedback/comment forms completed from the public consultation event held in February 2017. Those spoken to in the local area felt that the project should bring with it real and tangible benefits for the local community and that these should be developed at an early stage from operation of the wind farm.

Aspirations expressed by the community in the local area to date include:

- Financial assistance for local community buildings such as the local Church.
- The development of facilities for the elderly in the area and specifically the continuation of previous plans for nursing home facilities in the local area.
- Improvements to the local broadband services in the area.
- Supports for existing local groups such as the Mother and Toddler Group and the Tidy Towns.
- Development of new services such as local adult computer classes, women's fitness classes and a 'Men's Shed'.
- Assistance for the community in providing a local amenity and recreation area.
- The development of all-weather sports facilities in the area.
- An energy efficiency scheme for homes in the local area.
- A community educational scheme.
- A community enterprise scheme.

The input and suggestions of the local community will continue to be sought. In order to assist the community in achieving the aspirations for the area, Coole Wind Farm Ltd. will work to provide flexibility in the annual payments structure allowing for larger payments towards the earlier stages of operation where appropriate projects of scale are identified.

RESS Community Benefit Fund

Details were announced on the 24th July 2018 of the new RESS with the detailed terms and conditions of this scheme being confirmed in February 2020. Renewable energy projects which are developed under this scheme will have a significantly increased community benefit fund associated with them and for wind energy, this contribution is currently set at €2/MWhr.

A fundamental basic of the community aspect of RESS is the ambition to develop the concept of the Energy Citizen. This concept is being promoted by ensuring significant return to local communities/areas and seeking to maximise the level of local involvement in terms of the decision-making processes. This input will influence how community benefit funds are spent and where benefit is delivered.

As mentioned above, based on the current layout and design, should the Coole Wind Farm be developed under RESS, it would attract a community contribution in the region of approx.

€500,000/year for the local community for the lifetime this support. The value of this fund would be directly proportional to the electricity generated by the wind farm. This would offer a significant opportunity in terms of bringing economic, environmental and social benefits to the local area. The terms and conditions of RESS 1, set out how the community benefit aspect of this scheme will be structured at a high level. It is widely accepted that RESS 1 will form the blueprint for the terms and conditions of future RESS auctions however it is expected that this will evolve in the years to come. One such aspect of this scheme that is expected to evolve, is a mechanism that will allow local communities invest and get a return from renewable energy projects. The Dept. have indicated that they are committed to developing this feature of RESS and should this be included in future RESS auctions, it will be applicable to the Coole Wind Farm project if the proposal is successful in gaining RESS support.

Under current t&c's of RESS, the following would be required for Coole Wind Farm:

- **Direct payments** – to those living closest to the wind farm. A minimum €1,000 payment per annum for houses within 1km of the development.
- **Energy Efficiency** – Approximately €200,000 per year would be available for the development of energy initiatives to benefit people living in the local area. This is to be provided to not for profit community enterprises.
- **Support for local groups** – In excess of €200,000 per year would be available for local groups, clubs and not for profit organisations that provide services in the local area. This would include services for the elderly, local community buildings, groups such as the parent and toddler group and the development of sporting facilities such as all weather playing pitches etc. Community broadband initiatives could also be considered.
- **Administration costs** - a maximum of 10% of this fund to be made available for the administration and governance costs of the fund.

It is important to note that this funding would be directed toward the local area in the first instance and community input will be sought to influence how this funding should be distributed in the local area.

Direct Return

As outlined above, the RESS terms and conditions mandate that a minimum of €1,000 per annum be made available to all households located within 1km of the wind farm. For the Coole Wind Farm, this would mean that all 18 houses which are located within 1km of the proposed turbines would receive this direct return, distributing €18,000 per annum to local households. It should also be noted that RESS allows for larger direct payments and a wider area (out to 2km) to be considered where appropriate. Coole Wind Farm Ltd will work with the local community, and within any guidelines to be published by the Department, to establish how the direct return aspect of this proposal might be delivered most appropriately.

Feedback during consultation with the local community indicated that it was felt that those closest to the proposed project should benefit directly from the wind farm. Previous commitments made on the Local Household Dividend Scheme for the permitted 13 turbine layout will be maintained under the RESS. This dividend from the wind farm is aimed to allow people in the local area to directly benefit from the wind farm and thus improve the economic sustainability of not only individual households but the local community overall. It is hoped that households receiving a financial return from the wind farm will help to get people actively involved in renewable energy and help people to recognize the opportunities associated with our country's transition towards becoming a low carbon economy.

Local Community Enterprise Involvement in RESS

RESS1 terms and conditions set out that a not for profit community enterprise should receive 40% of the community benefit fund. This community enterprise's primary focus or aim will be the promotion of initiatives towards the UN sustainable development goals, in particular Goals 4, 7, 11 and 13, including education, energy efficiency, sustainable energy and climate action initiatives.

This aspect of the community benefit fund can support the development of Greener Living Initiatives within the local area and is in line with feedback that we have received on local aspirations for the use of the community benefit fund. This aspect can also support, and expand, the development of the Greener Homes Scheme committed to for the permitted 13 turbine project within the local area. Approximately €200,000 per annum would be available for these initiatives.

Examples of initiatives that could potentially be supported would include:

- Converting to low carbon home heating solutions such as heat pumps;
- Increasing the BER rating of local homes;
- Carrying out energy efficiency works to homes;
- Installation of wiring for Electric vehicle charging;
- Support for those who would like to buy an Electric Vehicle; and
- Supporting remote working.

