Knockastanna Wind Farm

Chapter 4: Population and Human Health

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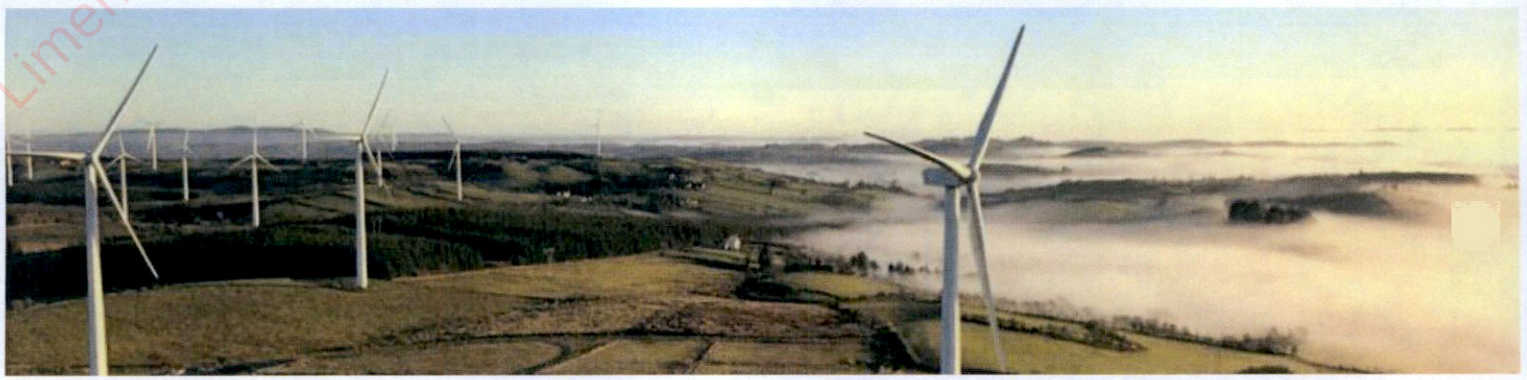


4.1 Introduction

This chapter identifies, describes and assesses the likely significant, direct and indirect effects of the proposed 15-year extension of the operations of the existing development on population and human health.

Human beings comprise a significant element of the environment and any likely effects on the status of population and human health must be comprehensively addressed. This includes the existence, activities, and wellbeing of people. Whilst most developments will affect other people, the EIAR concentrates on those topics which are manifested in the environment, such as new land uses, more buildings or greater emissions. The chapter has been structured under the following headings:-

- Population;
- Employment and Economic Activity;
- Land Use;
- Recreation, Amenity and Tourism; and
- Human Health and Safety.

4.1.1 Statement of Authority

This chapter of the EIAR was prepared by Ciarán O'Sullivan of SLR Consulting. Ciarán is a qualified Town Planner with five years' experience. He holds a Bachelor (International, Spanish) of Geography, Planning and Environmental Policy and a Masters of Regional and Urban Planning (MRUP) from University College Dublin. Ciarán has previously worked on numerous planning applications and EIAR's.

4.1.2 Summary of the Proposed Development

In summary, the proposed development comprises the continued operations of the existing wind farm for a further period of 15-years. The existing development, including secondary ancillary developments, consists of the following main components:-

- 4 no. wind turbines;
- Associated turbine foundations and crane hardstandings;
- 1 no. electrical control building with a total footprint of 66 square metres (m^2), including welfare facilities and associated electrical equipment enclosure;
- Underground electrical cabling between each of the existing wind turbines and the electrical control building;
- 1 no. site entrance and 2km of site access tracks; and
- Site drainage infrastructure.

A full description of the proposed development is presented in **Chapter 3**.

4.1.3 Consultation

Consultation responses of relevance to the population and human health assessment were received from Fáilte Ireland as well as from the wider community through public consultation. The consultation responses received have been given due consideration in the formation of this chapter.

Prescribed Body	Comment
Failte Ireland	The consultee forwarded an updated copy of Fáilte Ireland's Guidelines for the Treatment of Tourism in an EIA, which you may find informative for the preparation of the Environmental Impact Assessment for the proposed project. The purpose of this report is to

	provide guidance for those conducting Environmental Impact Assessment and compiling an Environmental Impact Assessment Reports, or those assessing EIARs, where the project involves tourism or may have an impact upon tourism. These guidelines are non-statutory and act as supplementary advice to the EPA EIAR Guidelines outlined in section 2."
HSA	No response received.
HSE	No response received.
Community Consultation	Matters raised in the course of the community consultation process included noise, details of community funding, telecommunication interference, and transport/roads during construction phase.

Table 4.1: Scoping Responses

4.2 Methodology

4.2.1 Desk Based Research

This chapter has been prepared following a review of:-

- the National Planning Framework 2040;
- the Regional Spatial and Economic Strategy for the Southern Region;
- the Limerick County Development Plan 2010 – 2016 (as varied);
- Draft Limerick Development Plan 2022-2028;
- North Tipperary County Development Plan 2010 (as varied);
- South Tipperary County Development Plan 2009 (as varied);
- Draft Tipperary County Development Plan 2022 – 2028;
- Central Statistics Office (CSO);
- Pobal Profiling GIS Data (https://maps.pobal.ie/);
- The Limerick Tourism Development Strategy 2019 – 2023; and
- Limerick Local Economic and Community Plan 2016 – 2021.

This chapter has also had regard to the following guidelines:-

- *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* (Environmental Protection Agency, May 2022);
- *Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* (Environmental Protection Agency, August 2017);
- *Advice Notes for Preparing Environmental Impact Statements, Draft September 2017*; and
- *Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment* (Department of Housing, Planning and Local Government, August 2018).

The determination of significance of impact is in line with the EPA's *Guidelines on the 'Information to be Contained in Environmental Impact Assessment Reports'* (EPA, May 2022).

Demographic data has been sourced from the Central Statistics Office (CSO)'s Census of Ireland (2016) records. Demographic information relating to the State, County Limerick, County Tipperary and the 'Study Area'[1] has been assessed to

[1] The study area is defined as a 2km radius from the operational turbines and the Electoral Divisions within this zone, for comparison with counties Tipperary and Limerick and the State – see **Section 4.2.2** for more details.

establish the existing **demographic trends. The** 'Study Area' **for the demographic** analysis of this chapter is defined in terms of Electoral Divisions (EDs) and is focused on a 2km buffer surrounding the existing wind turbines.

Eircode data (2021), Geodirectory data (2021), and planning application lists within the study area have been assessed to identify receptors in proximity to the proposed development. The data gathered has informed the assessment of existing populations within the immediate environs of the proposed development and allows for a comprehensive assessment of the likely effects on population trends which may occur during the continued operation, and decommissioning, of the existing wind farm.

A socio-economic profile of the existing environment was established using Census 2016 data to outline an employment profile of the Study Area.

Land use in the area was examined, using Corine Land Cover data (2018), to determine the likely effects on existing land use patterns which may arise as a result of the proposed development.

With regard to recreation, amenity and tourism; Fáilte Ireland published a guideline document on tourism and environmental impacts in 2011 entitled *Guidelines on the Treatment of Tourism in an Environmental Impact Statement*. This document has been considered, as recommended by Fáilte Ireland in its EIAR scoping response, and is assessed in **Section 4.3.11** of this chapter specifically. The document informed the methodology used in assessing the likely effects on recreation, amenity and tourism. A profile of tourism in the region was established through examination of Fáilte Ireland statistics in order to indicate the strength of recreation, amenity and tourism in the surrounding region. Recreation and amenity facilities and attractions in the area were identified through a desktop study and distances from the proposed development were established. Likely effects as a result of the proposed development were then considered in relation to the tourism profile and amenity and recreation facilities and attractions of the area.

The assessment on human health and safety has had regard to CSO data (2016) and reports published by the Department of Health were examined to establish a baseline health profile of the Study Area. Peer reviewed literature (see **Section 4.3.13**) was also assessed in considering likely effects on human health. A desktop examination of potentially hazardous land uses in the Study Area was carried out and vulnerability of the proposed development to natural disaster was assessed through a desktop geographical study and literature review.

In relation to cumulative effects, the likelihood of the proposed development acting **'in combination' with other projects**; including those listed at **Chapter 1**; has been assessed.

4.2.2 Study Area

The proposed development site and surrounding environment are typical of an upland landscape with extensive tracts of commercial forestry plantations dominating the surrounding, undulating, landscape. Other agricultural activities in the wider environs of the proposed development site tend to be extensive (i.e. non-intensive) cattle and sheep enterprises.

The Study Area has been defined by a 2km buffer zone from the development site area and the Electoral Divisions (EDs) located within this buffer zone, which incorporates the EDs of Bilboa and Doon West in County Limerick, and Abington Glengar in County Tipperary.

In total, there are 53[2] no. residential receptors (some dwellings may be unoccupied) within 2km of an existing wind turbine; while it should be noted that there are no residential receptors within 500m an existing wind turbine. For completeness of assessment, a total of 69 no. receptors were considered, however, 16 no. of these are located outside of the 2km buffer zone and Study Area. The Study Area and relevant EDs are illustrated at **Annex 4.1**.

4.3 Description of Existing Environment

4.3.1 Population

Population relates to the people living in an area. Assessing the demographic makeup of an area can reveal relevant information to help guide environmental considerations of a proposed development. This section provides a comprehensive overview of the population profile for the Study Area, and compares these with corresponding topics within the administrative areas of Limerick County, Tipperary County and the State, in order to create a baseline demographic profile of the receiving environment and identify likely effects on demographic trends arising as a result of the proposed development.

For the purpose of assessing population within the Study Area, a review of the four EDs located within 2km of the proposed development site was carried out.

In the years between the 2011 and the 2016 Census, the population of Ireland increased by 3.8% (see **Table 4.2** below). During this time, the population of Limerick County grew by 1.6% to 194,899 persons and the population of Tipperary County grew by 0.5%. In the same period, population of the Study Area grew by 81.8%.

Area	2011	2016	% Change
State	4,588,252	4,761,865	3.8%
Limerick City and County	191,809	194,899	1.6%
Tipperary	158,754	159,553	0.5%
Study Area	812	1,476	81.8%

Table 4.2: Population 2011–2016 (Source: CSO)

It is notable that the population of the Study Area has grown at a rate far greater than that of the above stated comparators. Each of the four EDs experienced a population increase between the two Census years; the largest being Bilboa, which increased in population from 200 no. persons in 2011 to 409 no. persons in 2016, a respective increase of 104.5%.

4.3.2 Population Density

The population densities recorded within the State, Limerick County, Tipperary County, and the Study Area during the 2011 and 2016 Census are set out below in **Table 4.3**. The population density of the Study Area has increased from 6 no. persons per square kilometre in 2011 to 11 no. persons per square kilometre in 2016; representing an overall increase in population density of 83.3%.

Area	Population Density (Persons per km²) 2011	Population Density (Persons per km²) 2016

[2] There are 53 no. residential dwellings located within 2km of an existing wind turbine; however, it is also noted that the curtilage of 5 no. additional dwellings are located within the 2km area.

State	67		70
Limerick City and County	70		71
Tipperary	37		37
Study Area	6		9

Table 4.3: Population Density 2011–2016 (Source: CSO)

However, it should be noted that although the population density of the Study Area has experienced a high proportional increase, it remains a far less densely populated area than that of the above stated comparators. For instance, the average population density per square kilometre within the state was recorded at 70 no. persons in 2016. Although there has been a significant increase in population from 2011 to 2016 in the Study Area, it remains a sparsely populated area when compared to that of not only the state but also Tipperary and Limerick counties.

4.3.3 Household Statistics

Table 4.4 sets out the number of households and average household size (in persons) for the State, Limerick County, Tipperary County and the Study Area for 2011 and 2016.

Area	2011		2016	
	No. of Households	Avg. Size (persons)	No. of Households	Avg. Size (persons)
State	1,654,208	2.8	1,702,289	2.8
Limerick City and County	69,649	2.7	71,224	2.7
Tipperary	58,497	2.7	59,276	2.7
Study Area	524	3.0	524	2.9

Table 4.4: Number of Household and Average Household Size 2011–2016 (Source: CSO)

The total number of households within the Study Area has remained the same from the years 2011 to 2016, at 524 no. households. This is explained by the fact that although two EDs, Biloba and Doon West, experienced an increase in the number of households during the period, Abington and Glengar experienced a decrease. In percentage terms and among the above stated comparators, the State experienced the largest increase in terms of total number of households at 2.9%. With respect to average household size in persons, that of the Study Area is only slightly higher than the aforementioned comparators; albeit this has decreased from 3.0 persons in 2011 to 2.9 persons in 2016.

4.3.4 Age Structure

The age structure of the Study Area recorded in 2011 and 2016 is largely in line with that of the national age structure and age structure of Limerick County and Tipperary County as detailed in **Table 4.5**, **Figure 4.2**, **Table 4.6**, and **Figure 4.3** below.

In 2011, the Study Area was composed of a higher percentage of persons in the 45 – 64 age cohort, at 26.11%, compared to that of the State, Limerick County and Tipperary County, recorded at 22.73%, 23.13%, and 24.44% respectively. Compared to the other three age cohorts, as highlighted in **Figure 4.2** below, the Study Area was composed of a similar or lower population distribution in percentage terms. However,

it should be noted that the population of the Study Area is far less than that of the State, Limerick County and Tipperary County, in absolute numbers, as highlighted in **Table 4.5**.

Area	0 - 14	15 – 24	25 - 44	45 - 64	65+
State	979,590	580,250	1,450,140	1,042,879	535,393
Limerick City and County	39,064	27,052	58,021	44,359	23,313
Tipperary	34,386	18,675	45,698	38,799	21,196
Study Area	173	102	228	212	97

Table 4.5: Population Distribution by Age Category 2011 (Source: CSO)

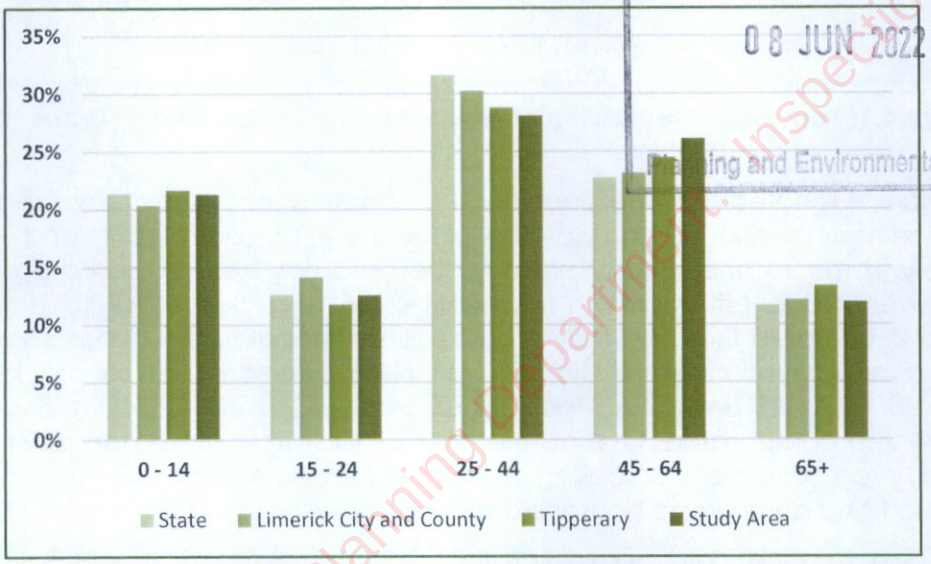


Figure 4.2: Population Distribution of Age Category in Percentage Terms – 2011 (Source: CSO)

In 2016, the Study Area was also composed of a higher percentage of persons in the 45 – 64 age cohort, at 27.51%, compared to that of the State, Limerick County and Tipperary County, recorded at, 23.84%, 23.97% and 25.58% respectively. Most notably, the State recorded a significantly high proportion in the 25 – 44 age cohort at 41.64%, compared to Limerick County, Tipperary County and the Study Area, at 33.57%, 26.33%, and 24.53% respectively. This is highlighted in **Figure 4.3** below.