The majority of those spoken to during the consultation with the local community see the long-term financial benefits transitioning towards low carbon solutions and reducing their overall energy usage while others expressed interest in receiving a payment which would go directly towards their electricity bills. In Ireland's move towards transitioning to a low carbon economy Coole Wind Farm Ltd. would like to assist the local community in becoming more energy savvy and see locals reaping long term gains from this scheme. Coole Wind Farm Ltd. will also consider requests from those who feel that contributions towards electricity bills in the short term might be more appropriate for them.

Local Community groups in RESS

The balance of funding which would be expected to be in excess of €200,000 per annum (after stipulated allocations and administration costs) will be distributed within the area to local groups and households in line with the RESS terms and conditions. The allocation of this funding will be influenced by local community feedback, inputs and requirements.

Expected future RESS Community Investment opportunities

In addition to the significantly increased community benefit fund that will be associated with RESS projects, it is envisaged that future RESS auction terms and conditions will require that projects developed under the new scheme will also have a requirement to offer a community investment opportunity to people living in the local area. During the consultation with the local community much interest was expressed in terms of the role that the Proposed Development can play in combatting climate change and reducing dependencies on fossil fuels while opening up opportunities for those in the local area and bringing benefit locally. In order to provide those in the wider community with an opportunity to get involved in green projects and have an interest in this project specifically, Coole Wind Farm Ltd. will work to develop this facility where available under RESS.

Whilst this initiative was proposed in the draft terms and conditions for RESS1, it was removed as the full workings of this aspect of the scheme had not been finalised. The department have however indicated their intention to further develop this proposal and to include it in future RESS auctions.

Local Business Support Strategy

During Coole Wind Farm Ltd.'s engagement with the local community, the opinion was expressed that local businesses should benefit from the development of the proposed wind farm. In response to this and as a part of Coole Wind Farm Ltd.'s commitment to seek to increase the economic sustainability of areas surrounding wind farm developments, the applicant continues to develop a Local Business Support Strategy. This strategy is aimed at maximising the economic return for the local area by ensuring that local suppliers, contractors and business are considered for all appropriate opportunities.

The Local Business Support Strategy includes the following:

- The development and maintenance of an up to date Local Business Database;
- The communication of all potential contract/supply opportunities to businesses and individuals on this database;
- The provision of contact details for a dedicated Project Liaison Officer who will facilitate and assist local business in endeavours to apply for contracts or supply agreements;
- The inclusion of the Local Business Database in invitations to tender being sent to potential main contractors interested in securing contracts during the construction and operation of the Proposed Development;
- Tenderers will be required to provide a statement of Local Economic Gain in their tender documents with consideration of local business involvement a material consideration in the tendering process; and
- During construction and operation, contractors will be required to report on performance in terms of both the number of local businesses supplying services or goods to the project and the local economic benefit accruing therefrom.

A Local Business Database is being developed and businesses are being encouraged to provide details on the services or goods that they feel that they could deliver relevant to the construction and operation of the wind farm. This information will be passed on to all contractors tendering for works on the Proposed Development. During consultation with the local business community, the Local Business Support Strategy and the formation of the Local Business Database has been very well received.

In addition to local economic benefit that can be derived directly from the construction and operation of the wind farm, the Community Benefit Package proposed also offers significant local economic opportunity in its own right. The Local Community Enterprise Scheme would further provide opportunities for local businesses and tradesmen to retrofit existing houses to make them greener and more energy efficient. Whilst the responsibility of administering this fund may not ultimately lie solely with the wind farm operator, it would be intended that the principles of the Local Business Support Strategy would also apply i.e. communication of Local Business Database.

Overall, it is concluded that the socio-economic impacts of the proposed Coole Wind Farm will be beneficial on a local, regional and national level.

5.9.2.3 Population

Those working on the construction phase of the Proposed Development will travel daily to the site from the wider area. Specialist electrical contractors will also be employed in the construction of the Grid Connection Route, who may be required to travel from further afield. The construction phase will have no impact on the population of the area in terms of changes to population trends or density, household size or age structure.

5.9.2.4 Land-use

This EIAR assesses the potential for peat extraction works on the site to continue as a worst-case scenario. The Proposed Development has been designed to operate on this site should peat extraction continue or cease during the lifetime of the project. The commercial peat harvesting works, can continue in conjunction with this proposed use of the site while the Wind Farm Site is under construction. It is envisaged that the current land uses of forestry, low-intensity and pastoral agriculture will continue on site in conjunction with the Wind Farm Site. The Proposed Development will have no impact on existing land-uses as it has been designed to co-exist with these land-uses. Whilst there will be a change of land use to facilitate the development of the wind turbines and infrastructure, this is an acceptable and unavoidable part of the Proposed Development.

The existing land-use of public roads will continue on the Grid Connection Route. There will be a requirement to place an unbound surface layer over the underground cable route where it transverses forestry and agricultural land, as per ESB design requirements, in order to accommodate maintenance vehicles. This is an acceptable and unavoidable part of the Proposed Development.

5.9.2.5 Tourism and Amenity

Pre-Mitigation Impacts

Given that there are currently no tourism attractions specifically pertaining to the site there are no impacts associated with the construction phase of the Proposed Development. With regard to tourist attractions and amenity use around the site, described in Section 5.3.2, traffic management safety measures will be in place.

In terms of the Grid Connection Route, as there will be some traffic restrictions in place through the construction phase, there may be a short-term slight negative effect to local tourism. Any impacts associated with the underground grid connection route will however be limited to the active construction area (generally a few hundred-metre stretch of road, with crews starting at each end of the route) and will be temporary in nature.

It is considered that the construction phase of the Proposed Development has the potential to give rise to an indirect short-term slight negative impact on tourism in the area, given that a greater number of vehicles associated with construction will be using the road than would otherwise be the case.

Following the implementation of mitigation measures outlined below, the potential residual effect is considered to be short-term in duration, on the basis that any potential impact will only arise during the construction phase.

Proposed Mitigation Measures

Construction of the Proposed Development has been designed to work in conjunction with a traffic management plan which will be developed to ensure a safe system of works, allowing access to be maintained during the construction period. Where road closures are required to facilitate underground cabling works along narrow stretches of the public road, appropriate diversions and alternative routes for through traffic will be put in place. Please see traffic impacts below for further details on proposed mitigation measures.

Residual Impact

Short-term imperceptible negative impact.

Significance of Effects

Based on the assessment above there will be no significant effects.

5.9.2.6 Noise

Pre-Mitigation Impacts

There will be an increase in noise levels in the vicinity of the Proposed Development during the construction phase, as a result of heavy machinery and construction work which has the potential to cause a nuisance to sensitive receptors located closest the Proposed Development. These impacts will be short-term in duration. The noisiest construction activities associated with wind farm development are excavation and pouring of the turbine bases and the extraction of stone from the borrow pit.

Excavation of a base can typically be completed in one to two days however, and the main concrete pours are usually conducted in one continuous pour, which is done within a matter of hours.

The options of rock breaking and blasting were both considered for the extraction of rock from the proposed borrow pit. Based on feedback received from the local community, Coole Wind Farm Ltd. has revised this proposal, and blasting is no longer proposed as an option here.

Construction noise at any given noise sensitive location will be variable throughout the construction project, depending on the activities underway and the distance from the main construction activities to the receiving properties. The potential noise impacts that will occur during the construction phase of the Proposed Development are further described in Chapter 11: Noise and Vibration.

With regard to the Grid Connection Route, construction works may give rise to noise impacts on sensitive receptors in the area, however these noise impacts will be temporary in nature as the works move along the Grid Connection Route.

Proposed Mitigation Measures

Best practice measures for noise control will be adhered to onsite during the construction phase of the Proposed Development in order to mitigate the slight short-term negative impact associated with this phase of the development. These measures will include:

- No plant used on site will be permitted to cause an on-going public nuisance due to noise.
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract.
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers.
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.
- Any plant, such as generators or pumps, which is required to operate outside of general construction hours will be surrounded by an acoustic enclosure or portable screen.
- During the course of the construction programme, supervision of the works will include ensuring compliance with the limits detailed in Chapter 11 using methods outlined in British Standard BS 5228-1:2014+A1:2019 Code of practice for noise and vibration control on construction and open sites – Noise.
- The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 7:00hrs and 19:00hrs Monday to Saturday. However, to ensure that optimal use is made of good weather periods or at critical periods within the programme (i.e. concrete pours, large turbine component delivery, rotor/blade lifting) it could occasionally be necessary to work outside of these hours which will be agreed with the local authority where required.

Where rock breaking is employed in relation to the proposed borrow pit location, the following are examples of measures that will be employed, where necessary, to mitigate noise emissions from these activities:

- Fit suitably designed muffler or sound reduction equipment to the rock breaking tool to reduce noise without impairing machine efficiency.
- Ensure all leaks in air lines are sealed.
- Use a dampened bit to eliminate ringing.
- Erect acoustic screen between compressor or generator and noise sensitive area. When possible, line of sight between top of machine and reception point needs to be obscured.

- Enclose breaker or rock drill in portable or fixed acoustic enclosure with suitable ventilation.

Residual Impact

Following the implementation of the above mitigation measures, there will be a short-term imperceptible negative residual impact due to an increase in noise levels during the construction phase of the Proposed Development.

Significance of Effects

Based on the assessment above there will be no significant direct or indirect effects.

5.9.2.7 Air (Dust)

Pre-Mitigation Impacts

Potential dust emission sources during the construction phase of the Proposed Development include tree felling, upgrading of existing access tracks and construction of new access roads, turbine foundations, construction compound, borrow pit, substation and laying of underground cabling. An increase in dust emissions has the potential to cause a nuisance to sensitive receptors in the immediate vicinity of the site. The entry and exit of construction vehicles from the site may result in the transfer of mud to the public road, particularly if the weather is wet. This may cause nuisance to residents and other road users. These impacts will not be significant and will be relatively short-term in duration. The potential dust impacts that may occur during the construction phase of the Proposed Development are further described in Chapter 10: Air and Climate.

Proposed Mitigation Measures

All aggregate material for the construction of roads and turbine bases will be sourced onsite and will only be outsourced where necessary; therefore, reducing the need to transport this material to the site. Truck wheels will be washed to remove mud and dirt before leaving the site. All plant and materials vehicles shall be stored in the dedicated compound area. Areas of excavation will be kept to a minimum, and stockpiling will be minimised by coordinating excavation, spreading and compaction. Construction traffic will be restricted to defined routes and a speed limit will be implemented.

In periods of extended dry weather, dust suppression may be necessary during tree felling, along haul roads and around the borrow pit areas to ensure dust does not cause a nuisance. If necessary, water will be taken from the site's drainage system, and will be pumped into a bowser or water spreader to dampen down haul roads and the temporary site compound to prevent the generation of dust. Silty or oily water will not be used for dust suppression, because this would transfer the pollutants to the haul roads and generate polluted runoff or more dust. Water bowser movements will be carefully monitored, as the application of too much water may lead to increased runoff.

Construction of the Grid Connection Route will be undertaken by two crews, one crew will start at one end of the Grid Connection Route with the other team starting approximately half way along the Grid Connection Route. Both teams will be constructing in the same direction maintaining a distance between the teams of approx. 13km. The active construction area for the Grid Connection Route will be small, ranging from 150 to 300 metres in length at any one time by each crew, and it will be transient in nature as it moves along the route. All construction machinery will be maintained in good operational order while on-site, minimising any emissions that are likely to arise. Aggregate materials for the construction of the underground grid connection route will be sourced from the on-site borrow pit to reduce the amount of emissions associated with vehicle movements.