Area	0 - 14	15 – 24	25 - 44	45 - 64	65+
State	1,006,552	576,452	1,982,743	1,135,003	637,567
Limerick City and County	39,594	25,834	65,428	46,716	27,418
Tipperary	34,035	18,306	42,003	40,811	24,398
Study Area	282	185	362	407	223

Table 4.6: Population Distribution by Age Category 2016 (Source: CSO)

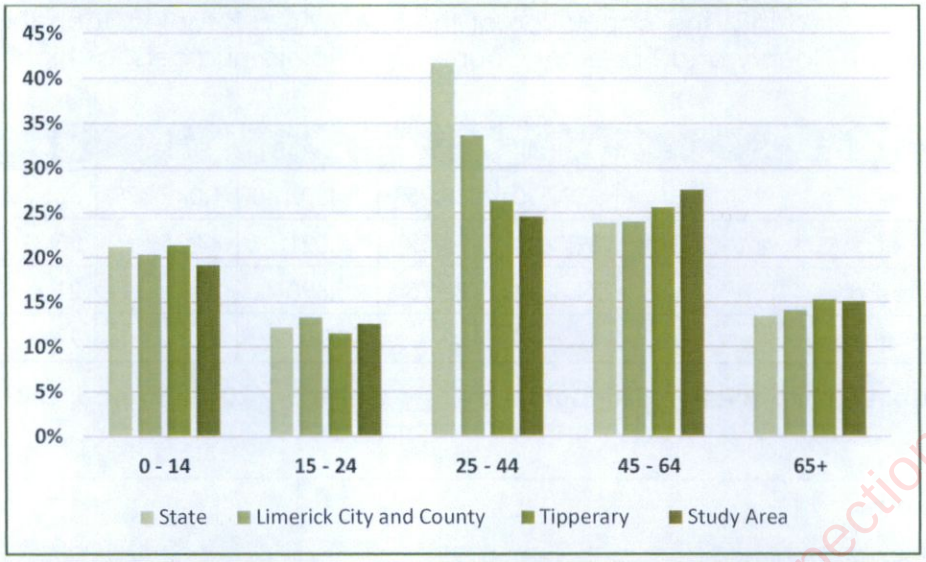


Figure 4.3: Population Distribution of Age Category in Percentage Terms – 2016 (Source: CSO)

In summary, it is noted that the population characteristics of the Study Area vary to that of the aforementioned comparators of the State, Limerick County and Tipperary County, in some instances. Most notably, the area has experienced a significantly higher level of population growth from 2011–2016, recorded at 81.8%. However, it should also be noted that the Study Area is sparsely populated in comparison, which recorded a population density in 2016 of 11 no. persons per square kilometre, compared to 70, 71 and 37 no. persons respectively, when viewed alongside the above stated comparators. Overall, the household statistics and age distribution of the Study Area correlate, composing of a higher percentage of persons in the 25 - 44 age cohort and an average household size of 2.9 persons.

4.3.5 Employment and Economic Activity

Socio-economic grouping divides the population into categories depending on the level of skill or educational attainment required. **Figure 4.4** illustrates the percentages of those employed in each socio-economic group in the State, Limerick County, Tipperary, and the Study Area, as per the 2016 Census.

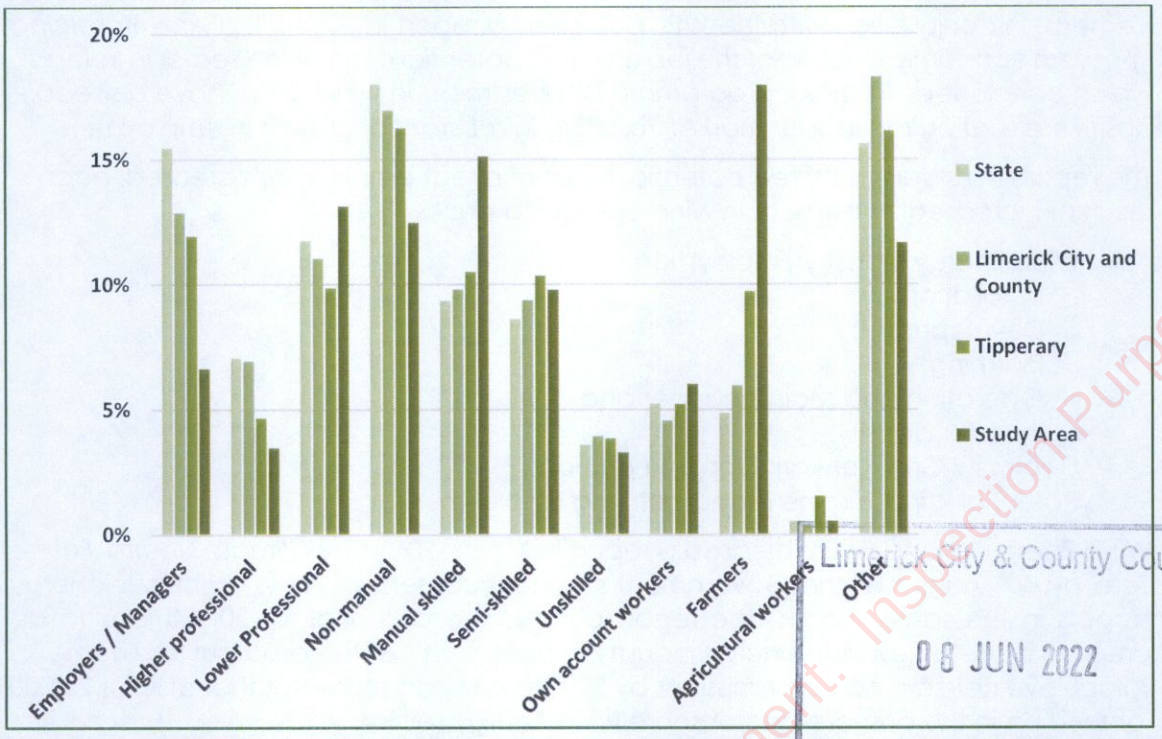


Figure 4.4: Employment by Socio-Economic Group – 2016 (Source: CSO)

The highest level of employment within the Study Area was recorded in the Farmers category at 17.94%, accounting for 268 no. persons. The Study Area also comprises a higher level of workers in relative percentage terms in the Manual Skilled, Lower Professional Categories, and Own Account Workers, recorded at 15.13%, 13.12%, and 6.02% respectively. It should be noted that the CSO employment figures grouped by socio-economic status includes the entire population for the Study Area. As such, the socio-economic category of 'Other' includes those who are not in the labour force. However, it should also be considered that in 2016 there were 282 no. persons recorded in 0-14 age cohort, which are generally considered too young to work.

4.3.6 Employment and Investment Potential in the Irish Wind Energy Industry

The Sustainable Energy Authority of Ireland (SEAI) estimates, in their *Wind Energy Roadmap 2011-2050*[3], 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 billion by the same year.

A 2014 report titled *The Value of Wind Energy to Ireland*[4], published by Pöyry, 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, by 2030 the country will be reliant on natural gas for most of its electricity generation, at a cost of €671 million per annum in fuel import costs.

[3] Sustainable Energy Authority of Ireland (2011) *Wind Energy Roadmap to 2050*, Available at: https://www.seai.ie/publications/Wind_Energy_Roadmap_2011-2050.pdf

[4] Poyry Management Consulting (2014) *The Value of Wind Energy to Ireland': A report to Irish Wind Energy Association 2014*. Available at: https://windenergyireland.com/images/files/9660bd6b05ed16be59431aa0625855d5f7dca1.pdf

Siemens, in conjunction with the WEI, published a report in 2014 titled *An Enterprising Wind: An economic analysis of the job creation potential of the wind sector in Ireland*[5], which concluded, *"a major programme of investment in wind could have a sizeable positive effect on the labour market, resulting in substantial growth in employment."*

The report considers the three potential types of direct employment created, as a result of increased investment in wind energy, to be: -

- Wind Energy Industry Employment:-
  - Installation;
  - Development;
  - Planning;
  - Operation and Maintenance; and
  - Investor activity;
- Electricity Grid Network Employment; and
- Potential Wind Turbine Manufacturing Employment.

Wind Energy Ireland (WEI) released a report in March 2021 *Our Climate Neutral Future Zero by 50*[6] **in light of the Government's announcement of new, ambitious energy** targets in the same month. The report outlines the potential for 50,000 jobs to be created in the renewable energy industry in order to meet the build out requirements to achieve net-zero carbon emissions by 2050. The report estimates that at least 25,000 jobs will be in the onshore and offshore wind energy sector.

KPMG released a report with WEI in April 2021 titled *Economic impact of onshore wind in Ireland*[7] which states that the wind sector currently supports 5,130 jobs (not including employment in grid development) and further emphasises that this includes *"a strong foothold in rural Ireland"*. It states that through its direct and indirect activities and employment, the sector supports payment of labour incomes totalling €225 million.

A study carried out by the Institute for Sustainable Futures (2015) estimates that the operational and maintenance job output for a wind farm is 0.3 jobs per MW of total installed capacity based on an average of 6-7 studies. Based on this estimate, the proposed development (with an installed capacity of 6MW) would be expected to contribute to 1.8 long term direct and indirect jobs. This is consistent with the current actual provision which 1 no. Site Supervisor and a team of 3 no. Operation & Maintenance Technicians which are shared resources across 5 no. other operational wind farms.

These jobs provide a slight direct benefit to the Study Area. Indirectly, the operational phase supports jobs for legal and professional services, as well as suppliers of material for access track maintenance, the maintenance of the septic tank, suppliers of consumables (e.g. oils, lubricants) etc. Through the multiplier effect, this in turn benefits the economy of Limerick City and County and Tipperary County. The operational phase of the proposed development has a slight positive effect on employment in the Study Area, Limerick City and County and Tipperary County.

[5] Siemens, IWEA (2014) *An Enterprising Wind: An economic analysis of the job creation potential of the wind sector in Ireland*. Available at: https://www.esri.ie/system/files/media/file-uploads/2015-07/BKMNEXT250.pdf

[6] Wind Energy Ireland, MaREI (2021) *Our Climate Neutral Future Zero by 50*. Available at: https://windenergyireland.com/images/files/our-climate-neutral-future-0by50-final-report.pdf

[7] KPMG, Wind Energy Ireland (2021) *Economic impact of onshore wind in Ireland*. Available at: https://windenergyireland.com/images/files/economic-impact-of-onshore-wind-in-ireland.pdf

4.3.7 Economic Value

A 2009 Deloitte report in conjunction with the Irish Wind Energy Association (now Wind Energy Ireland, WEI) titled *Jobs and Investment in Irish Wind Energy – Powering Ireland's Economy*[8] states that the construction and development of wind energy projects **across the island of Ireland would involve approximately €14.75 billion of investment from 2009 up to 2020, €5.1 billion of which would be retained in the Irish economy (€4.3 billion invested in the Republic of Ireland and €0.8 billion in Northern Ireland).**

The report also states that increasing the share of our energy from renewable sources will deliver significant benefits for the electricity customer, the local economy and society. It estimates that between 25 and 30% of capital investment is retained in the local economy. This typically flows to companies in construction, legal, finance and other professional services. The report states:-

> *"...the framework acknowledges the need to put the energy/climate change agenda at the heart of Ireland's economic renewal. Every new wind farm development provides a substantial contribution to the local and national economy through job creation, authority rates, land rents and increased demand for local support services. More wind on the system will also result in lower and more stable energy prices for consumers while helping us achieve our energy and emissions targets."*

A 2019 report by Baringa, *Wind for a Euro: Cost-benefit analysis of wind energy in Ireland 2000-2020*, has analysed the financial impact for end consumers of the deployment of wind generation in Ireland over the period 2000-2020. The report calculates how the costs and benefits for consumers would have differed if no wind farms had been built. The analysis indicated that the deployment of 4.1 GW of wind generation capacity in Ireland between 2000 and 2020 (2018-2020 results being projective) **will result in a total net cost to consumers, over 20 years, of €0.1bn (€63 million to be exact), which equates to a cost of less than €1 per person per year** since 2000. **Further cost benefit analysis noted that wind energy has delivered €2.3 billion in** savings in the wholesale electricity market. As such, the economic benefit of renewable energy to consumers is greater than what would have been if Ireland did not invest in wind power.

The April 2021 KPMG report introduced above states that by 2030, the onshore wind **industry along will bring an Additional Gross Value (GVA) of €550million per annum to the Irish economy, will contribute €305millon total** payment in incomes across the **supply chain and has the potential to contribute approximately €100millon to local** authority rates, if 2030 targets are reached. **Furthermore, it is estimated that €2.7billion** in capital would be invested in the country through to 2030 if Climate Action Plan targets are reached.

4.3.8 Energy Targets

In March 2021, the Government of Ireland approved the Climate Bill which aims for net-zero emissions by 2050 and an Interim Target of 51% reduction to be reached by 2030, relative to a baseline of 2018. The Government is required to adopt a series of economy-wide five-year carbon budgets, with the first two five-year carbon budgets correlating to the Interim Target. The Bill also provides the framework for Ireland to meet its international and EU climate commitments and to become a leader in

[8] Deloitte, Irish Wind Energy Association (2009) *Jobs and Investment in Irish Wind Energy Powering Ireland's Economy*. Available at: https://windenergyireland.com/images/files/9660bd5e72bcac538f47d1b02cc6658c97d41f.pdf

addressing climate change. The Bill states that Local Authorities must prepare individual Climate Action Plans which will include both mitigation and adaptation measures and must be updated every five years. Local Authority Development Plans must align with their Climate Action Plan.

The Government launched the national Climate Action Plan 2021 on 4th November 2021, an ambitious plan to put Ireland on a more sustainable path, cutting emissions, creating a cleaner, greener economy and society and protecting us from the devastating consequences of climate change.

The Climate Action Plan follows the Climate Act 2021, which commits Ireland to a legally binding target of net-zero greenhouse gas emissions no later than 2050, and a reduction of 51% by 2030. These targets are a key pillar of the Programme for Government. The emissions reduction targets by sector to 2030 are as follows:-

- Electricity: 62-81%;
- Transport: 42-50%;
- Buildings: 44-56%;
- Industry/Enterprise: 29-41%;
- Agriculture: 22-30% reduction; and
- Land Use, Land Use Change and Forestry (LULUCF): 37-58%.

4.3.9 Land Use

As previously noted, the proposed development site and surrounding environment are typical of an upland landscape with extensive tracts of commercial forestry plantations dominating the surrounding undulating, landscape. Other agricultural activities in the wider environs of the proposed development site tend to be extensive (i.e. non-intensive) cattle and sheep enterprises. The presence of peat is also noted within and immediately surrounding the development site (see **Annex 4.2**).

4.3.10 Recreation, Amenity and Tourism

This section provides an overview of the recreation, amenity and tourism value for the Study Area, County Limerick, County Tipperary and the State in order to assess the likely effects arising from the proposed development. As 2020 and 2021 have experienced an unprecedented negative impact on international tourism due to the COVID-19 pandemic, this section focuses on statistics from 2018 and 2019 as a reasonable scenario for tourism in counties Limerick and Tipperary. This section had regard to Fáilte Ireland's *Guidelines on the Treatment of Tourism in an Environmental Impact Statement* in accordance with the recommendations of the scoping response received.

Tourism is one of the major contributors to the national economy and is a significant source of full time and seasonal employment. During 2019, total tourism revenue generated in Ireland was approximately €9.5 billion, an increase on the €9.1 billion revenue recorded in 2018. Overseas tourist visits to Ireland in 2019 grew by 0.7% to 9.7 million ('Key Tourism Facts 2019, Fáilte Ireland, March 2021). Ireland is divided into seven tourism regions. The Study Area is located within the Mid-West Region which comprises counties Limerick, Tipperary and Clare. **Table 4.7** below provides total revenue and breakdown of visitor numbers for the region during 2019.

Mid-West		
Market	**Numbers (000's)**	**Revenue (€m)**
Britain	378	107

Mainland Europe	456	122
North America	522	212
Other Areas	75	31
All Overseas	1,432	472
Northern Ireland	23	8
Domestic	1,197	217

Table 4.7: Tourism Revenue and Numbers (Source: Key Tourism Facts 2019, Fáilte Ireland, 2021)

4.3.11 Tourist Attractions

Currently, the area around the proposed development site is not a tourism destination, and there are no amenity or tourism designations noted for the area in the Limerick County Development Plan 2010-2016, the Draft Limerick City & County Development Plan 2022-2028 or the Limerick Tourism Development Strategy 2019 - 2023. The proposed development is proximate to the following minor tourism attractions:-

- The Slieve Felim Mountains (located c. 5km to the west)
- the Slieve Felim Way (c. 4km to the west at its closest point); and
- The Clare Glens forest and riverside walk (c.10km to the west at its closest point).

As per the National Monuments Service, the following features are in the proximity of the proposed development site:-

- Enclosure - Record Number: LI008-009 (300m north east);
- Enclosure - Record Number: LI008-008 (250m north east);
- Ritual site, holy well - Record Number: LI008-006 (660m south west);
- Megalithic tomb, wedge tomb - TS044-001 (800m south east);
- Megalithic structure - Record Number: TS039-023 (1.5km north east); and
- Barrow, unclassified - Record Number: LI008-007 (650m north west).