Potential dust emissions during the construction period will not be significant and will be relatively short-term in duration.

Residual Impact

Following the implementation of the above mitigation measures, there will be a short-term imperceptible impact due to dust emissions from the construction of the Proposed Development.

Significance of Effects

Based on the assessment above there will be no significant direct or indirect effects.

5.9.2.8 Traffic

Pre-Mitigation Impacts

The delivery of large wind turbine components includes for the construction of a link road between the R395 and R396 Regional Roads to facilitate turbine delivery, and junction improvement works to facilitate turbine delivery including: hardsurfacing at the N4 in the vicinity of its junction with the L1927 Local road in the townland of Joanstown; Temporary removal of the existing hedgerow and hardsurfacing before the railway line level crossing on the L1927; hardsurfacing and widening of the L1927 and L5828 junction in the townland of Boherquill; clearing of existing verge and vegetation and hardsurfacing at the gentle right turn from the L5828 onto the R395; hardsurfacing including clearance of vegetation and road verge to provide access and egress at proposed link road; hardsurfacing including clearance of vegetation and road verge at site access points off the R396, and at four points along the L5755. The planning application includes for the construction of underground electricity cabling from the proposed onsite substation located in the townland of Camagh. This connection is carried out via an underground cable which is almost entirely contained within the public road corridor to the existing 110kV Mullingar substation located in the townland of Irishtown. Proposed upgrade works at the existing Mullingar substation will consist of the construction of an additional dedicated bay to facilitate connection of the cable. The total length of the proposed cable route is approximately 26 kilometres. The construction phase of the Proposed Development will last for approximately 12 -18 months. The proposed turbine delivery and construction traffic route is shown in Figure 14-1 in Chapter 14 of this EIAR.

Non-turbine construction traffic will follow the same transport route as the wind turbines to the Proposed Development site if they are coming from the direction of the N4 National Primary Road. Traffic approaching from the direction of Granard will use the R396 to the site, while those approaching from the direction of Castlepollard will use the R395 before turning onto the R396 at Coole. Traffic from the eastern section of the Wind Farm Site will use the short section (approximately 1.6 kilometres) of local road L5755 that connects the borrow pit to the remainder of the Wind Farm Site. Non-turbine construction traffic will be comprised of Heavy Goods Vehicle (HGV) and Light Goods Vehicle (LGV) movements involved in the delivery of construction materials to the site and the export of excess construction materials and plant from the site. A complete Traffic and Transportation Assessment (TTA) of the Proposed Development has been carried out by Alan Lipscombe Traffic and Transport Consultants. The full results of the TTA are presented in Section 14.1 of Chapter 14: Material Assets.

The types of vehicles that will be required to negotiate the local network represent abnormal size loads and a detailed assessment of the geometry of the proposed route was therefore undertaken. This will have a temporary slight to moderate negative impact on existing road users, which will be minimised with the implementation of the mitigation measures included in the proposed traffic management plan.

In terms of the Grid Connection Route, as there will be some traffic restrictions in place through the construction phase, there may be a short-term slight negative effect to local traffic. Construction of the Grid Connection Route will be undertaken by two crews, one crew will start at one end of the Grid Connection Route with the other team starting approximately half way along the Grid Connection Route. Both teams will be constructing in the same direction maintaining a distance between the teams of approx. 13km. The active construction area for the Grid Connection Route will be small, ranging from 150 to 300 metres in length at any one time by each crew, and it will be transient in nature as it moves along the route. Any impacts associated with the underground Grid Connection Route will however be limited to the active construction area and be temporary in nature.

Proposed Mitigation Measures

A Traffic Management Plan will be developed and implemented to ensure any impact is short term in duration and slight in significance during the construction of the Proposed Development. Prior to commencement of any works, the occupants of dwellings in the vicinity of the proposed works will be contacted and the scheduling of works will be made clear. Local access to properties will also be maintained throughout any construction works and local residents will also be supplied with the number of the works supervisor in order to ensure that disruption will be kept to a minimum.

The majority of aggregate materials for the construction of any additional site tracks will be obtained from the proposed borrow pit within the Wind Farm Site. This will significantly reduce the travel time and distances travelled by delivery vehicles required to access the site.

Residual Impact

Once a traffic management plan is implemented for the construction phase of the Proposed Development, there will be a short-term imperceptible negative residual impact on local road users.

Significance of Effects

Based on the assessment above there will be no significant direct or indirect effects.

5.9.2.9 Shadow Flicker

Shadow flicker, which occurs during certain conditions due to the movement of wind turbine blades, as described in Section 5.7 of this chapter, occurs only during the operational phase of a wind energy development. There are therefore no shadow flicker impacts associated with the construction phase of the Proposed Development.

5.9.3 Operational Phase

The effects set out below relate to the operational phase of the Proposed Development including the period when turbines are being commissioned.

5.9.3.1 Health and Safety

Pre-Mitigation Impact

The operational phase of the Proposed Development poses little threat to the health and safety of the public. The Department of the Environment, Heritage and Local Government (DoEHLG)'s '*Wind Energy Development Guidelines for Planning Authorities 2006*' state that there are no specific safety considerations in relation to the operation of wind turbines. Fencing or other restrictions are not necessary for safety considerations. People or animals can safely walk up to the base of the turbines.

The DoEHLG Guidelines state that there is a very remote possibility of injury to people from flying fragments of ice or from a damaged blade. However, most blades are composite structures with no bolts or separate components and the danger is therefore minimised. The build-up of ice on turbines is unlikely to present problems. The wind turbines will be fitted with anti-vibration sensors, which will detect any imbalance caused by icing of the blades. The sensors will cause the turbine to wait until the blades have been de-iced prior to beginning operation.