As per the National Inventory of Architectural Heritage, the following features are in the proximity of the proposed development site:-

- Commaun Bridge - Registration No: 21,900,803 (800m south west); and
- Gowlagh Bridge – Registration No: 21,900,801 (690m north west).

4.3.12 Human Health and Safety

This section provides the health profile of the receiving environment, in comparison with Limerick County, Tipperary County and the State, in order to provide for the assessment of likely effects on human health that may arise as a result of the proposed development.

Human health in relation to this assessment refers to the nature and possibility of adverse health effects on humans. In the context of existing human health, the Department of Health has published a report titled *Health in Ireland, Key Trends 2016*[9] which provides statistics relating to human health in Ireland over the last 10 years. Generally speaking, Ireland has a high level of good/very good health as

[9] Department of Health (2016), *Health in Ireland, Key Trends 2016*. Available at: https://assets.gov.ie/19006/a4a0ace510564a0f91489f8f527d0482.pdf

demonstrated in self-evaluation statistics included in Census data, which has been provided below in **Table 4.8**.

Area	Very Good	Good	Fair	Bad	Very Bad	Not Stated
State	59%	28%	8%	1%	0%	3%
Limerick City and County	57%	29%	9%	2%	0%	3%
Tipperary	58%	29%	9%	1%	0%	2%
Study Area	59%	30%	8%	1%	0%	2%

Table 4.8: Population by General Health – 2016 (*Source: CSO*)

Approximately 89% of the responses recorded for the Study Area in 2016 indicated that they had very good or good health which is above average when compared to the State, recorded at 87%; and greater than Limerick and Tipperary counties' response, recorded at 86% and 87%, respectively, for 2016. 1% of the Study Area, Tipperary County **and the State is reported to have 'bad'** general health, while Limerick County recorded 2% in this regard. The Census data indicates that the population of the Study Area is generally in good health.

With regard to the control of major accident hazards involving dangerous substances, on examination of upper and lower tier Seveso Establishments in the surrounding region of the proposed development, no Seveso Establishments were identified in proximity to the site.

4.3.13 Health Impact Studies

While there are anecdotal reports of negative health effects on people who live very close to wind turbines, peer-reviewed research has not supported these reports. 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.

'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.

'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; and*
- *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; and*
- *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."*

'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; and*
- *"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."*

'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.

'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."**

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; and
- 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 no. 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 5.1 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.

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 Draft Wind Energy Development Guidelines (2006), as a means of setting noise limits and set back distances from the nearest dwellings.

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

The WHO Environmental Noise Guidelines provide recommendations for protecting human health from exposure to environmental noise originating from various sources such as transportation noise, wind turbine noise and leisure noise. The Guideline Development Group (GDG) defined priority health outcomes and from this were able to produce guideline exposure levels for noise exposure.

For average noise exposure, the GDG conditionally recommends reducing noise levels produced by wind turbines below 45 dB Lden. The GDG recognise the potential for increased risk of annoyance at levels below this value but cannot determine whether this increase risk can impact health. Wind turbine noise above this level is reportedly associated with adverse health effects.

The GDG points out that evidence on health effects from wind turbine noise (apart from annoyance) is either absent or rated low/very low quality and effects related to attitudes towards wind turbines are hard to differentiate from those related to noise and may be partly responsible for the associations. The GDG also recognises that the percentage of people exposed to noise from wind turbines is far lower than other sources such as road traffic and state that any benefit from specifically reducing population exposure to wind turbine noise in all situations remains unclear.

That being said, the GDG recommends renewable energy policies include provisions to ensure noise levels from wind farm developments do not rise above the guideline values for average noise exposure. The GDG also provides a conditional recommendation for the implementation of suitable measures to reduce noise exposure.

4.3.14 Turbine Safety

In relation to turbines, the Department of the Environment, Heritage and Local Government (DoEHLG)'s *Wind Energy Development Guidelines for Planning Authorities 2006* 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. People or animals can safely walk up to the base of the turbines.

The adopted 2006 Guidelines and the Draft 2019 Guidelines[10] 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. Modern wind turbines are fitted with anti-vibration sensors, which 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 from glass reinforced plastic, which prevent any likelihood of an increase in lightning strikes within the site of the proposed development or the local area. Lightning protection systems are integral to the construction of turbines and those installed at the proposed development site are fitted with appropriate protection systems.

4.4 Description of Likely Effects

This section addresses the likely effects of the proposed development.

4.4.1 Construction Phase

All construction activities associated with the proposed development have been completed and no additional infrastructure is proposed. The proposal seeks to extend the operational life of a pre-existing wind farm and associated on-site infrastructure. Therefore, there is no likelihood of construction phase related effects commonly discussed, such as may relate to Population and Human Health, Land Use, Employment and Economic Activity, Recreation, Amenity and Tourism and Safety.

4.4.2 Operation Phase

4.4.2.1 Population

The extended period of operations will have no effect on the population of the area with regards to changes to trends, population density, household size or age structure.

4.4.2.2 Land Use

The footprint of the proposed development site, including turbines and access tracks, will occupy only 0.28% of the total Study Area. The access tracks and turbines cover an area of c. 1.8ha, the proposed development site covers an area of c. 43ha, while the Study Area covers an area of c. 15,200ha. Furthermore, it is not proposed to provide any additional infrastructure which would result in an alteration of existing land uses. The main land-use of commercial forestry and non-intensive cattle and sheep enterprises will continue to co-exist with the wind farm during the operational phase. The proposed development will have no effect on other land-uses within the wider area.

4.4.2.3 Employment and Economic Activity

The operational phase affords opportunity for mechanical-electrical contractors and craftspeople to become involved with the operation and maintenance (O&M) of the wind farm. On a long-term basis, the wind farm will be visited on 1-2 no. occasions per week for maintenance purposes. In this regard, the proposed development will maintain the current employment provision of 1 no. Site Supervisor and a team of 3

[10] Department of Housing, Planning and Local Government (2019) *Draft Revised Wind Energy Development Guidelines*. Available at: https://www.gov.ie/en/publication/9d0f66-draft-revised-wind-energy-development-guidelines-december-2019/

no. Operation & Maintenance Technicians which are shared resources across 5 no. other operational wind farms.

Where specific maintenance works are required; for example, the maintenance of the access track or turbine hardstandings; additional employment opportunities are likely to arise for the duration of the necessary works. However, it is assessed that the proposed development is unlikely to have a perceptible effect on employment within the Study Area.

In terms of the established community benefit fund, SSE Renewables (Ireland) Limited (SSE)[11] has confirmed that it makes annual contributions to community groups in the vicinity of its operational wind farms. In 2021, SSE has presented more than €13,500 to community groups in the vicinity of the Knockastanna Wind Farm. The 2021 fund brings the overall contribution of this development to local communities to €171,721 since 2010. A total of 7 no. local groups benefited from the 2021 community fund including schools, sports clubs and community organisations. The successful applicants were Cappawhite National School, Cullen–Lattin AFC, Curreeny Community Council, Doon GAA Club, Kilcommon Community Council, Rearcross National School and Sean Treacy's GAA Club. Kilcommon Community Council will be putting their funding towards the replacement of a defibrillator.

While; at a county, regional and national level; the economic benefits of the community benefit fund as assessed as resulting in a slight positive effect, it is likely that such annual contributions represent a moderate-significant positive effect to each individual group or organisation. However, in EIA terms, the positive effect is assessed to be imperceptible-slight.

Subject to planning permission being granted, the Applicant proposes to continue to operate a community benefit fund for the duration of the proposed extended operational period.

If consented, the proposed development will continue to contribute to the economic value that renewable energy brings to the country. Over the last 5-years, the existing wind farm has contributed commercial rates of in excess of €100,000 per annum to Limerick City & County Council. In excess of €1million has been paid in commercial rates to Limerick County Council during the wind farm's operation to date. These rates have assisted the Council in the provision of services in both the local area and throughout the County.

General council services will benefit from rates and development contributions including road upkeep, fire services, environmental protection, street lighting, footpath works etc., along with other local community initiatives and supports. The payment of rates and development contributions is likely to have a substantial beneficial effect on service provision in the County Limerick area.

Local landowners will also benefit from lease agreements associated with the lands of the proposed development. It is highly likely that income generated by local landowners will be spent in the local economy thus resulting in multiplier effects and indirect employment opportunities.

Furthermore, the continued purchase of materials and consumables from local suppliers in order to maintain the access tracks, the septic tank, and the turbine

[11] The Applicant's parent company.

infrastructure itself will also result in a positive effect in terms of local spend and related income.

4.4.2.4 Recreation, Amenity and Tourism

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 a significant adverse effect on tourism in the vicinity. The existing wind farm has been present in the landscape for a number of years and there is no evidence to suggest that its presence has negatively impacted on tourism activity in the area.

Currently, there are no dedicated amenity walkways within the site of the proposed development. The closets recreation amenities to the proposed development which are considered minor in nature are the Slieve Felim Way (c. 4km to the west at its closest point) and the Clare Glens forest and riverside walk (c. 10km to the west at its closest point). The existing wind farm is remote from these areas and its continued operation is unlikely to pose any adverse effect on their attractiveness to tourists.

The findings of **Chapter 9** (Landscape) conclude that existing turbines occupy a small proportion of all available views, which are typically panoramic in nature and do not dominate any of these views. While the existing turbines are noticeable elements, they do not change the composition/balance of the surrounding upland landscape and do not affect the agricultural lowland landscape, due to the physical separation.

4.4.2.5 Human Health and Safety

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

Appropriate site safety measures will continue to be utilised during the operational phase by all personnel. High visibility clothing, hard hats and safety boots will be worn at all times to avoid potential injury. Appropriate security measures are in situ to prevent unauthorised access to the electrical switchroom and to the turbine towers.

In addition, **Chapter 11** (Noise) describes that the noise environment at a set of representative noise-sensitive locations in the vicinity of the existing wind farm has been quantified by an appropriate survey of operational phase noise levels. Using the recorded results, it has been confirmed that recorded noise levels are below the criteria set out by An Bord Pleanála in respect of the parent planning permission.

Furthermore, **Chapter 12** (Shadow Flicker) has concluded that that all 3 no. dwellings located within 705m of an existing wind turbine will experience shadow flicker; it is assessed that no dwelling will experience a significant effect. Over the course of a year, 'expected' shadow flicker levels are extremely low; while local topography and intervening vegetation will serve to reduce the level of shadow flicker.

4.4.3 Decommissioning Phase

4.4.3.1 Population

The decommissioning phase of the proposed development is described in **Chapter 3** and provides for the removal of turbines and associated infrastructure from the site. A works crew will be required for dismantling the infrastructure and carrying out restoration works where necessary. This will result in a small increase in the population

of the Study Area during working hours and a return back to regular population outside of working hours. It is not likely that the decommissioning phase will result in any perceptible effect on population in terms of changes to population trends, density, household size, or age structure.

4.4.3.2 Land Use

Decommissioning works will include removal of all above ground structures including the turbines, mountings, fencing, and substations. The turbine foundations will be covered over and allowed to re-vegetate naturally. Depending on any future proposals for the site, access tracks may be left in situ (e.g. for agricultural or forestry operations) or may be removed in a similar manner as described above.

These works will require a construction crew on-site and may cause temporary disruption to agricultural operations which currently co-exist at the site. However, significant effects are not assessed as likely.

4.4.3.3 Employment and Economic

A construction crew will be required for dismantling the infrastructure and carrying out remediation where necessary. During the decommissioning phase, employment opportunities are likely to be available in the Study Area and outlying areas of County Limerick and County Tipperary. The influx of construction workers to the Study Area will have an indirect impact on local businesses and services contributing to the local economy.

There will be a slight, positive temporary effect on socio-economics, employment and economic activity associated with the employment of construction workers within the vicinity of the development during the decommissioning phase.

4.4.3.4 Recreation, Amenity and Tourism

There may be a slight temporary effect due to increased traffic associated with decommissioning works, which has the potential to create an indirect effect on the Slieve Felim Way and the Clare Glens forest and riverside walk. Although the tracks associated with these trails will not be closed to the public, there is potential for indirect effect due to increased construction traffic which may cause dust and noise nuisance at the amenity trail locations. Due to the volume of traffic any negative effects would be both slight and temporary.

4.4.3.5 Human Health and Safety

During the decommissioning works, there is a risk of significant effects on human health and safety for construction workers on site. However, significant effects will be prevented through best practice methods and will include staff training and knowledge of the site-specific decommissioning plan. Once mitigation measures and best practice construction site methods are followed, the likely effect on human health and safety is expected to be non-significant and temporary.

During the decommissioning works, adverse effects on the health and safety of the public may arise. Effects are associated with the presence of a construction crew, increased traffic, presence of heavy goods vehicles and machinery, and obstructions on the public road.

Effects on public health and safety during the decommissioning phase is slight and temporary. However, a Decommissioning Plan will be followed, clear signage will be utilised on public roads and the community will be informed of works prior to commencement to avoid any likely effect on public health and safety. Once good

practice is followed, the likelihood of effects on public health and safety is assessed to be temporary and non-significant.

4.4.4 Cumulative Effects

4.4.4.1 Population

To the east and southeast of the proposed development site (in County Tipperary) lies a large wind energy complex comprising a number of individual wind farm developments. Given that the proposed development is not assessed as likely to affect population, it is further assessed that these developments will have no effect on the population of the study area with regards to changes to trends, population density, household size or age structure.

Other developments located within the wider environs of the proposed development site are not assessed as likely to result in significant adverse effects.

4.4.4.2 Land Use

To the east and southeast of the proposed development site (in County Tipperary) lies a large wind energy complex comprising a number of individual wind farm developments. These existing developments, along with the continued operation of the subject existing development, will have no effect on land use.

The main land-use of commercial forestry and non-intensive cattle and sheep enterprises will continue to co-exist with the wind farm during the operational phase. The proposed development will have no effect on other land-uses within the wider area.

Other developments located within the wider environs of the proposed development site are not assessed as likely to result in significant adverse effects.

4.4.4.3 Employment and Economic Activity

The proposed development has been assessed as likely to result in slight positive effects on employment and economic activity. Therefore, it is assessed that any cumulative effects arising will also be of a positive nature.

4.4.4.4 Recreation, Amenity and Tourism

It is not considered that the proposed development together with other projects in the area will cumulatively affect any tourism infrastructure in the wider area.

4.4.4.5 Human Health and Safety

The proposed development will have no cumulative effects in terms of health and safety. There is no credible scientific evidence to link wind turbines with adverse health effects.

4.5 Mitigation & Monitoring Measures

4.5.1 Population

As there will be no significant effect on population trends, density, household size or age structure, no mitigation measures are required.

4.5.2 Land Use

Decommissioning works will be undertaken within the framework of a Decommissioning Plan, which will provide details on day to day works and methodologies. As part of these works, the public and other relevant stakeholders will

be provided with updates on construction activities which may affect existing land uses.

4.5.3 Employment and Economic Activity

Given that the likely effects of the proposed development at operation and decommissioning phases are predominantly positive in respect of employment and economic activity, no mitigation measures are considered necessary.

4.5.4 Recreation, Amenity and Tourism

Given that this assessment has not identified any likelihood of adverse effects on tourism assets, it is considered that no mitigation measures are required.

4.5.5 Human Health and Safety

It is not anticipated that the continued operation of the wind farm will present a danger to the public and livestock. Rigorous safety checks will continue to be conducted on the turbines during operation to ensure their optimal operation.

Notwithstanding the above, an operational phase Health and Safety Plan will continue to be implemented during the proposed period of extended operations to ensure that the risks posed to staff, landowners and the general public remain negligible.

4.6 Residual Effects

4.6.1 Population

The residual effects of the proposed development with respect to population are associated with operation and maintenance jobs during the operational phase of the proposed development. This is likely to result in a temporary slight transient population increase in the Study Area during working hours. As per the assessment, any effect to the population of the Study Area in terms of changes to population trends, density, household size, or age structure will be imperceptible. It is therefore unlikely that long term residual effects will occur to population and demographic trends as a result of the proposed development.

4.6.2 Land Use

Following decommissioning works, there is unlikely to be any residual effect on any subsequent land use alternatives including agriculture and forestry. Once mitigation measures are in place, no significant adverse negative residual effects on land use are likely.

4.6.3 Employment and Economic Activity

The residual impact of the development with respect to socio-economics is considered to be slight positive impact with respect to employment. This is as a result of the employment opportunities associated with the operation and maintenance of the development. There will also be a slight positive economic impact from income spent by construction and operations workers in the local area.

As detailed in **Section 4.4.2.3**, the community benefit fund will provide a long-term slight positive effect to the Study Area and wider community. Rates payments and development contributions have potential to improve service provision throughout County Limerick and in the local area. This is considered a slight positive residual impact.

4.6.4 Recreation, Amenity and Tourism

There will be no significant adverse effect to recreation, amenity and tourism in the surrounding area as a result of the proposed development.

4.6.5 Human Health and Safety

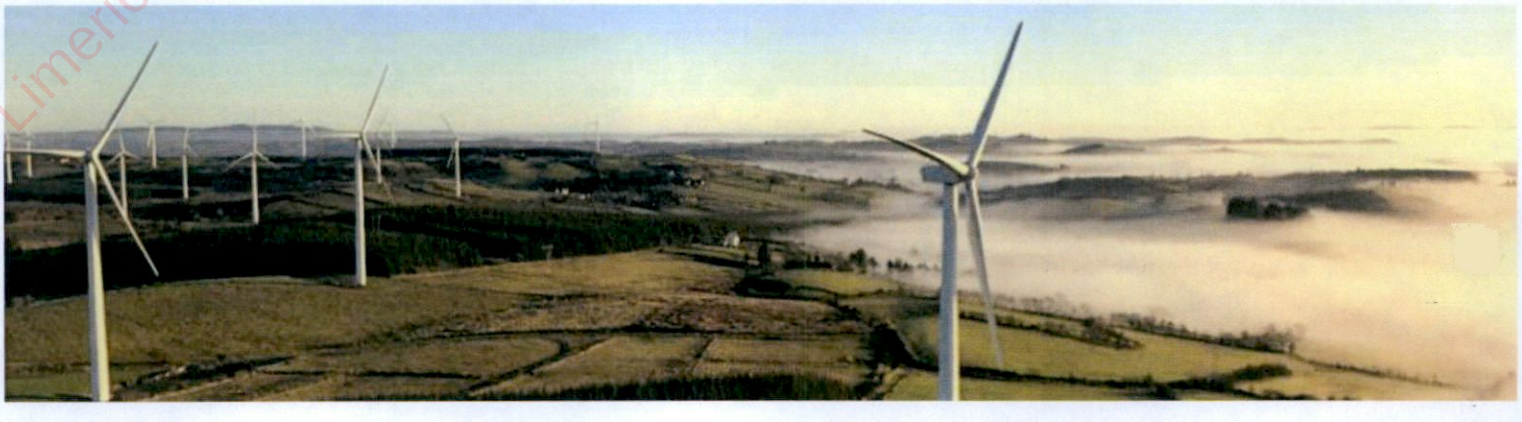
With the implementation of the above mitigation measure, there will be a long-term, imperceptible residual impact on health and safety during the operational life of the proposed development.

Through operational and decommissioning phases of the proposed development, negative residual impact on human health is expected to be imperceptible. This is due to the significant setback distance from nearby dwellings, absence of significant shadow flicker occurrences at neighbouring dwellings and noise control measures to reduce effects on nearby receptors. Furthermore, the mitigation measures as set out throughout the EIAR will prevent any likely significant effects on human health during the decommissioning phase.

4.7 Summary

The assessment of Population & Human Health has established the existing characteristics of the Study Area and compared this to Limerick County, Tipperary County and the State to establish a baseline for the impact assessment. Likely significant effects were considered for the operational and decommissioning phases of the proposed development as well as likely residual and cumulative impacts. Mitigation measures have been proposed where relevant.

In conclusion, once the minor mitigation measures set out throughout this EIAR are implemented, no significant negative effects on population and human health are assessed as likely to occur.



Knockastanna Wind Farm Extension of Operational Life

Chapter 5: Biodiversity

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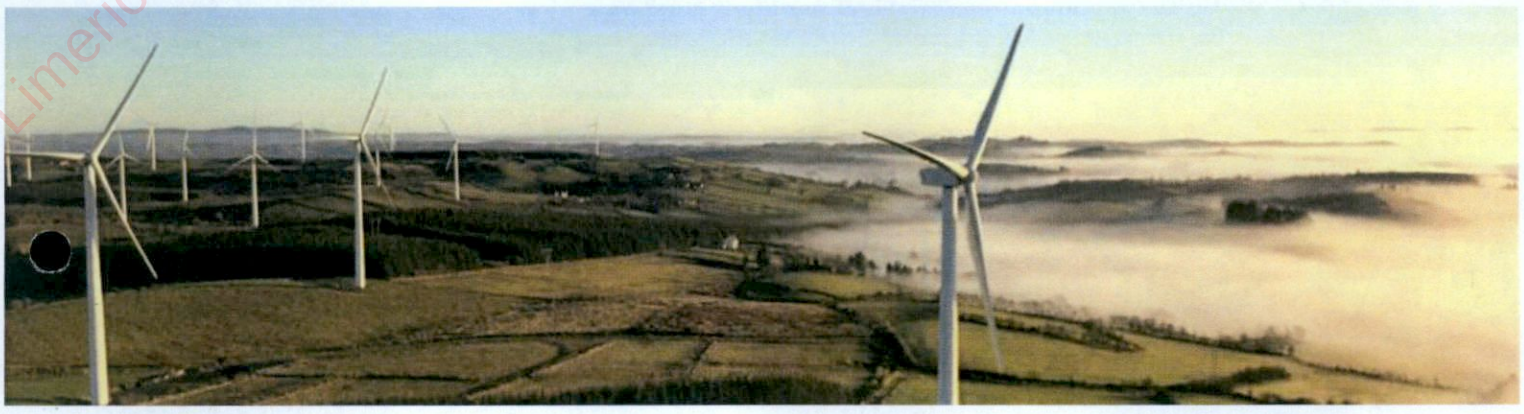

Contents

5.1 Introduction

5.1.1 Overview

This chapter identifies, describes and assesses the likely significant, direct and indirect effects of the proposed 15-year extension of the operations of the proposed development on biodiversity, including designated sites, habitats and species. It used information collected during the operation of the existing Knockastanna Wind Farm, and other sources, to assess the likely significant effects of the ongoing operation of the wind farm.

5.1.2 Statement of Authority

This biodiversity chapter was prepared by Richard Arnold BSc MRes MCIEEM CEnv. Richard is a consultant ecologist with 23-**years' experience** which includes the preparation of biodiversity chapters with respect to EIARs. Richard is a Technical Director within the Ecology team at SLR Consulting.

The chapter is based on bird monitoring undertaken by Geoff Oliver (2007), Fehily Timoney and Company (2008 and 2009) and Geoff Oliver and Gyr Penn (2010 to 2019); and bat survey work designed and undertaken by Owen Twomey, with assistance from Aisling Kinsella of SLR Consulting in 2021. The bird monitoring was pursuant to Condition No. 4 of the original planning consent (Planning Reg. Ref. 01/1385 / PL 13.130938).

5.1.3 Summary of the Proposed Development

In summary, the proposed development comprises the continued operations of the existing wind farm for a further period of 15-years. The existing development, including secondary ancillary developments, consists of the following main components:-

- 4 no. wind turbines;
- Associated turbine foundations and crane hardstandings;
- 1 no. electrical control building with a total footprint of 66 square metres (m^2), including welfare facilities and associated electrical equipment enclosure;
- Underground electrical cabling between each of the existing wind turbines and the electrical control building;
- 1 no. site entrance and 2km of site access tracks; and
- Site drainage infrastructure.

A full description of the proposed development is presented in **Chapter 3**.

5.1.4 Guidance

This biodiversity chapter is primarily based on the guidelines for ecological impact assessment produced by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2018). Guidance for specific surveys is provided in **Table 5.4**.

5.1.5 Legislation and Planning Policy

In addition to the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018, as amended, the legislation set out in **Table 5.1** has been considered where relevant to this chapter.

Legislation	Description
Wildlife Act, 1976, as amended	The principal national legislation for the protection of wildlife and the control of activities that may adversely affect wildlife. Also seeks to conserve a representative sample of important

	ecosystems and regulate game resources. It makes licences mandatory for certain activities which may interfere with ecosystems and regulates the possession, trade and movement of wildlife. Areas of importance for wildlife may be protected under the Act, either as Nature Reserves, Refuges for Fauna, or by way of management agreements.
Wildlife (Amendment) Act, 2000, 2010, 2012	Amended the Wildlife Act, 1976. Main objectives are to designate and give protection to Natural Heritage Areas (NHAs) and improve the conservation of wildlife and their habitats while ensuring **Ireland's compliance with international** biodiversity agreements. Broadened the scope of the Wildlife Act to include hitherto omitted species. Legislates for fines and punishments and allows for the imposition of prison sentences in certain circumstances.
Flora (Protection) Order 2015	This is the most up to date legislation regarding protected plant species in Ireland and supersedes three earlier versions of the Order. The order makes it illegal to cut, damage, or uproot protected species or to interfere with their habitats and seeds
European Communities (Birds and Natural Habitats) Regulations, 2011, as amended.	A collection of regulations which implements the EU Habitats Directive and the EU Birds Directive. The Habitats Directive is the main piece of EU legislation governing the protection and conservation of habitats and organisms (excluding birds) deemed to be threatened and of EU wide importance. It establishes Special Areas of Conservation (SACs) where habitats and/or wildlife present are deemed to be ecologically valuable. The EU Birds Directive conserves wild bird populations in Europe by protecting not only the birds but also their habitats through the creation of Special Protection Areas (SPAs).
Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species, as amended, together with Commission Implementing Regulation (EU) 2016/1141 and Implementing Regulation (EU) 2019/1262	Mandates measures to prevent introduction, monitor and eradicate or control certain non-native invasive species i.e. those identified in the commission implementing regulations, which provide the list of 54 invasive alien species of Union concern.
The Heritage Act 2018	Amends the Wildlife Act 1976 by creating discretionary powers for the government to allow burning of uncultivated land in March and the cutting of roadside hedgerows in August and provides additional exemptions for cutting roadside vegetation for reasons of road safety, as well as giving additional powers to the police to enforce wildlife legislation, including fixed penalties.

Table 0: Biodiversity Legislation

In addition to the legislation outlined above, the following planning policies as applicable to the proposed development are set out in **Table 5.2**.

Policy Document	Description
Project Ireland 2040: National Planning Framework	The National Planning Framework is the national spatial strategy for Ireland. It includes policy objectives which are to be incorporated into lower tier plans, such as Local Development Plans. One of these (no. 58) is to provide integrated planning for green infrastructure and ecosystem services, another (no. 59) is to enhance the conservation status and improve the management of protected nature conservation sites and protected species, and to protect and restore biodiversity through the planning system. It mandates that all applications for development that are likely to have significant effects on the environment are accompanied by at least an ecological impact assessment report.
Project Ireland 2040: National Development Plan 2018 – 2027	The National Development Plan sets out the priorities for infrastructure and investment projects and spending. These are informed by the policy objectives of the National Planning Framework and are designed to achieve those objectives. The 10 National Strategic Outcomes described in the Plan include (no. 7) enhanced amenity and heritage, which includes protection and enhancement of biodiversity through the National Development Plan, specifically, implementing the National Biodiversity Action Plan 2017 – 2021, support for local biodiversity action plans and the restoration of peatlands.
Regional Spatial and Economic Strategy for the Southern Region	Regional Spatial and Economic Strategy for the Southern Region provides the regional policies. Policy RPO 126 pertains to the protection of biodiversity specifically. It sets out general support for the protection of biodiversity both inside and outside protected areas, support for the National Biodiversity Action Plan, support for local biodiversity plans, support for the conservation, management, and enhancement of natural heritage. Policy RPO 127 deals with invasive species and Policy RPO 128 deals with pollinators.
Limerick County Development Plan 2010 - 2016	The current development plan for Limerick County. Policy EH P1 promotes sustainable management and conservation of the natural environment; Policy EH O1 reiterates the protection for Natura 2000 sites (SACs and SPAs) and provides protection for NHAs and pNHAs (proposed NHAs); EH O2 provides protection for species protected by law; EH O3 provides protection for peatlands outwith protected sites and to develop a wind farm map based on an ecological assessment of upland areas.
Limerick Development Plan 2022-2028 (Draft)	The emerging development plan for Limerick City and County. EH P1 reiterates the protection for Natura 2000 sites (SACs and SPAs) and provides protection for NHAs and pNHAs; EH P2 promotes sustainable management and conservation of the natural environment and to protect and enhance natural heritage; EH P3 compels the Council to take into account the contents of the National Biodiversity Action Plan; EH P4 compels the Council to put ecological and environmental

	issues at the centre of planning policies and decisions, while supporting the Limerick Heritage Plan 2017 – 2030.
Limerick Heritage Plan 2017-2030	Has objectives for biodiversity, which include support for the National Parks and Wildlife Service (NPWS) in protecting sites for biodiversity.

Table 0: Planning Policy and Biodiversity

5.1.6 Conditions

Condition No. 4 of the parent permission also provides context for this chapter of the EIAR:-

> *"Prior to the commencement of development, the developer shall agree with the planning authority a protocol for annual reports on the impact of the windfarm on wildbirds in the vicinity, with particular reference to the hen harrier and red grouse. These reports shall be submitted on an agreed date annually for as long as the windfarm is operational."*

The details of the agreed bird survey methods are summarised at **Annex 5.1**.

5.1.7 Limitations

The survey and assessment are subject to a number of limitations and uncertainties, these are as follows:-

- The bird surveys followed a monitoring protocol advised by the National Parks and Wildlife Service in 2006, this did not include the monitoring of control sites, habitats or disturbance, and therefore it is difficult to relate changes in bird populations at the site to any one cause;
- There was only one survey visit for breeding bird transect surveys in each of 2006 and 2007 instead of two visits;
- There was a change in surveyors for the bird surveys in 2008 and 2009 which may have led to some inconsistency in the way in which bird survey methods were applied and therefore the results. In particular, unusually high counts were made of some species in 2008;
- There were no bat surveys undertaken at the proposed development site prior to the construction of the wind farm or any time afterwards until 2021, and again there has been no monitoring of a control site or habitats, meaning that trends in the bat populations at the proposed development site are unknown, nor are variances in bat activity between the proposed development site and nearby areas;
- There have been no carcass searches at the wind farm during the operation of the wind farm, meaning that it is difficult to estimate any bird and bat mortality at the wind farm; and
- On occasion the bat detectors failed to operate which reduced the amount of data from expected, the details are provided in **Annex 5.2**.

Nevertheless, 14-years of bird survey, 11 no. of which coincide with the operation of the wind farm, and one full season of bat survey, also coincidental with the operation of the wind farm, are available to inform the assessment of likely significant effects. The bird survey included comprehensive monitoring of hen harrier populations and movements around the operational wind farm. In addition, coarse changes in habitat during the operation of the wind farm can be assessed through examination of aerial imagery. In most situations (i.e. new development proposals), no site-specific data collected during operation would be available to inform the assessment. The

limitations and uncertainties above are therefore minor and did not affect the ability to make an accurate assessment of the likely significant effects of the proposed development.

5.1.8 Consultations

A consultation response of relevance to biodiversity was received from the Department of Housing, Local Government and Heritage and this was fully considered in the formation of this chapter. The consultation response and how it has been addressed is provided in **Table 5.3**.

Prescribed Body	Comment	Response
Department of Housing, Local Government & Heritage	The Department notes that this development is located within the Slievefelim to Silvermines Mountains Special Protection Area (SPA) (Site Code 004165) and that Hen Harrier is listed as a Special Conservation Interest for this SPA. Based on information available at present it **is this Department's view** that a proposed extension of operational life would screen-in for appropriate assessment and will require the preparation of a Natura Impact Statement (NIS) and a full Appropriate Assessment will have to be undertaken by the relevant consent authority as part of the decision making process. In this regard, the consent authority must be in a position to conclude that the proposed development will not adversely affect the integrity of a European Site either individually and in-combination with other plans and projects. If it cannot be definitively concluded that the project will not adversely affect the integrity of a European site consideration must, in the first instance, be given to alternative solutions which will not adversely affect the integrity of a European site. If following such consideration, there are no such alternative solutions identified, consideration may be given by the relevant planning authority to whether the proposal should proceed for imperative reasons of overriding public interest.	An AA Screening and NIS are provided separately.
	This Department is of the view that the Environmental Impact Assessment Report (EIAR) and Natura Impact	The loss of habitat that occurred during construction of the wind farm was considered as part of

Statement (NIS) should consider the loss of Hen Harrier habitat, if any, that occurred due to the wind farm construction and operation, both in terms of the footprint of the development and any zone of avoidance around the development. This should include an assessment of any deterioration in habitat quality or prey availability around the development.	the original planning application for Knockastanna Wind Farm. The proposed development i.e. the extension of the operational life of the wind farm does not include any construction activity that would result in any additional direct loss of habitat. It is therefore not appropriate to consider direct loss of habitat in this EIAR (or NIS) that occurred as part of the earlier consent other than in reference to the baseline conditions. Ongoing displacement (zone of avoidance around the development site), deterioration in habitat quality and changes in prey availability have been considered for the proposed development, see **Section 0**. In summary, (i) the wind farm is assessed as likely to result in displacement of hen harrier from 30ha of suitable habitat at Knockastanna Hill; (ii) the habitat within the proposed development site has remained suitable for hen harrier however much of the rest of Knockastanna Hill (200ha of 450ha), which is outside the control of SSE, has been afforested and is now unsuitable; (iii) prey availability (meadow pipit abundance) has not declined within the proposed development site but must have done in the afforested areas.
The EIAR and NIS should also consider the likely quality and value of that habitat if it were to become available to Hen Harriers once again.	This is assessed in **Section 0** of this chapter. In summary, due to afforestation (and historic agricultural improvement of grassland), there is less than 100ha of open moorland habitat at Knockastanna Hill (71ha remains), which means Knockastanna Hill is not currently suitable to support a breeding hen harrier pair (a minimum of 100ha out of 300ha is required). Removal of the wind farm on its own would not change this situation.