The turbine blades are typically manufactured of wood and laminated layers of glass fibre which will prevent any likelihood of an increase in lightning strikes within the site of the optimised development or the local area. Lightning protection conduits will be integral to the construction of the turbines. Lightning conduction cables, encased in protection conduits, will follow the electrical cable run, from the nacelle to the base of the turbine. The conduction cables will be earthed adjacent to the turbine base. The earthing system will be installed during the construction of the turbine foundations. There will be no impact on health and safety.

It is not anticipated that the operation of the wind farm will present a danger to the public and livestock. Rigorous safety checks are conducted on the turbines during design, construction, commissioning and operation to ensure the risks posed to staff, landowners and general public are negligible.

Proposed Mitigation Measures

Notwithstanding the above, the following mitigation measures will be implemented during the operation of the Proposed Development to ensure that the risks posed to staff and landowners remain negligible throughout the operational life of the wind farm.

Access to the turbines is through a door at the base of the structure, which will be locked at all times outside maintenance visits.

Staff associated with the project will conduct frequent visits, which will include inspections to establish whether any signs have been defaced, removed or are becoming hidden by vegetation or foliage, with prompt action taken as necessary.

Signs will also be erected at suitable locations across the site as required for the ease and safety of operation of the wind farm. These signs include:

- Buried cable route markers at 50m (maximum) intervals and change of cable route direction;
- Directions to relevant turbines at junctions;
- “No access to Unauthorised Personnel” at appropriate locations;
- Speed limits signs at site entrance and junctions;
- “Warning these Premises are alarmed” at appropriate locations;
- “Danger HV” at appropriate locations;
- “Warning – Keep clear of structures during electrical storms, high winds or ice conditions” at site entrance;
- “No unauthorised vehicles beyond this point” at specific site entrances; and
- Other operational signage required as per site-specific hazards.

An operational phase Health and Safety Plan will be developed to fully address identified Health and Safety issues associated with the operation of the site and providing for access for emergency services at all times.

The components of a wind turbine are designed to last a minimum of 30 years and are equipped with a number of safety devices to ensure safe operation during their lifetime. During the operation of the wind farm regular maintenance of the turbines will be carried out by the turbine manufacturer or appointed service company. A project or task specific Health and Safety Plan will be developed for these works in accordance with the site's health and safety requirements.

Residual Impact

With the implementation of the above mitigation measures, there will be a long-term, imperceptible residual impact on health and safety during the operational life of the Proposed Development.

Significance of Effects

Based on the assessment above there will be no significant direct or indirect effects.

5.9.3.2 Employment and Investment

The operational phase will present an opportunity for mechanical-electrical contractors and craftspeople to become involved with the maintenance and operation of the wind farm. On a long-term scale, the Proposed Development will create approximately 2 jobs during the operational phase relating to the maintenance and control of the wind farm, having a long-term slight positive effect.

Rates payments for the wind farm will contribute significant funds to Westmeath County Council, which will be redirected to the provision of public services within Co. Westmeath. These services include provisions such as road upkeep, fire services, environmental protection, street lighting, footpath maintenance etc. along with other community and cultural support initiatives.

5.9.3.3 Population

The operational phase of the Proposed Development will have no impact on the population of the area with regards to changes to trends, population density, household size or age structure.

5.9.3.4 Property Values

As noted in Section 5.6 above, the conclusions from available international literature indicate that property values are not impacted by the positioning of wind farms near houses. It is on this basis that it can be reasonably concluded that there would be a long-term imperceptible impact from the Proposed Development.

5.9.3.5 Land-use

This EIAR assesses the potential for peat extraction works on the site to continue as a worst-case scenario. The Proposed Development has been designed to operate on this site should peat extraction continue or cease during the lifetime of the project. The existing commercial peat harvesting works, can continue in conjunction with this proposed use of the site while the Wind Farm Site is under construction. It is envisaged that the current land uses of forestry, low-intensity and pastoral agriculture will continue on site in conjunction with the Wind Farm Site. The Proposed Development will have no impact on existing land-uses as it has been designed to co-exist with these land-uses. Whilst there will be a change of land use to facilitate the development of the wind turbines and infrastructure, this is an acceptable and unavoidable part of the Proposed Development.

The existing land-use of public roads will continue on the Grid Connection Route. There will be a requirement to place an unbound surface layer over the underground cable route where it transverses forestry and agricultural land, as per ESB design requirements, in order to accommodate maintenance vehicles. This is an acceptable and unavoidable part of the Proposed Development.

The Proposed Development will have no impact on other land-uses within the wider area.

5.9.3.6 Noise

A baseline assessment of the existing background noise conditions was carried out, the results of which are presented in Chapter 11: Noise & Vibration. A noise assessment of the operational phase of the Proposed Development has also been carried out through modelling of the development using noise prediction software. The predicted noise levels for the Proposed Development have been compared with the existing background noise levels and the best practice guidance levels for noise emissions from wind farms as set out by the Department of the Environment, Heritage and Local Government (DoEHLG). There is no other wind energy development within 5km of the proposed development to be considered in a cumulative noise impact assessment.

Details of the noise assessment carried out by AWN Consulting are presented in Chapter 11 of the EIAR. The noise assessment determined that the predicted operational noise effect at the closest noise sensitive receptors to the site is of a moderate, negative, long-term nature. It is noted that this effect considers the periods of greatest potential effect prior to mitigation, i.e. the worst-case scenario. For the majority of locations assessed, operation of the proposed turbines will have a slight, negative, long-term effect. The noise assessment notes that these effects should be considered in terms that the effect is variable, and that this assessment considers periods of the greatest potential effect.

As stated in the noise assessment in Chapter 11, the assessment identified that there are two Noise sensitive locations (NSLs) where potential exceedances are predicted. If confirmed during post-construction monitoring, a curtailment strategy will be implemented to reduce noise levels due to the wind farm to within the criteria at all NSLs.