Ecological surveys particularly Hen Harrier surveys carried out prior to the 2003 grant of planning permission and prior to the 2007 construction should be considered in the EIAR and NIS and compared to surveys carried out after construction.	This has been carried out in **Annex 5.1** of the EIAR. In summary, (i) sightings of hen harrier at Knockastanna Hill were made in 2000 and 2001 but breeding status was not confirmed; (ii) a hen harrier pair held territory at Knockstanna Hill in 2003, 2004, 2005, 2006 and 2007, with successful breeding known to occur in 2003; and (iii) there was also a hen harrier pair holding territory at Knockastanna Hill in 2017, but this pair did not breed successfully. Whilst the near cessation of hen harrier breeding at Knockastanna Hill coincides with the construction and operation of the wind farm, it also coincides with a period during which substantial areas of forestry on Knockastanna Hill **matured beyond the 'pre-thicket' stage and became** unsuitable for nesting hen harrier and its chief prey item, the meadow pipit. Importantly, the breeding population has, if measured as successful breeding pairs, remained stable in the SPA as a whole during this period or, if measured as pairs holding territory, has increased from 5 to 10 pairs.
Any impacts resulting from the operation of the windfarm should be considered in relation to the Conservation Objectives for the site, in particular any decline in the natural range or the area covered by the species within that range should be considered and the availability of a sufficiently large habitat to maintain the population on a long term basis.	The relationship between effects including loss of range and the conservation objectives is considered in the NIS. In summary, the operation of the wind farm has not undermined the draft conservation objectives for the SPA and its continued operation would also not undermine the draft conservation objectives for the SPA
The EIAR and NIS should detail what monitoring of bird usage has taken place at the site since construction and whether regular systematic searching for corpses of birds or bats has taken place on the site and what the results of that have been	The details of bird monitoring are provided in **Annex 5.1**. The scope of the monitoring surveys was agreed with the NPWS beforehand. This did not include regular systematic searching for corpses of birds or bats on the site and such searches have not

		been done. However, it is proposed, for the purpose of adaptive management, to undertake such searches under the consent for the continued operation of the wind farm.
	The Department notes that the consultation letter states that the development site was not part of the SPA until 2011, however the Natura 2000 standard data form states that the SPA was designated in March 2007 and the importance of the Slievefelim to Silvermines Mountains area for Hen Harriers was identified in the 1998-2000 national survey. The Statutory Instrument (S.I. 587/2011) was signed in 2011 but some protections existed prior to this.	In this assessment (EIAR and NIS), the date of designation is taken to be March 2007.

Table 01 Response to Consultation Comments

5.2 Methodology

5.2.1 Baseline Assessments

As the proposed development site is already constructed and operational, baseline information has been provided in the form of annual monitoring reports on the impact of the windfarm on wild birds in the vicinity, with particular reference to the hen harrier and red grouse. A full list of surveys used to inform the assessment is set out **Table 5.4** below. This includes annual bird surveys from 2006 to 2019 (14-years) which were completed in order to comply with Condition No. 4 of the parent permission. Other surveys were undertaken to inform the assessment in 2021, specifically habitats and bats.

Study	Description and Extent	Timing	Reference*
Desk Study	Desk study for designated sites and bat records within 10km	March 2022	
Vegetation and Habitats	The vegetation at the wind farm site was surveyed for the original planning application in 2001 and re-visited in 2021.	May 2001 and August 2021	(Fossitt, 2007)
Bat Survey	Four static bat detectors were positioned at the four turbine locations to record bat activity in each of three seasons; 15-20 nights per season. One year of survey data was collected in 2021, see **Annex 5.1** for details of the bat survey methodology.	Late May to Early September 2021	(Collins, 2016) (NatureScot, 2021)
Bird Surveys	Annual bird surveys from 2006 onwards comprising flight activity surveys from two Vantage Points (VPs); searches for breeding hen harrier within 5km; transect surveys to record meadow pipit *Anthus pratensis* and skylark *Alauda arvensis* within the site; red	VPs April to July; HH April to August; Transects April to	(Gilbert, Gibbons, & Evans, 1998)

	grouse *Lagopus lagopus* survey of one visit per *annum* (Oliver & Penn, 2007 - 2019) (Fehily Timoney & Company, 2008 - 2009), see Annex 5.2 for further details of the bird survey methodology.	June; RG December to March; all 2006 – 2019	(Madders, 2002)[1]

Table 5.4: Study Methods

** the reference is for the standard methodology upon which the surveys were based.*

5.2.2 Evaluation of Ecological Features

Following the baseline assessments (as set out in **Table 5.4**), the ecological features (sites, habitat areas, species populations, veteran trees, etc.) were assigned a level of value based upon the published guidelines for ecological impact assessment (CIEEM, 2018). The levels of value available for use in the assessment are:-

- International and European;
- National;
- Regional i.e., Southern Region;
- County i.e., Limerick;
- Local i.e. Townland and around;
- Site i.e. within the proposed development site; and
- Negligible.

The level of value is determined by reference to standard criteria. All features of Local value and higher are considered in the assessment if they are likely to be significantly affected. Other features are also considered in the assessment if they are protected by law or policy, or otherwise require consideration in the development process.

5.2.3 Significance criteria

The significance criteria depart from the standard CIEEM guidance[2] and instead adopt the matrix approach for consistency with other chapters in this EIAR. The magnitude of impacts is set out in **Table 5.5**, while the sensitivity of features based on the CIEEM scale is set out in **Table 5.6** and the matrix and the approach to determining impact significance is set out in **Table 5.7**.

	Large	Moderate	Small	Negligible
Total loss of or severe damage to a site, habitat, species population or other ecological feature.	✓			
Partial loss or moderate damage or degradation of a site, habitat, species population or other ecological feature or creation of such features.		✓		
Minor damage or degradation of a site, habitat, species population or other ecological feature or enhancement of such features.			✓	

[1] This guidance has now been replaced; however it was current at the beginning of monitoring programme.

[2] The CIEEM guidelines attribute levels of significance based on the same geographic scale presented in **Section 5.2.2**. For example, an impact on a feature of county importance would generally be described as an impact significant at the county level (CIEEM, 2018).

Imperceptible effect on a site, habitat, species population or other ecological feature.				✓

Table 5.5: Magnitude of Impacts

	High	Medium	Low	Negligible
Features of International, European & National importance	✓			
Features of Regional, & County importance		✓		
Features of Local or Site importance			✓	
Features of Negligible importance				✓

Table 5.6: Sensitivity of Receptors

	Magnitude of Impact			
Sensitivity	**Large**	**Moderate**	**Small**	**Negligible**
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Minor	Negligible
Negligible	Minor	Negligible	Negligible	Negligible

Table 5.7: Significance of Effects

The results of the assessment using the above approach are presented at **Table 5.13**.

5.3 Description of Existing Environment

5.3.1 Designated Sites

The proposed development site is within the Slievefelim to Silvermines Mountains Special Protection Area (SPA). This SPA was designated in March 2007, after planning consent was obtained for the existing wind farm but before it was built. The SPA is designated solely for its population of hen harrier and it supported five pairs (four confirmed breeding) at the time that the site was designated, although it has supported more in the past (nine pairs in 1998-2000, eight confirmed breeding) and subsequently (ten pairs in 2015, four confirmed breeding). in 2020, there were five confirmed breeding pairs (NPWS, 2021).

The proposed development site is drained by streams which flow onto the Bilboa River, which is included within the Lower River Shannon Special Protection Area (SAC). There are seven other SACs within 15km of the proposed development site, plus three Natural Heritage Areas (NHAs) and nine proposed Natural heritage Areas (pHNAs) which are not included in an SAC. These are shown at **Figure 5.1** (**Annex 5.3**) and described in **Table 5.8**.

The only sites designated for supporting birds within this search area are the Slievefelim to Silvermines Mountains SPA and the Aughnaglanny Valley pNHA. None of the sites are designated for bats.

Site Name	Site Code	Distance to Site	Brief Description	Value
Special Protection Areas				
Slievefelim to Silvermines Mountains SPA	004165	0km, site is included	Very large upland site (20,913ha) including Keeper Hill, Slieve Felim, Knockstanna, Knockappul, Mother Mountain, Knockteige, Cooneen Hill and Silvermine Mountain. The site comprises conifer plantation (c.50%), blanket bog and wet heath (c25%) and other upland habitats. It is designated as an SPA for its population of hen harrier (5 pairs in 2005); one of six SPAs designated for this species in Ireland. It also supports peregrine *Falco peregrinus* and merlin *Falco columbarius* (1 pair of each).	International
Special Areas of Conservation				
Lower River Shannon SAC	002165	0.42km	Another very large site (68,300ha), this time comprising rivers, riverine, floodplain and coastal habitats. The Bilboa and Gortnageragh Rivers are part of the SAC, which support salmon and native woodland along the riverbanks.	International
Lower River Suir SAC	002137	6.4km	A large (7,096ha) site comprising rivers, riverine, floodplain and coastal habitats. The Multeen River forms part of this SAC.	International
Anglesey Road SAC	002125	6.9km	Species-rich montane acid grassland on a steep-sided valley which extends approximately 1.8km along the Multeen River.	International
Keeper Hill SAC	001197	8.7km	Upland site (416ha) supporting blanket bog and wet heath, known to support peregrine falcon and red grouse	International
Philipston Marsh SAC	001847	10.3km	Small wetland with reedbed and calcareous fen.	International
Bolingbrook Hill SAC	002124	10.5km	Upland site (205ha) supporting wet heath, dry heath and species rich acid grassland	International
Clare Glen SAC	000930	11.1km	Woodland site which supports Killarney fern *Trichomanes speciosum*.	International

Glenstal Wood SAC	001432	11.1km	Woodland site which supports Killarney fern.	International
Silvermines Mountains West SAC	002258	12.2km	Upland site (625ha) supporting wet heath, dry heath and species-rich grassland on mining waste.	International
Silvermine Mountains SAC	000939	12.4km	Small upland site supporting species-rich acid grassland and dry heath.	International
Natural Heritage Areas				
Mauherslieve Bog NHA	002385	4.9km	Upland blanket bog (135ha).	National
Grageen Fen And Bog NHA	002186	5.9km	Upland site (45ha) with upland bog and alkaline fen.	National
Bleanbeg Bog NHA	002450	8.0km	Upland blanket bog (135ha).	National
Proposed Natural Heritage Areas				
Bilboa And Gortnageragh River Valleys pNHA	001851	1.7km	Included in Lower River Shannon SAC; no synopsis available.	As for SAC.
Knockanavar Wood pNHA	000961	5.2km	Included in Lower River Shannon SAC; no synopsis available for the pNHA.	As for SAC.
Inchinsquillib and Dowlings Woods pNHA	000956	7.5km	Included in Lower River Shannon SAC; no synopsis available.	As for SAC.
Keeper Hill pNHA	001197	8.7km	Included in Keeper Hill SAC	As for SAC.
Kilbeg Marsh pNHA	001848	9.4km	Wet woodland, fen and open pools.	National
Derrygareen Heath pNHA	000931	9.6km	Rocky area of shallow peaty soils supporting wet heath.	National
Dromsallagh Bog pNHA	001850	9.9km	Cutaway raised bog that is regenerating.	National
Ballyvorheen Bog pNHA	001849	10.3km	Included in Lower River Shannon SAC; no synopsis available for the pNHA.	As for SAC.
Philipston Marsh pNHA	001847	10.3km	Included in Philipston Marsh SAC	As for SAC.
Nenagh River Gorge pNHA	001133	10.6km	Steeply sloping valley sides with rush grassland, scrub, heath and woodland, plus the River Nenagh.	National
Aughnaglanny Valley pNHA	000948	10.6km	Semi-natural woodland in a steep-sided river valley, it is of ornithological interest and	National

			supports a range of woodland birds.	
Glenstal Wood pNHA	001432	10.7km	Partly included within Lower River Shannon SAC; no synopsis available for the pNHA.	As for SAC.
Clare Glen pNHA	000930	11.1km	Included in Clare Glen SAC.	As for SAC.
Silvermine Mountains pNHA	000939	12.2km	Included in Silvermine Mountains SAC.	As for SAC.
Ballyneill Marsh pNHA	001846	12.2km	Wetland habitats in a series of **'kettle holes'** including open water and red beds.	National
Annacarty Wetlands pNHA	000639	13.1km	Series of four wetlands at varying stages of succession and high diversity of wetland plant species.	National
Ballydonagh Marsh	001844	14.3km	Three small basin fens designated for botanical interest.	National
Dundrum Sanctuary pNHA	000950	14.9km	Native woodland, including wet woodland and a pond with wetland habitats. There is a known colony of whiskered bats *Myotis mystacinus* in the International Scout Centre,	National

Table 5.8: Designated Sites within 15km

5.3.2 Habitats and Flora

The site is an existing wind farm comprising 4 no. turbines, an electrical switchroom and an access track linking the turbines. The track begins at a minor road at Foilmahonmore and extends to the southeast, terminating approximately 90m short of the summit of Knockastanna (444m ASL). The total proposed development site area is c. 43.3ha and it occupies approximately 10% of Knockastanna Hill.

Fields of improved grassland (GA1) are either side of the access track to the north. As the track ascends, the habitat on either side grades into upland blanket bog (PB2) and wet heath (HH3). 3 no. of the turbines, and about half the access track, sit within wet heath and the fourth turbine and remaining infrastructure sit within improved pasture.

The wet heath and upland blanket bog habitats occupy 71ha or approximately 16% of Knockastanna hill, including the proposed development site. These habitats are of high nature conservation value, potentially of county importance, while the grassland is likely to be of local value. These, and the other habitats present within and adjoining the proposed development site, are described at **Table 5.9** and shown on **Figure 5.2** (**Annex 5.3**).

Beyond these habitats, and outside the proposed development site, are conifer plantations including Sitka spruce *Picea sitchensis*. That on the eastern flank of Knockastanna Hill is managed by Coillte; three blocks Curraghafoil 68.80ha, Foilmahonmore (part) 16.2ha and Foilycleary 51.9ha. In addition, there is private forestry on the southern flank (23.6ha) and western flank (21.7ha and 13.3ha). Knockastanna Hill is approximately 450ha and therefore forestry (195.5ha) takes up 43% of the hill.

The forestry has mostly been planted in areas of former wet heath and blanket bog, with all the planting apparently taking place after 1990. In 2000, there was approximately 110ha of open moorland, with substantial areas being planted after 2005 and largely complete by 2012. In the older plantations, the trees are now dense and mature and, for the remainder, the trees are mostly beyond the pre-thicket stage.

Knockastanna Hill is drained by the Bilboa River (north and western slopes), Aughsullish Stream (eastern slopes) and Gortnageragh River (southern slopes). These watercourses are of high nature conservation value, as they are included in sites of international value or flow into such sites. The proposed development site is on the northern side of Knockastanna Hill and therefore drains into the Bilboa River via tributaries.

Habitat	Description	Status	Value
GA1 Improved agricultural grassland (15.3ha)	Agriculturally improved grassland which has been recolonised by soft rush *Juncus effusus*, Yorkshire fog *Holcus lanatus*, ragwort *Senecio jacobea*, marsh thistle *Cirsium palustre* and other common plant species indicative of neutral grassland. This habitat is present on the lower slopes of Knockatanna, in the north of the proposed development site.	-	Local
WS1 Scrub (1.56ha)	European gorse *Ulex europaeus* and bramble *Rubus fruticosus* agg scrub, with occasional grey willow *Salix cinerea*, and rowan *Sorbus aucuparia*.	-	Site
FW4 Drainage ditches	Drainage ditches alongside the access track and cut into the peat, mostly with still water, others with running water, Species present are grey willow, common haircap moss *Polytrichum commune*, *Sphagnum* spp.	-	Negligible
BL3 Buildings and artificial surfaces (1.0ha)	The access track and the bases of the turbines are bare, acritical surfaces, while the electrical control building is the only building on the proposed development site.	-	Negligible
FW1 – Eroding/upland rivers	Curraghfoil watercourse originates within the proposed development site. It has slow flow, 2 cm deep, 50 cm wide, with overgrown banks and little aquatic vegetation. Species present were bog stitchwort *Stellaria alsine*, lesser spearwort *Ranunculus flammula*, bramble, **soft rush, lady's fern** *Athyrium filix-femina*, hard fern *Blechnum spicant*, and broad buckler fern *Dryopteris dilatate*. A tributary of the Bilboa River.	-	Local
HH3 Wet heath (18.3ha)	At the summit of Knockastanna Hill and mid slopes within the proposed development site is wet heath on peat less than 0.5m deep. Species present were purple moor-grass *Molinia caerulea*, heather *Calluna vulgaris*, tormentil *Potentilla erecta*, cross-leaved	Annex I	County

	heath *Erica tetralix*, common haircap moss, heath rush *Juncus squarrosus*, cotton grass *Eriophorum angustifolium*, wood rush *Luzula sylvatica*, grey willow saplings, *Sphagnum* spp. (mainly *S. capillifolium* and occasionally *S. palustre*), the lichen *Cladonia portentosa*, common bent *Agrostis capillaris*, bog asphodel *Narthecium ossifragum*, green-ribbed sedge *Carex binervis*, star sedge *Carex echinate*, carnation sedge *Carex panicea*, and deergrass *Trichophorum caespitosum*. There are signs of historic cutting of peat from which the vegetation has recovered however the vegetation and soil has more recently been degraded by goats and cattle.		
PB2 Upland blanket bog (4.0ha)	Towards the summit of Knockastanna is an area of upland blanket bog on peat greater than 1m deep, with typical species of blanket bog including heather, deergrass, cross-leaved heath, bilberry *Vaccinium myrtillus*, heath bedstraw *Galium saxatile*, heath milkwort *Polygala serpyllifolia* common sedge *Carex nigra*, red fescue *Festuca rubra*, purple moor-grass, *Sphagnum* spp (similar species to HH3 but also *S.cuspidatum* and *S. recurvum*) and common haircap moss. The blanket bog has also been cut for peat and is also being damaged by grazers, as noted during the 2021 surveys.	Annex I	County
WL1 Hedgerow	Hedgerow along the road to the north of the site and field boundaries in the north of the proposed development site, with European gorse, hawthorn *Crataegus monogyna* and hazel *Corylus avellana*.	-	Site
WL2 Treeline	Planted line of trees in the northeast of the proposed development site with Sitka spruce, lodgepole pine *Pinus contorta*, rowan, grey willow, sycamore *Acer pseudoplatanus* and beech *Fagus sylvatica*.	-	Site
WD4 Conifer plantation (outside but bordering the proposed development site)	Sitka spruce dominated conifer plantation, outside and to the east and west of the proposed development site, planted on former wet heath and upland blanket bog. The trees are approximately 20m tall. Non-native trees however provides habitat for breeding birds and other wildlife.	-	Site

Table 5.9: Habitats within and adjacent to the Proposed Development Site

5.3.3 Bats

The operational wind farm site was found to be used by, common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *Pipistrellus pygmaeus*, Nathusius' pipistrelle *Pipistrellus*

nathusii, brown long-eared bat *Plecotus auritus*, **Leisler's bat** *Nyctalus leisleri*, **Daubenton's bat** *Myotis daubentonii*, **Natterers' bat** *Myotis nattereri* and Whiskered bat *Myotis mystacinus*. Many of these species have also been recorded at varying distances from the site, with most of these species being common and widespread in Ireland. The exceptions are Nathusius' **pipistrelle which is uncommon but is being** recorded more frequently, **Natterers' bat** *Myotis nattereri* and Whiskered bat *Myotis mystacinus*. The level of bat activity varied from low to moderate-high depending on the species, see **Table 5.10**, although the low levels of activity recorded for brown long-eared bat may also be a reflection of its biology (it calls less often than other bats). The nearest known roost is nearly 9km distant although it is likely that the bats present on site are roosting closer to the proposed development site.

Species	Maximum Activity Levels on Site	National Population*	Assessment	Value
Common pipistrelle *Pipistrellus pipistrellus*	Moderate-high	1,070,000 to 2,400,000	Numerous and widespread species both locally and nationally.	Local
Soprano pipistrelle *Pipistrellus pygmaeus*	Moderate -high	500,000 to 1,200,000	As for common pipistrelle	Local
Nathusius' pipistrelle *Pipistrellus nathusii*	Moderate	3,000 to 5,000	Low national population with limited distribution in Limerick and Tipperary.	Regional
Daubenton's bat *Myotis daubentonii*,	Low - moderate	57,000 to 79,000	Less common than common/soprano pipistrelle but widespread and relatively numerous.	Local
Natterers' bat Myotis nattereri	Low - moderate	Unknown, recorded from 321 occupied 1km squares (of 84,500)	Rare in the county and South-west Ireland, uncommon nationally. the species was recorded on all three survey occasions indicating a resident population.	National
Whiskered bat *Myotis mystacinus*	Low - moderate	Unknown, recorded from 185 occupied 1km squares	Rare in the county, region and country, the species was recorded on all three survey occasions indicating a resident population.	National
Brown long-eared bat *Plecotus auritus*	Low - moderate	62,000 to 97,000	**As Daubenton's bat.**	Local
Leisler's bat *Nyctalus leisleri*	Moderate	63,000 to 113,000	**As Daubenton's bat.**	Local

Table 5.10: Bat Species within the Proposed Development Site

** population data taken from Article 17 reporting (NPWS, 2019).*

5.3.4 Hen harrier

During construction and post-construction (2008 to 2019 inclusive), there has been no evidence of hen harrier breeding or occupying territories within the proposed development site except in 2017 when there was evidence of an occupied territory, but breeding was not confirmed. The level of hen harrier activity recorded on the proposed development site has been low, including in 2017, despite the apparently occupied territory. Since construction of the wind farm in 2008, less than 8 no. hen harrier sightings per year have been made within the proposed development site or around it (Knockastanna Hill), with the number of sightings staying roughly the same with a mean of 4 no. sightings (during 60-hours of observation) made per year between 2008 and 2019. The sightings tend to be brief and of individuals hunting or flying over the proposed development site. This is equivalent to a single bird passing through once a day. There was no evidence of a breeding territory in 2018 or 2019 at Knockastanna Hill.

Hen harrier has continued to breed within 5km of the wind farm site, with between 5 no. and 7 no. pairs present each year (Oliver & Penn, 2007 – 2019). See **Table 5.11** for an evaluation of the hen harrier population.

5.3.5 Other birds of prey

Kestrel *Falco tinnunculus* is resident at Knockastanna Hill (proposed development site and surrounding area) and has been recorded in every year, including pre-construction, during construction and during operation of the wind farm.

Peregrine falcon, short-eared owl *Asio flammeus*, white-tailed eagle *Haliaeetus albicilla*, sparrowhawk *Accipiter nisus* and buzzard *Buteo buteo* have all been recorded after the wind farm was constructed but not before. Of these, only sparrowhawk and buzzard are resident; the other species have been recorded only rarely. The records of these 5 no. species on and around the proposed development site following construction is likely to be a function of both increasing populations and increased survey effort.

There has been no confirmed evidence of merlin before or after wind farm construction other than in 2007 when a bird (thought to be a female blackbird) was found which may have been killed by a merlin. See **Annex 5.1** for details.

5.3.6 Waders

Curlew *Numenius arquata* was recorded only before the wind farm was constructed (in 2006) but not afterwards, despite the increased survey effort. This could be a result of generally declining populations of this species in Ireland; it is now a rare breeding bird.

Snipe *Gallinago gallinago* were recorded on the proposed development site before the wind farm was constructed (2006 and 2007) and regularly after the wind farm was constructed (2010, 2012, 2015, 2018 and 2019). This species is easily missed during surveys and may therefore have been present in other years. The majority of the records were made in February, with one in January and just two in April and none further into the breeding season or recorded as showing signs of breeding behaviour. Therefore, this species is most likely wintering on the proposed development site and not breeding.

Golden plover *Pluvialis apricaria* was recorded twice on the proposed development site after the wind farm was constructed (2014 and 2019) but not before, probably a reflection of increased survey effort.

5.3.7 Red Grouse

One to two pairs of red grouse are likely to maintain a permanent presence (recorded in all but two of the years when monitoring surveys were undertaken) within the proposed development site and likely breed there (see **Annex 5.1**).

5.3.8 Other Moorland/Grassland Birds

The proposed development site supports a community of other moorland birds. Recorded in all or most years are meadow pipit, skylark, swallow *Hirundo rustica*, reed bunting *Emberiza schoeniclus* and linnet *Carduelis cannabina*. Species occurring more sporadically include stonechat *Saxicola rubicola*, grasshopper warbler *Locustella naevia* and raven *Corvus corax*.

The only species which is numerous is meadow pipit. Numbers of this species fluctuate from year to year but there has been no overall change between 2006 and 2019.

Skylark numbers are lower than meadow pipit, with an unexplained peak in the Skylark population in 2008, but otherwise numbers generally rose between 2006 and 2013 with peak counts of between 2 no. and 7 no. birds followed by a decline and then apparent absence in 2016. This was followed by its reappearance at lower numbers in 2017 – 2019, which are nevertheless similar to numbers recorded in 2006.

In summary, there is no pattern or trend evident in the populations of other moorland/grassland species.

5.3.9 Woodland Birds

The conifer plantations, which are adjacent to the proposed development site, and the treelines, which are within the proposed development site, support a community of woodland birds. Recorded in all or most years are wren *Troglodytes troglodytes*, chaffinch *Fringilla coelebs*, willow warbler *Phylloscopus trochilus*, blackbird *Turdus merula*, robin *Erithacus rubecula*, wood pigeon *Columba palumbus*, song thrush *Turdus philomelos*, dunnock *Prunella modularis* and blackcap *Sylvia atricapilla*. Other than an unexplained peak in numbers in 2008 (the same as observed for skylark) for several species (wren, chaffinch, willow warbler and wood pigeon) numbers have been fluctuating but similar in all years from 2006 to 2019, except for blackbird which may have declined steadily over this period. Other species are recorded more sporadically including blue tit *Cyanistes caeruleus*, great tit *Parus major*, coal tit *Periparus ater* and goldcrest *Regulus regulus*. There is no pattern or trend evident in any of these species either.

5.3.10 Other Species

A single common frog *Rana temporaria* was found on the proposed development site incidentally during the 2021 habitat survey.

Recorded in the same 10km square are bank vole *Myodes glareolus*, Eurasian badger *Meles meles*, eurasian red squirrel *Sciurus vulgaris*, European otter *Lutra lutra*, European rabbit *Oryctolagus cuniculus*, fallow deer *Dama dama*, greater white-toothed shrew *Crocidura russula*, Irish hare *Lepus timidus* subsp. *hibernicus*, Irish stoat *Mustela erminea* subsp. *ibernica*, pine marten *Martes martes*, red fox *Vulpes vulpes* and West European hedgehog *Erinaceus europaeus*.

The Mulkear and Bilboa Rivers, which are hydrologically connected to the proposed development site are known to support salmon *Salmo salar* and three species of lamprey. There are recent but unconfirmed reports of freshwater pearl mussel *Margaritifera margaritifera* in the Mulkear River.

Species	Population within/ near* the Proposed Development Site	National Population**	Assessment	Value
Hen harrier	1 pair	128 – 172 pairs	Just less than 1% of the national total, with localised and declining populations.	National
Kestrel	2	12,100 – 21,220	A small proportion of the national and regional total, widespread species however, not numerous and declining.	Local
Sparrowhawk	2	9,100 – 14,830	A small proportion of the national and regional total, widespread and stable population, however, not numerous.	Local
Buzzard	2	1,500	As for sparrowhawk but with an increasing population.	Local
Snipe	<5	4,275 pairs breeding, higher numbers in winter	As for kestrel.	Local
Red Grouse	2 - 4	1,708 - 2,116	Less than 1% of the national total, but localised and declining populations.	County
Meadow Pipit	20 - 60	1,090,350 – 1,869,060	Very small proportion of the national and regional total, widespread and stable populations.	Local
Skylark	<10	218,410 – 430,880	Very small proportion of the national and regional total, widespread and stable populations.	Local
Other resident bird species	N/A	N/A	Common and widespread species, typical of moorland and conifer plantation or occurring only sporadically at the site	Local

** recorded during surveys undertaken within the proposed development sites, which would normally be around 300m for small birds and 500m to 1km for birds of prey in flight. Birds recorded at this distance are capable of using suitable habitat both inside and outside the proposed development site.*

*** data taken from Article 12 reporting[3] under the Birds Directive*

Table 5.11: Bird Populations within/near the Proposed Development Site

5.3.11 Predicted Future Baseline

The predicted future baseline is the baseline that is predicted at the point when the proposed development begins. It takes into account any changes which may occur between the time when the surveys were completed and the start of the development, which in this case is the ongoing operation of the existing wind farm after 2023.

Conditions within the proposed development site would be expected to remain as they are now up until the point when further operations commence. Specifically, bird and bat populations, whilst fluctuating, are expected to remain consistent between now and 2023. The habitats and their condition within the proposed development site are also not expected to change (they are broadly the same now as they were in 2001).

However, the conifer plantation, which is outside the proposed development site, may undergo harvesting and therefore change the bird habitats and populations at Knockastanna Hill. A review of the Coillte management proposals[4] (Coillte, undated) (which are separate **from SSE's management of the wind farm site,** not in any way related to the wind farm, and subject to its own consenting process) indicate that Curraghafoil (68.8ha), a forestry block on the eastern flanks of Knockastanna, may be either clear felled or thinned by removing 11-20% of the trees, or a combination, before 2025. It also indicates that part of Foilmahonmore (16.27ha), an adjoining area of forestry may be thinned by removing 21-30% of the trees, also before 2025. Thinning of the trees, even by 30%, would not result in significant changes to the baseline conditions however a substantial clear fell operation would favour moorland bird species, such as skylark, meadow pipit and hen harrier, and result in local declines of woodland bird species and possibly also bats. In addition, two consented but not yet built wind farms may commence construction between now and when the proposed development commences. These are Upperchurch and Castlewaller Wind Farms, 8.8km NE of Knockastanna and just outside the SPA, and 9.0km NW and inside the SPA, respectively. Both are likely to become operational during the operational phase of the proposed development.

5.4 Description of Likely Effects

5.4.1 Construction Phase

As the wind farm is already operational and no additional infrastructure is proposed, there will be no construction phase effects associated with the proposed development i.e, the ongoing operation of the wind farm. As set out in **Chapter 3**, the removal and reinstatement of turbines including Turbine T05, is ongoing maintenance with no changes in turbine size or increases in the development footprint.

5.4.2 Operation Phase

[3] https://cdr.eionet.europa.eu/Converters/run_conversion?file=/ie/eu/art12/envuvesya/IE_birds_reports-14328-144944.xml&conv=343&source=remote#A082_B

[4] https://coillte.maps.arcgis.com/apps/webappviewer/index.html?id=7b05ec6a44a14bd8b523ea1fcb78b4e9

5.4.2.1 Designated Sites

As noted previously, the proposed development site is entirely within the Slievefelim to Silvermines Mountains SPA and there are no other SPAs within 15km of the proposed development site.

The Aughnaglanny Valley pNHA, which is 10.6km away is also designated for its breeding birds, all woodland species. Woodland bird species are not vulnerable to significant impacts from operational wind farms (NatureScot, 2021) and certainly not at this distance from the proposed development site.

All other designated sites within 15km are designated for their habitats, flora or aquatic species.

Therefore, there is no scope for the continued operation of the wind farm to affect any designated site beyond the Slievefelim to Silvermines Mountains SPA. Also as noted previously, the sole qualifying feature for the SPA is hen harrier and therefore effects on this species are also an effect on the designated site. Effects on hen harrier are assessed below.

5.4.2.2 Habitats and Flora

The continued operation of the wind farm will not have any effects on habitats and flora in proximity; for example, it will not require any vegetation clearance and it does not prevent the land from being grazed by livestock.