5.9.3.7 Traffic

One to two service technicians may have to attend to the site of the proposed wind farm on a weekly basis during the operational phase of the Proposed Development. A Traffic and Transportation Assessment (TTA) of the Proposed Development has been completed by Alan Lipscombe Traffic and Transport Consultants, the results of which are presented in Section 14.1 of this EIAR. The TTA found that there will be a long-term neutral impact on traffic created during the operational phase of the Proposed Development.

On completion of the Grid Connection Route, the road corridors in which the works are to be undertaken will be fully reinstated, leaving no visible above-ground evidence of the proposed works that have the potential to give rise to any operational phase effects. The reinstatement planned for the public road corridor will be agreed with Westmeath County Council prior to any works taking place. During the operational phase of the Grid Connection Route, there will be access required by maintenance workers.

5.9.3.8 Tourism

Given that there are currently no tourism attractions or amenity walkways located within the Proposed Development site there are no impacts associated with the operational phase of the Proposed Development. The Department of the Environment, Heritage and Local Government's *Wind Energy Development Guidelines for Planning Authorities* 2006 state that "*the results of survey work indicate that tourism and wind energy can co-exist happily*". It is not considered that the Proposed Development would have an adverse impact on tourism infrastructure in the vicinity.

5.9.3.9 Shadow Flicker

Pre-Mitigation Impact

Assuming worst-case conditions, a total of 33 properties may experience daily shadow flicker in excess of the DoEHLG guideline threshold of 30 minutes per day. Of these 33 properties, 5 no. are currently derelict, and 4 no. are participating properties. The DoEHLG total annual guideline limit of 30 hours is exceeded at 3 properties once the regional sunshine average of 30.1% and wind reduction factor of 37% is considered.

As detailed above in Section 5.7.3, the assessment herein is based on compliance with the DoEHLG Guidelines (2006) limit (30 hours per year or 30 minutes per day), however in line with the commitment made for the permitted Coole Wind Farm (See Section 2.5.1 in Chapter 2 of this EIAR) and following continuing engagement with the local community, Coole Wind Farm Ltd. continues to commit to zero shadow flicker at occupied residential receptors within 10 rotor diameters of the Proposed Development.

Proposed Mitigation Measures

Where shadow flicker exceedances are experienced at buildings, a site visit will be undertaken firstly to determine the level of occurrence, existing screening and window orientation. If annoyance is found, suitable mitigation measures such as wind turbine control measures including turbine shutdown and/or screening will be employed to eliminate the exceedance to zero shadow flicker at the affected property. In event of an exceedance the procedure for logging public complaints is outlined in the CEMP at Appendix 4-8.

As the shadow flicker assessment is based on a "bare-earth" scenario, a screening assessment which accounts for features such as undulations in local topography, built structures such as sheds or walls, or vegetation, may find that there is no requirement for further mitigation strategies. In the absence of screening features as described above, a number of screening measures will be proposed to the affected property owner, including the installation of window blinds or curtains in affected rooms, planting of screening vegetation or other site-specific measures agreeable to the affected party.

Residual Impact

Shadow flicker could potentially have a long-term slight negative impact. However, as the applicant has committed to exceeding the existing daily and annual guideline requirement and committed to zero shadow flicker at occupied residential receptors, there will be no impact from shadow flicker on human beings.

Significance of Effects

Based on the assessment above and the mitigation measures proposed there will be no significant effects related to shadow flicker.

5.9.3.10 Interference with Communication Systems

Wind turbines, like all large structures, have the potential to interfere with broadcast signals, by acting as a physical barrier or causing a degree of scattering to microwave links. The alternating current, electrical generating and transformer equipment associated with wind turbines, like all electrical equipment, also generates its own electromagnetic fields, and this can interfere with broadcast communications. The most significant effect at a domestic level relates to a possible flicker effect caused by the moving rotor, affecting, for example, radio signals. The most significant potential effect occurs where the wind farm is directly in line with the transmitter radio path. This interference can be overcome by the installation of deflectors or repeaters.

As part of the scoping and consultation exercise undertaken by MKO, the national and regional broadcasters and fixed and mobile phone operators were contacted regarding potential interference from the Wind Farm Site. Full details are provided in of Chapter 2: Background to the Proposed Development and Section 14.2 (Telecommunications and Aviation) of Chapter 14: Material Assets. Copies of the scoping responses received are presented in Appendix 2-1 of the EIAR.

Reponses were received from BT Communications Ireland, ComReg (Commission for Communications Regulation), Eir, ENET Telecommunications, ESB Telecoms, Irish Aviation Authority, Imagine Group, Ripplecom, RTE Transmission Network (2rn), Tetra Ireland Communications, Three Ireland, Viatel, Virgin Media, and Vodafone Ireland.

Further detail on the actions taken to ameliorate any potential interference, including micro-siting of turbines can be found in Chapter 2 and Chapter 14. Following these measures, there will be no interference risk from any of the proposed turbines providing the design complies with recommended buffer zones and telecommunication solutions. Therefore, the Wind Farm Site will have no impact on telecommunications.

5.9.3.11 Residential Amenity

Pre-Mitigation Impacts

Potential impacts on residential amenity during the operational phase of the Proposed Development could arise primarily due to noise, shadow flicker or changes to visual amenity. Detailed noise and shadow flicker modelling have been carried out as part of this EIAR, which shows that the Proposed Development will be capable of meeting all required guidelines in relation to noise thresholds and the shadow flicker thresholds set out in the Wind Energy Guidelines (DoEHLG 2006). As detailed above in Section 5.7.3, the assessment herein is based on compliance with the DoEHLG Guidelines (2006) limit (30 hours per year or 30 minutes per day), however in line with the commitment made for the permitted development and following continuing engagement with the local community, Coole Wind Farm Ltd. continues to commit to zero shadow flicker at occupied residential receptors within 10 rotor diameters of the Proposed Development.

The visual impact of the Proposed Development is addressed comprehensively in Chapter 12: Landscape and Visual. The Proposed Development has been designed to maximise turbine separation distances to dwellings in the area. The closest occupied dwelling (i.e. dwelling not involved with the Proposed Development) is located at a distance of approx. 700 metres from the nearest proposed turbine. An assessment of roadside screening was carried out for roads within 5 kilometres of the proposed turbine locations, with both the methodology and findings of this are described in Chapter 12. Along roads immediately surrounding the site, there is a significant level of dense and intermittent screening, particularly to the north, north-east, south and west. Roads to the north-west, south-west and east were shown to have little screening and there were open, unobstructed views towards the Proposed Development. In consideration of this, visual effects arising from these roads have been assessed in detail via photomontage viewpoints located on these routes and are presented in Chapter 12. Given the separation distance of the residential properties from the proposed turbines, and the level of existing screening in the area, the Proposed Development will have no significant impact on existing visual amenity at dwellings.

Proposed Mitigation Measures

The closest occupied dwelling (i.e. dwelling not involved with the proposed development) is located at a distance of approx. 700 metres from the nearest proposed turbine, which is equal to 4 times the turbine tip height (700m) from any other occupied property, a recognised parameter in assisting in the protection of residential visual amenity. All mitigation as outlined under noise and vibration, dust, traffic, visual amenity and shadow flicker in this EIAR will be implemented in order to reduce insofar as possible impacts on residential amenity at properties located in the vicinity of the Proposed Development works, including along the proposed turbine and construction materials haul route.

Residual Impact

With the implementation of the mitigation measures outlined in relation to noise and vibration, dust, traffic, shadow flicker and visual amenity, the Proposed Development will have an imperceptible impact on residential amenity.

Significance of Effects

Based on the assessment above there will be no significant direct or indirect effects on residential amenity.

5.9.4 Decommissioning Phase

The wind turbines proposed as part of the Proposed Development are expected to have a lifespan of a minimum of 30 years. Following the end of their useful life, the wind turbines may be replaced with a new set of turbines, subject to planning permission being obtained, or the site may be decommissioned fully. The substation will remain in place as it will be under the ownership of ESB/EirGrid.

The works required during the decommissioning phase are described in Section 4.11 in Chapter 4: Description of the Proposed Development. Upon decommissioning of the Proposed Development, the wind turbines will be disassembled in reverse order to how they were erected. The turbines will be disassembled with the same model of cranes that were used for their erection. The turbine will be removed from site using the same transport methodology adopted for delivery to site initially. The turbine materials will be transferred to a suitable recycling or recovery facility.

All above ground turbine components would be separated and removed off-site for recycling. Turbine foundations would remain in place underground and would be covered with earth and reseeded as appropriate. Leaving the turbine foundations in-situ is considered a more environmentally prudent option, as to remove that volume of reinforced concrete from the ground could result in environment emissions such as noise, dust and/or vibration.

Site roadways could be in use for purposes other than the operation of the development by the time the decommissioning of the Proposed Development is to be considered, and therefore it may be more appropriate to leave the site roads in situ for future use. If it were to be confirmed that the roads were not required in the future for any other useful purpose, they could be removed where required.

The underground grid connection cable will be left in-situ and it is envisioned it will become a permanent part of the electricity transmission network.

A decommissioning plan is included Appendix 4-11 of this EIAR for the decommission of the Proposed Development, the detail of which will be agreed with the local authority prior to any decommissioning. The potential for effects during the decommissioning phase of the proposed wind farm has been fully assessed in the EIAR.

Any impact and consequential effect that occurs during the decommissioning phase will be similar to that which occurs during part of the construction phase when turbines were being erected. The impacts and associated effects will be materially less than during the construction phase as significant ground works are not required to decommission a wind farm

The decommissioning phase will have no impact on shadow flicker, interference with communications system, employment, tourism or health & safety once all standard construction phase mitigation measures described above are implemented.

5.9.5 Cumulative Effects

For the assessment of cumulative impacts, any other existing, permitted or proposed developments (wind energy or otherwise) have been considered. The factors to be considered in relation to cumulative effects include population and human health, biodiversity, land, soil, water, air, climate, material assets, landscape, and cultural heritage as well as the interactions between these factors.

The potential cumulative impact of the Proposed Development and other relevant developments has been carried out with the purpose of identifying what influence the Proposed Development will have on the surrounding environment when considered cumulatively and in combination with relevant approved, and existing projects in the vicinity of the Proposed Development site.

Further information on projects considered as part of the cumulative assessment are given in Chapter 2: Background to the Proposed Development. The impacts with the potential to have cumulative effects on human beings are discussed below and in more detail in the relevant chapters: Chapter 11: Noise & Vibration, Chapter 12: Landscape & Visual Impacts, Chapter 14: Material Assets.

5.9.5.1 Employment and Economic Activity

There is 1 no. existing single wind turbine at Ballyjamesduff, Co. Cavan, located at a distance of 16.4 kilometres from the Wind Farm Site at its closest point. There is 1 no. proposed turbine in Ballyjamesduff located at a distance of approximately 16 kilometres from the Wind Farm Site at its closest point. These projects will contribute to short term employment during their construction stages and provide the potential for long-term employment resulting from maintenance operations. This results in a long-term moderate positive impact.