5.4.2.3 Bats

The proposed development comprises the continued operation of 4 no. turbines of relatively small size (hub height of 64.7m, a rotor diameter of 70.5m and an overall tip height of 99.95m.) This means that the risk of bat mortality as a result of the ongoing operation of the wind farm is relatively limited because the combined area swept by the turbines is relatively small. Wind farms comprising smaller turbines and smaller numbers of turbines generally pose lower risks to bats than larger ones (NatureScot, 2021).

Moreover, the turbines are located at least 100m from the edges of woodland. The woodland edges are likely to be the main areas used by foraging bats at the proposed development site. NatureScot guidance for calculating appropriate buffers between woodland edge and wind turbines provides a minimum distance of 72m for the turbines installed at the proposed development site with an assumed tree height of 20m. Again, this reduces the risk to bats.

The surveys undertaken in 2021 (see **Table 5.4**) have demonstrated use of the proposed development site by species of bat which are at risk of collision with wind turbines. Those at high risk are common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle and Leisler's bat, while the other species including Natterer's bat and whiskered bat are at low risk of collision (NatureScot, 2021). The proposed development would therefore continue the risk for the additional period of operations. Using NatureScot guidelines (NatureScot, 2021), the site has an overall amber risk rating for collision risk for bats.

5.4.2.4 Hen harrier

Mortality

Hen harrier typically flies low and below the height of turbine blades. Collisions with wind turbines have been recorded only rarely; this species is expected to avoid wind

turbines on 99% of occasions (Whitfield & Madders, 2006). Around 9% of the observed flights of hen harrier at the proposed development site were at heights coincidental with the height of the turbines, although as noted above, it is expected that hen harrier will avoid the turbines on at least 99% of occasions and no collisions were observed during the surveys. There is therefore a very low risk of hen harrier collisions with the turbines which will be continued by the proposed development.

However, the hen harrier population of the Slievefelim to Silvermines Mountains SPA as a whole has apparently increased during the period that the wind farm has been operational; in 2005, there were five pairs (four confirmed breeding), in 2010, seven (six confirmed breeding) and in 2015, ten (four confirmed breeding) (Ruddock, et al., 2016). This potentially indicates that either there has been no mortality of hen harrier as a result of the wind farm, or any such mortality has not had any effect on the wider hen harrier population.

Displacement

In Scotland, home-range size for males averaged 8km^2 (800ha) while average home-range size for females was 4.5km^2 (450ha) (Arroyo, Leckie, Amar, McCluskie, & Redpath, 2014) however, one study (Irwin S. , et al., 2012) from Ireland based on just 3 no. birds suggests that home ranges are larger in Ireland. Knockastanna Hill is approximately 450ha and therefore equivalent to the home range of one breeding female, or the larger part of such a territory. Home ranges can overlap.

The available research suggests that wind turbines have a relatively weak displacement effect on hen harrier of around 100m from each wind turbine (Whitfield & Madders, 2006) (Wilson, Fernández-**Bellon, Irwin, & O'Halloran, 2017)**. This equates to 3ha per turbine or 12ha for Knockastanna wind farm in total.

Mature forestry has a strong displacement effect **(Wilson, Gittings, O'Halloran, Kelly, &** Pithon, 2006) (NPWS, 2015). Hen harrier is known to prefer breeding and foraging in young plantations, up to 11-years old, and open moorland but to strongly avoid conifer plantations of greater than 12-years old. The habitat on Knockastanna Hill has therefore become less attractive for this species as the forestry has matured, with areas becoming unsuitable in blocks from approximately 2001, with almost all of it now **being beyond the 'pre-thicket' stage which is suitable for hen harrier.**

It is certain that the maturing forestry would have had a negative effect on the hen harrier and it is likely that this is enough to have displaced the hen harrier from Knockastanna Hill in the absence of the continued operation of the wind farm for the next fifteen years. One study **(Wilson, Gittings, O'Halloran, Kelly, & Pithon, 2006)** indicates that, for a breeding territory, hen harrier needs 100ha out of 300ha to be suitable hen harrier habitat (open moorland/bog, rough grassland and young conifer plantations) whereas only approximately 71ha of suitable habitat remains on Knockastanna Hill.

Barrier Effect

One study has demonstrated increased energetic costs because of a barrier effect for a wind farm comprising 72 no. turbines placed in eight north–south orientated rows, 850m apart at 480m intervals east–west, covering an area of 60km^2. The study species (common eider duck *Somateria mollissima*) flew an additional 500m to avoid the wind farm site during its migration to avoid flying through the turbines (Masden, et al., 2009). This diversion was regarded as trivial on a migration journey of 1400km although could become significant if multiple wind farms are placed along the same migration route.

Since Knockastanna Wind Farm comprises 4 no. relatively small turbines (see **Chapter 3**), covering an area of 0.4km^2, and it is some distance (minimum 3km, see **Table 5.12**) from other wind farm projects, the birds will be able to fly around the wind farm without difficulty and there is no scope for the wind farm to provide a significant barrier to hen harrier movement. Moreover, birds have been observed moving through the landscape around the proposed development site during the monitoring surveys.

Disturbance

Ongoing maintenance operations have the potential to disturb hen harrier. Since this species does not currently nest on Knockastanna Hill, the risk of such disturbance affecting the hen harrier population is negligible.

5.4.2.5 Other Birds of Prey

The only other birds of prey which are ordinarily resident on or around the proposed development site are kestrel, sparrowhawk and buzzard. The last two of these have become resident after the wind farm was constructed. There is a low risk of collision with the turbines for these species. During the monitoring surveys, sparrowhawk and buzzard tended to be observed away from the turbines or soaring at higher altitudes, indicating a very low risk of collision. Kestrel was observed on several occasions within the proposed development site hunting at heights between 10m and 100m, indicating the risk of collision may be higher for this species, however, no collisions were observed during the monitoring surveys. The proposed development would continue this risk for a further 15-years.

These species have not been displaced from the proposed development site, as described at **Section 5.3.5** and indicated at **Annex 5.2** (**Table 3.1**), nor do they experience a barrier effect, because of the proposed development. The continued presence of these species on and around the proposed development site confirms that they have not been adversely affected by maintenance works under the existing consent. It is therefore expected that these species would also not be adversely affected by the proposed development.

The remaining birds of prey were observed so infrequently that the risks of collision, displacement, barrier effect and disturbance from the proposed development are negligible.

5.4.2.6 Waders

Due to external factors (primarily agricultural practices across Ireland), curlew is now likely to be absent from the proposed development site, while golden plover was recorded in only two years post-construction (2014 and 2019) and is not ordinarily resident at Knockastanna Hill. Neither of these species are therefore at significant risk of collision, displacement, barrier effects and disturbance as a result of the ongoing operation of the wind farm.

Snipe has been recorded more regularly but as a wintering population, not breeding. This species spends much of its time on the ground during winter and therefore is at very low risk of collision with wind turbines. The research suggests that snipe numbers are depressed at wind farms compared to reference sites (Pearce-Higgins, Stephen, Douse, & Langston, 2012) and this effect could extend for 400m from the turbines (Pearce-Higgins, Stephen, Langston, Bainbridge, & Bullman, 2009). This may be happening at the proposed development site, with 10 no. recorded in 2006, 4 no. in 2007 and then only 1 no. bird in 2010 and 2012, 4 no. in 2015 and only 1 no. in 2018 and 2019. However, this species has undergone a severe decline in its breeding and

wintering population in Ireland (Gilbert, Stanbury, & Lewis, 2021), so the survey results may also be reflecting this decline. The proposed development may result in continued reduced numbers of snipe at the proposed development site (within about 200m of the turbines) but not beyond (200-400m from the turbines) due to the adjoining conifer plantation which occupies this zone and is not suitable habitat for this species.

5.4.2.7 Red Grouse

Red grouse generally stay on the ground or make short, low-level flights meaning that it has a negligible risk of collision with wind turbines, including those that form the proposed development.

It is also not susceptible to displacement by wind farms during operation as it has been found using wind farms sites to the same degree both before and after construction of the wind farm (Douglas, Bellamy, & Pearce-Higgins, 2011) (Pearce-Higgins, Stephen, Douse, & Langston, 2012) (Pearce-Higgins, Stephen, Langston, Bainbridge, & Bullman, 2009).

It is a resident species and, given the lack of avoidance of wind farms, it is not likely to experience any barrier effect. Its ongoing presence at the proposed development site indicates that its population and occurrence are not affected by routine maintenance operations.

5.4.2.8 Other Moorland/Grassland Birds

There is some scientific evidence that meadow pipit and skylark numbers are reduced in proximity to turbines, within 100m and 200m respectively, compared to elsewhere (Pearce-Higgins, Stephen, Langston, Bainbridge, & Bullman, 2009) however, the evidence is ambiguous (Pearce-Higgins, Stephen, Douse, & Langston, 2012).

From the bird survey data from the proposed development site, there is no evidence of a decline in meadow pipit populations; however, there may have been a decline in the skylark population at the proposed development site (see **Annex 5.2**). Ignoring a very high count in 2008, the average peak count[5] from 2006 to 2015 was five birds which fell to 1.25 birds from 2016 to 2019. The situation on the proposed development site does however have a resemblance to the national population trend with a trough in recorded numbers of skylark in 2011 followed by a recovery. In summary, the proposed development may perpetuate reduced numbers of skylark present at the proposed development site but not beyond due to the adjoining conifer plantation which is not suitable habitat for this species.

5.4.2.9 Woodland Birds

Small passerine woodland species are generally not subject to significant effects from wind farm developments (Farfán, Vargas, Duarte, & Real, 2009). At the proposed development site, the coniferous woodland is located greater than 100m from any of the turbines which further reduces the likelihood of significant effects. Moreover, the long-term bird monitoring at the proposed development site has not revealed any population declines of the woodland bird species except for blackbird. This contrasts with the trend in Ireland which shows a moderate increase in blackbird populations over the same period[6]. Blackbird is however a common and widespread species

[5] The maximum count on any one of (one or) two visits for each year of survey, averaged over the years mentioned.

[6] b=Birdwatch Ireland Countryside Bird Survey Data
https://c0cre470.caspio.com/dp/4bae3000b62efcaae08e4f4da8bd

which is not currently of conservation concern (green list) and therefore minor changes in populations of this species are not significant.

5.4.2.10 Other Species

No operation effects on other species, such as common frog, are expected.

5.4.3 Decommissioning Phase

5.4.3.1 Designated Sites

The main risk to designated sites during decommissioning is suspended solid pollution of the watercourses which feed into the Bilboa River when the buildings and hard standing are removed or disturbed. The significance of the effect is dependent on the degree of any pollution. There is also a risk to the vegetation and flora within the SPA, as discussed below. As the existing wind farm is due to be decommissioned in 2023, and the proposed additional period of operations will delay this process, only the timing of this risk would change under the proposed development.

5.4.3.2 Habitats and Flora

There is a risk but also an opportunity for habitats and flora during decommissioning. The risk arises from damage to adjoining habitats as tracks and infrastructure is removed, especially the Annex I Wet Heath and Upland Blanket Bog habitats. However, this is offset by the opportunity to restore these habitats in areas where infrastructure is removed. Again, the risk and opportunity exist under the current consent, only the timing will change as a result of the proposed development.

5.4.3.3 Bats

There is no risk to bats during the decommissioning stage.

5.4.3.4 Hen harrier

Decommissioning activity could result in disturbance to hen harrier, especially if this takes place during the breeding season in proximity to usual nesting sites, which are on the ground. Whilst this species is not currently breeding on Knockastanna Hill, this may be influenced more by the stage of growth of commercial forestry plantations than any other factor. Should clear felling take place by Coillte, with or without replanting of trees, this species could return to breed on Knockastanna Hill and therefore become more susceptible to disturbance during decommissioning.

5.4.3.5 Other birds of prey

The 3 no. ordinarily resident species of bird of prey, sparrowhawk, buzzard and kestrel all nest in trees (and other high places for kestrel). These species are therefore not so vulnerable to disturbance arising from decommissioning activities during the breeding season.

5.4.3.6 Waders

There is no evidence of waders breeding on Knockastanna Hill in recent years and therefore any disturbance during decommissioning is likely to affect non-breeders only, mainly snipe. The research suggests that this species can suffer significant displacement during the construction of wind farms and the same is likely to apply during decommissioning (Pearce-Higgins, Stephen, Douse, & Langston, 2012). The effect is likely to be short-lived with birds returning once decommissioning activities cease.

5.4.3.7 Red Grouse

Red grouse is a ground nester and so is vulnerable to disturbance in the same way as hen harrier when breeding and it has also been shown to be displaced from wind farms during construction in the same way as snipe (Pearce-Higgins, Stephen, Douse, & Langston, 2012). Again, any effect would be short-lived with birds returning once decommissioning activities have ceased.

5.4.3.8 Other Moorland/Grassland Birds

Conversely, meadow pipit and skylark populations may benefit from the ground disturbance associated by decommissioning activity as it creates patches used by these species for foraging and breeding. Again, the effects would be short-lived as vegetation returns to a more natural state when decommissioning activities cease (Pearce-Higgins, Stephen, Douse, & Langston, 2012).

5.4.3.9 Woodland Birds

The woodland habitat and the bird community would not be affected by the decommissioning of the wind farm because the woodland lies outside the proposed development site and the treelines, which are within the proposed development site, will not be removed.

5.4.3.10 Other Species

There is low risk of killing/injury of common frog during decommissioning works if common frog is present in areas affected by the decommissioning works. These areas are mainly hard standing or unvegetated which makes the risk low. The mammal species are expected to escape construction areas and are therefore not at risk. The aquatic species are considered in the assessment of effects on the Bilboa River/ Lower River Shannon SAC.

5.4.4 Cumulative Effects.

Cumulative effects are possible mainly from other wind farms affecting the same populations of bats and birds at the same time. Other developments which have been identified for potential cumulative effects are listed and described at **Table 5.12** and illustrated at **Annex 1.5**.

Development	Planning Register Reference	Development Description	Status	Location
Rearcross Quarries, Co. Tipperary	03/510121 and 11/510323	Quarry and all associated ancillary infrastructure	Operational	2.3km NE
Lackamore Quarry, Co. Limerick	00/975 and 07/752	Quarry and all associated ancillary infrastructure	Operational	2.8km SW
Garracummer Wind Farm, Co. Tipperary	04/1034, 04/1259, 04/1178, 08/1236, 09/154, 09/213, 10/79, 10/183, 11/26,	17 no. wind turbines and associated ancillary infrastructure	Operational	3.2km SE, partly within the SPA

	11/70 and 12/77			
Mienvee Wind Turbine, Co. Tipperary	00/649, 00/700, 03/1478 and 05/1493	1 no. wind turbine and associated ancillary infrastructure	Operational	4.9 km SE
Cappawhite B Wind Farm, Co. Tipperary	12/510385, 13/510414, 14/10, 15/600566, 16/600701 and 18/601014	4 no. wind turbines and associated ancillary infrastructure	Operational	8.5km NE, less than 1km from the SPA
Cappawhite A Wind Farm, Co. Tipperary	07/364, 11/6, and 13/210	17 no. wind turbines and associated ancillary infrastructure	Operational	8.5km SE
Glencarbry Wind Farm, Co. Tipperary	07/255, 11/80, 13/24, 13/135, 13/205, 14/33, 15/955 and 16/796	12 no. wind turbines and associated ancillary infrastructure	Operational	8.8km SE
Upperchurch Wind Farm, Co. Tipperary	13/510003, 18/600913, 20/1048 and ABP-306204-19	22 no. wind turbines and associated ancillary infrastructure	Permitted	8.8km NE, just outside the SPA
Castlewaller Wind Farm, Co. Tipperary	11/510251 and 16/600472	16 no. wind turbines and associated ancillary infrastructure	Permitted	9km NW, also inside the SPA, forestry
Hollyford Wind Farm, Co. Tipperary	05/287 & 12/400	3 no. wind turbines and associated ancillary infrastructure	Operational	9.8km E
Glenough Wind Farm, Co. Tipperary	04/1195, 08/136, 08/701, 10/5 and 10/595,	14 no. wind turbines and associated ancillary infrastructure	Operational	9.87km E
Templederry Wind Farm Co. Tipperary	03510743, 07510779	2 no. wind turbines and associated ancillary infrastructure	Operational	13.4km N, also inside the SPA, peatland
Turraheen Upper Wind Turbine	14/600062 and 15/600867	1 no. wind turbine and associated ancillary infrastructure	Operational	10.2km E
Curraghgraigue Wind Farm Co. Tipperary	04/511635, 04/511665 06/510441 06/511940	4 no. wind turbines and associated ancillary infrastructure	Operational	16.5km NE

	10/510301 5122877			
Commercial Forestry, as set out in (Coillte, undated) and shown on the Coillte GIS[7]	Various	Various	Various	Various
Agricultural Developments	Various	Various	Various	Various
Residential Dwellings	Various	Various	Various	Various

Table 5.12: Other Projects assessed for Cumulative Effects

The main influence on bat and bird populations and their distribution in the upland landscape currently is the extent and stage of commercial forestry. Whilst afforestation is now rare, existing plantations mature, are felled, and replanted cyclically with the various stages favouring different species. The young stages of forestry are favourable to birds of open habitats including hen harrier (nesting and foraging), kestrel, and other moorland birds. By comparison, the wind energy developments have far less effect of bird populations and distribution in this locality.