The commercial peat harvesting works on the site of the Wind Farm Site employs 3 no. full time workers and 6 no. seasonal workers. This EIAR assesses the potential for peat extraction works on the site to continue as a worst-case scenario. The Proposed Development has been designed to operate on this site should peat extraction continue or cease during the lifetime of the project. The existing commercial peat harvesting works, can continue in conjunction with this proposed use of the site while the Wind Farm Site is under construction and operating, resulting in a long-term moderate positive cumulative impact should commercial peat extraction continue.

5.9.5.2 Tourism and Amenity

There are no key identified tourist attractions pertaining specifically to the site of the Proposed Development itself. According to the Westmeath County Development Plan 2014-2020, it is an objective of Westmeath County Council to extend public walking and cycling routes. A section of the proposed extension to the Westmeath Way runs adjacent to the Wind Farm Site. Should this route be pursued in the future, there are no problems foreseen with its integration with the Wind Farm Site. If the Westmeath Way is constructed adjacent to the Wind Farm Site there would be a long-term slight positive cumulative impact on local recreation and amenity.

Any slight cumulative impact that the Grid Connection Route and other projects listed in Section 2.5.2 may have on tourism will be very temporary in nature and related to traffic impacts during the construction phase. On completion, the road corridor in which the underground cabling works are to be undertaken will be fully reinstated, leaving no visible above-ground evidence of the proposed works that have the potential to give rise to any operational phase impacts or associated effects.

5.9.5.3 Traffic

Impacts

As standalone projects or cumulatively, the construction phase of projects will have a short-term slight to moderate negative impact as nuisance from construction traffic is unavoidable.

In terms of the Grid Connection Route, there will be some traffic restrictions in place through the construction phase, there may be a short-term slight negative effect to local traffic. Any impacts associated with the Grid Connection Route will however be limited to the active construction area (generally a few hundred-metre stretch of road, for each of the two construction crews and will be temporary in nature). Any traffic impacts during the construction phase of the Grid Connection Route and the potential for cumulative effects with the other projects listed in Section 2.5.3 are slight.

On completion, the road corridor in which the underground cabling works are to be undertaken will be fully reinstated, leaving no visible above-ground evidence of the proposed works that have the potential to give rise to any operational phase impacts or associated effects.

Proposed Mitigation Measures

Phased development will be employed to allow for construction traffic to be managed and to minimise the volume of construction traffic using the road network at any one time. The proposed phasing is set out Section 4.7 of Chapter 4: Description of the Proposed Development.

Residual Impact

Short term slight negative impact

Significance of Effects

Based on the assessment above there will be no significant effects.

5.9.5.4 Air (Dust)

The nature of the Proposed Development is such that, once operational, it will have a long-term, moderate, positive impact on the air quality.

During the construction phase of the Proposed Development and the construction phase of other developments within 25 kilometres of the Wind Farm Site that are yet to be constructed, there will be minor emissions from construction plant and machinery and potential dust emissions associated with the construction activities. However, once the mitigation proposals, as outlined in Section 10.2.4 and 10.3.4 of Chapter 10 are implemented during the construction phase of the Proposed Development, there will be no cumulative negative effect on air and climate.

The nature of the Proposed Development and other wind energy developments within 25 kilometres are such that, once operational, they will have a cumulative long-term, significant, positive effect on the air quality and climate.

5.9.5.5 Health and Safety

The Proposed Development will have no impacts in terms of health and safety. There is no credible scientific evidence to link wind turbines with adverse health impacts. All other existing, permitted or Proposed Developments (wind energy or otherwise) would be expected to follow all relevant Health and Safety Legislation during the construction, operation and decommissioning phases of the development. It is assumed also that all mitigation measures in relation to the other cumulative projects will also be implemented. It is on this basis that it can be concluded that there would be a long-term imperceptible cumulative impact from the Proposed Development and other developments in the area.

5.9.5.6 Property Values

As noted in Section 5.6 above, the conclusions from available international literature indicate that property values are not impacted by the positioning of wind farms near houses. It is on this basis that it can be concluded that there would be a long-term imperceptible cumulative impact from the Proposed Development and other wind farm developments in the area.

5.9.5.7 Services

The rate payments from the Proposed Development and other projects in the area will contribute significant funds to Westmeath County Council, which will be redirected to the provision of public services within the County. In addition, the injection of money into local services though the establishment of community benefit funds is also expected to be a long-term positive cumulative impact.

5.9.5.8 Shadow Flicker

As discussed in Section 5.7.6.2 above, no cumulative shadow flicker will occur at properties in the vicinity of the Proposed Development.

5.9.5.9 Residential Amenity

Pre-Mitigation Impacts

In the unlikely event of all permitted and proposed projects as described in the cumulative assessment in Section 2.7 of this EIAR being constructed at the same time, there is the potential for a resulting cumulative negative impact to occur on residential amenity.

Proposed Mitigation Measures

The closest occupied dwelling (i.e. dwelling not involved with the Proposed Development) is located at a distance of approx. 700 metres from the nearest proposed turbine. All mitigation as outlined under noise and vibration, dust, traffic, visual amenity and telecommunications in this EIAR will be implemented in order to reduce insofar as possible impacts on residential amenity at properties located in the vicinity of the Proposed Development works, including along the proposed turbine and construction materials haul route. It is assumed also that all mitigation measures in relation to the other cumulative projects will also be implemented.

Residual Impact

The proposed development will have an imperceptible impact on residential amenity.

Significance of Effects

Based on the assessment above there will be no significant effects.

5.10 Summary

Following consideration of the residual impacts (post-mitigation) it is noted that the Proposed Development will not result in any significant effects on Human Beings in the area surrounding the Proposed Development.

Provided that the Proposed Development is constructed and operated in accordance with the design, best practice and mitigation that is described within this application, significant effects on population and human health, associated with health and safety, noise, dust, traffic and shadow flicker, are not anticipated at international, national or county scale.