The wind energy developments listed in **Table 5.12** are generally to the south and some distance beyond the Slievefelim to Silvermines Mountains SPA. However, 3 no. are, or will be, located within the SPA (at least partly), a fourth is operational just beyond the SPA and a fifth is to be constructed just beyond it. These are, in order of distance from Knockastanna Wind Farm: Garracummer Wind Farm (17 turbines)[8], Cappawhite B (Milestone) Wind Farm (4 turbines)[9], Upperchurch Wind Farm (22 turbines)[10][11], Castlewaller Wind Farm (16 turbines)[12][13], and Templederry Wind Farm (two turbines)[14].

Garracummer Wind Farm (partially [3 no. of 17 no. turbines] inside the SPA) was granted consent in 2006 and subsequently constructed. Like Knockastanna Wind Farm, the consent included a condition to undertake post consent bird monitoring for hen harrier, although at Garracummer, this included carcass searches at the base of the turbines in more recent years (Inis, 2018). Hen harrier, sparrowhawk, buzzard and kestrel have continued to be observed around this wind farm. Activity of hen harrier was noted to increase in areas where mature conifers have been felled. The carcass searches yielded a dead Leisler's bat in 2017. The monitoring work indicates a low risk of mortality of birds, low levels of bat mortality, limited displacement effect of the wind

[7] https://coillte.maps.arcgis.com/apps/webappviewer/index.html?id=7b05ec6a44a14bd8b523ea1fcb78b4e9 (Accessed 30/03/2022)

[8] https://www.eplanning.ie/TipperaryCC/AppFileRefDetails/041259/0 Accessed 30/03/2022

[9] https://www.eplanning.ie/TipperaryCC/AppFileRefDetails/12510385/0 Accessed 30/03/2022

[10] https://www.eplanning.ie/TipperaryCC/AppFileRefDetails/13510003/0 Accessed 30/03/2022

[11] http://www.upperchurchwindfarmamendments.ie/environment/1-environmental-impact-assessment-report-eiar-2021/ Accessed 30/03/2022

[12] https://www.eplanning.ie/TipperaryCC/AppFileRefDetails/16600472/0 Accessed 30/03/2022

[13] https://www.eplanning.ie/TipperaryCC/AppFileRefDetails/11510251/0 Accessed 30/03/2022

[14] https://www.eplanning.ie/TipperaryCC/AppFileRefDetails/03510743/0 Accessed 30/03/2022

farm on birds of prey, including hen harrier, and a much stronger effect of forestry on the distribution of hen harrier (and other birds of prey).

Cappawhite B (Milestone) Wind Farm (just outside the SPA) is consented and operational. It was consented in 2014 and was the subject of an EIS, written in 2012. The main habitats at the Cappawhite B (Milestone) Wind Farm are described in the EIS as improved grassland, wet grassland and conifer plantation, mostly semi-mature. Soprano and pipistrelle bats were recorded at the site during baseline surveys. Two sightings of hen harrier were made during surveys in inform the EIS, however, the habitat is not suitable for a breeding pair and cumulative impacts on hen harrier were ruled out. Kestrel, meadow pipit and skylark were also resident. Cumulative impacts were also ruled out for these species. Knockastanna, Garracummer and Templederry were among the wind farms considered for cumulative effects. An AA screening report was produced, in which it was concluded that that there would be significant effects on the SPA or any other Natura 2000 site.

Upperchurch Wind Farm (just outside the SPA) has been consented but not yet built. It was originally consented in 2014 and was the subject of an EIS, written in 2011. It was then proposed to increase the size of the turbines and this amendment was the subject of an EIAR, written in 2021. The 2021 EIAR describes the Upperchurch Wind Farm site as primarily Improved agricultural grassland (GA1) (163.44ha or 40.2% of the site), Conifer plantation (WD4) (124.25ha, 30.5%), Wet grassland (GS4) (45.78ha,11.2%), Acid grassland (GS3) (20.59ha, 5.1%) and Upland blanket bog (PB2) (17.11ha, 4.2%). Bat species were common pipistrelle, soprano pipistrelle, Leisler's bat, brown Long-eared Bat and species within the *Myotis* genus, thought to be Natterer's bat and/or whiskered bat. Hen harrier, kestrel, buzzard, sparrowhawk and peregrine were among the birds recorded at the Upperchurch Wind Farm site, the latter two rarely. In the 2021 EIAR, a slight to moderate significant impact was predicted for bats due to collisions with turbines and a positive effect was predicted for hen harrier, although the rationale is not clear. Cumulative effects were considered in the 2011 EIS, including with Knockastanna Wind Farm, and considered unlikely to be significant.

Castlewaller Wind Farm (inside the SPA) was consented in 2012 but has not yet been constructed. The EIS at the time described the Castlewaller Wind Farm site as being dominated by closed canopy conifer plantation. Five bat species were recorded; common pipistrelle, soprano pipistrelle, Daubenton's bat, whiskered bat and Leisler's bat. Hen harrier was recorded in the centre of the site along the Cultey Stream valley and it was also recorded in open bog habitats adjoining Castlewaller Wind Farm site, along with red grouse and golden plover. Kestrel was also recorded. The EIS did not consider cumulative effects however it did conclude that there would be no significant negative effects on flora and fauna, and a slight improvement due to the creation of c. 34ha of open forested area suitable for hen harrier (a habitat improvement area).

Templederry Wind Farm (inside the SPA) was consented in 2003. The Environmental Impact Assessment did not consider impacts on ecology, however, the planning report stated that the Templederry Wind Farm is typical hill farmland with common flora and fauna and no evidence of protected species or habitats. No mitigation measures were deemed necessary. The site is however now included in the Slievefelim to Silvermines Mountains SPA and it is likely that the flora and fauna is similar to that at Knockastanna.

Further away from the SPA, there are several other wind farms which are within the Slievefelim area and within 10km of the proposed development site; Cappawhite A

Wind Farm, Mounvaun (Mienvee) Wind Turbine, Glencarbry Wind Farm, Glenough Wind Farm and Hollyford Wind Farm. These are all operational.

Each represents a low risk to birds of prey and bats through collisions with turbines, while some may contribute to displacement of some moorland bird species, such as hen harrier, snipe and skylark. However, they are widely separated (except Hollyford and Glenough, 17 no. turbines combined)) and unlikely to have effects on the populations of the wider region. For example, the hen harrier population in this area appears to have been increasing while many of the wind farms identified above have been operational.

As well as wind farms, other types of projects must be considered for cumulative effects, as identified in **Table 5.12**. Rearcross Quarry is amongst forestry, while agricultural developments and residential dwellings are principally in lowland settings. There is little scope for any effects at these sites to have cumulative effects with an operational wind farm in a moorland environment because they generally affect different species and habitats. However, Lackamore Quarry is within the Slievefelim to Silvermines Mountains SPA and is or has resulted in the loss of moorland habitat which would have locally significant effects on moorland bird populations, including hen harrier which formerly bred at Lackamore.

Knockastanna Wind Farm, Garracummer Wind Farm and Cappawhite A Wind Farm are in the Lower River Shannon Catchment, with the first two of these also within the Bilboa sub-catchment. The other wind farms identified in **Table 5.12** are outside the Lower River Shannon Catchment. Garracummer Wind Farm is to be decommissioned 25-years from the date of the planning consent, which was in November 2005, which means it would be decommissioned in 2030. Cappawhite A Wind Farm is a consented and operational wind farm with 17 no. turbines, 8 no. were consented in 2007 and 10 no. were consented in 2011, although 1 no. of the consented turbines was not installed. For the former, the operational period is 25-years from the date of consent and for the latter 10 no., the operational period is 25-years from the date of first operation, which was in 2017. So, decommissioning would be in 2032 and 2042, respectively. The decommissioning dates therefore do not coincide for any of the wind farms in the Lower River Shannon Catchment, which reduces the likelihood of cumulative effects through suspended solid pollution during decommissioning works.

The *Central Munster Five Year Forest Plan 2021-2025* (Coillte, undated) includes the commitment to maintain suitable foraging and nesting habitats for hen harrier within the SPA and identifies potential clear-felling operations within forestry at Knockastanna Hill and across much of the rest of the Coillte forest estate within the SPA, in consultation with the NPWS. It is not clear how much clear felling will take place; however, extensive areas of clear felling in the upland areas have the potential to provide a benefit to the hen harrier population.

The continued operation of the other elements of the Knockastanna Wind Farm (e.g. grid connection) will not have a cumulative effect with the continued operation of the wind turbines. These items are static or below ground and therefore would not result in operational effects on the sites, habits and species identified.

5.4.5 'Do Nothing' Scenario

The 'do nothing scenario' describes what would happen should the proposed development (i.e. the continued operation of the existing wind farm) not take place. In this scenario, the wind turbines would be decommissioned and removed from the proposed development site and the infrastructure removed in 2023.

This would clearly remove the, albeit low, risk of collision for birds and bats and the potential displacement effect for some species of birds, such as snipe during the winter. The effects described for decommissioning above would still occur, but earlier.

Any displacement effect on hen harrier associated with the wind turbines alone would also be removed. However, as described above, hen harrier territories are very much larger than the proposed development site and forestry is having a displacement effect on hen harrier at Knockastanna Hill. One study indicates that hen harrier needs 100ha out of an area of 300ha to be suitable hen harrier habitat (bog, rough pasture or young forest) **(Wilson, Gittings, O'Halloran, Kelly, & Pithon, 2006)**. As described above there is approximately 71ha of suitable hen harrier habitat on Knockastanna Hill. Therefore, it is unlikely that that hen harrier would return to breed at Knockastanna Hill if the only change is the removal of the wind farm; substantial clear felling of conifer plantation would also have to occur. As this tends to be replanted with conifers, the benefit to hen harrier could be short-lived as the replanted forestry becomes unsuitable again after 11-years.

5.5 Mitigation & Monitoring Measures

5.5.1 Operation Phase

5.5.1.1 Designated Sites

No mitigation is required for effects on designated sites during the operation of the wind farm.

5.5.1.2 Habitats and Flora

None required.

5.5.1.3 Bats

A risk of direct mortality of bats through collisions with turbines has been identified. It is therefore proposed to undertake monitoring by searching for carcasses at the turbine bases. Carcass searches (searches for dead bats) at the base of turbines will be undertaken in the early morning at times when bird survey work is already being undertaken on the site during the bat active season. A minimum of 3 no. searches per year will be carried out. The results of the carcass monitoring will inform the operation of the wind farm, for example, the need, or otherwise, for curtailment of the wind farm to reduce further mortality. Should significant bat mortality be detected then additional mitigation measures will be implemented to reduce the risk in accordance with NatureScot guidance (NatureScot, 2021).

5.5.1.4 Birds

Monitoring of bird populations will continue as they have been during the operation of the wind farm to date, as per Condition No. 4 of the parent permission. This will be extended to include carcass searches while such searches are undertaken for bats which again will inform the operation of the wind farm.

Should hen harrier be recorded breeding on Knockastanna Hill then intrusive maintenance operations such as demounting and reinstating turbines will be undertaken outside the hen harrier breeding season.

5.5.2 Decommissioning Phase

5.5.2.1 Designated Sites

During decommissioning, additional care will be required to protect existing habitats and restore habitats when infrastructure is removed due to the location of the proposed development site with the Slievefelim to Silvermines Mountains SPA and the hydrological connection to the Bilboa River, part of the Lower River Shannon SAC. This will be addressed through the implementation of the Planning-Stage Decommissioning Plan (See **Annex 3.3**) which details protection and restoration of habitats, and the control of suspended solid (and other) pollution.

5.5.2.2 Habitats and Flora

The implementation of measures as set out at **Section 5.5.2.1** above will also ensure the protection of habitats and flora.

5.5.2.3 Bats

No mitigation is required for bats during the decommissioning phase.

5.5.2.4 Birds

During decommissioning, there is a risk of disturbance of wintering birds such as snipe and breeding birds such as red grouse. The most intrusive decommissioning works (such as excavating existing infrastructure and regrading land after the hard standing has been removed) will be timed to occur outside the coldest winter months and the main breeding season (the main breeding season being April to August inclusive). Other decommissioning works will be confined to existing infrastructure and controlled through mechanisms to be set out in the Planning-Stage Decommissioning Plan (see **Annex 3.3**) to avoid disturbance to birds.

5.6 Residual Effects

A summary of the effects, mitigation, and residual effects, taking into account cumulative effects, is set out at **Table 5.13**.

Potential Effect	Potential Cumulative Effect	Significance Pre-mitigation	Summary of Mitigation	Significance or Residual Effect
Operation Phase				
Risk of bat mortality through collisions with turbines.	Risk slightly increased due to proximity of other wind farms although more recent applications include mitigation measures.	Small x Medium = Minor for **Nathusius'** pipistrelle, Negligible x High = Minor for **Natterer's** bat and whiskered bat. Small x Low = Minor for all other species.	Monitoring for carcasses followed by adaptive management if significant bat mortality is detected in accordance with NatureScot guidelines (NatureScot, 2021).	Minor for all species.

Very low risk of hen harrier mortality through collisions with turbines.	Risk slightly increased due to proximity of other wind farms although none individually pose significant risks.	Negligible x High = Minor.	None required as risks are very low.	Minor.
Displacement of hen harrier from breeding site in combination with maturing forestry.	May also have occurred at a few other sites; major factor is forestry.	Negligible x High = Minor.	None possible.	Minor.
Very low risk of kestrel, sparrowhawk and buzzard mortality through collisions with turbines.	Risk slightly increased due to proximity of other wind farms although none individually pose significant risks.	Small x Low – Minor.	None required as risks are very low.	Minor.
Displacement of wintering snipe from the proposed development site.	May also be occurring at a few other sites; major factor is forestry.	Small x Low – Minor.	None possible.	Minor.
Displacement of breeding skylark from the proposed development site.	May also be occurring at a few other sites; major factor is forestry.	Small x Low – Minor.	None possible.	Minor.
Disturbance of breeding and wintering birds during maintenance works.	Potential if forestry or other works take place around the proposed development site at the same time but unlikely to have population level effects.	Negligible.	None required unless hen harrier return to breed locally, this will be determined by monitoring, If hen harrier return, then turbine removal and reinstatement will take place outside the bird breeding season.	Negligible.
Decommissioning Phase (changed timing only)				

Risk of suspended solid pollution of Lower River Shannon SAC.	Potential if takes place at the same time as other developments.	Small x High = Moderate.	Control of pollution through implementation of the Planning-Stage Decommissioning Plan.	Negligible
Risk of damage to adjoining Annex I habitats.	No, site specific effect.	Small x Medium = Minor.	Control through implementation of the Planning-Stage Decommissioning Plan and reinstatement of habitats.	Negligible
Risk of disturbance to hen harrier.	Potential if takes place at the same time as other developments and species returns to breed.	Small x high = Moderate.	Monitoring/surveys to determine breeding status; most intrusive decommissioning works will be timed to occur outside the main breeding season if hen harrier returns to breed.	Negligible
Risk of disturbance to snipe.	As for hen harrier.	Small x Medium = Minor.	Most intrusive decommissioning works will be timed to occur outside the coldest winter months.	Negligible
Risk of disturbance to red grouse.	As for hen harrier.	Small x Medium = Minor.	Most intrusive decommissioning works will be timed to occur outside the coldest winter months and the main breeding season.	Negligible
Risk of killing/injury for common frog.	No.	Negligible but legally protected.	Search and remove frogs from any disturbed habitats.	Negligible

Table 5.13 Significance of Effects

5.7 Summary

As with many wind farm developments, the proposed development poses low risks to biodiversity and in particular bats and birds through, variously, collision and displacement. However, given the wind farm is already operational, these risks are demonstrably very low and have not resulted in discernible population level effects of any species locally, notably hen harrier. Cumulative effects arising from mortality of bats and birds and displacement of some bird species are possible but, even taking these into account, there is little prospect of significant effects at the population level for any of the species that currently use the proposed development site as a result of the ongoing operation of the wind farm. Therefore, taking into account the mitigation measures, there should be no significant effects on biodiversity as a result of the proposed development.

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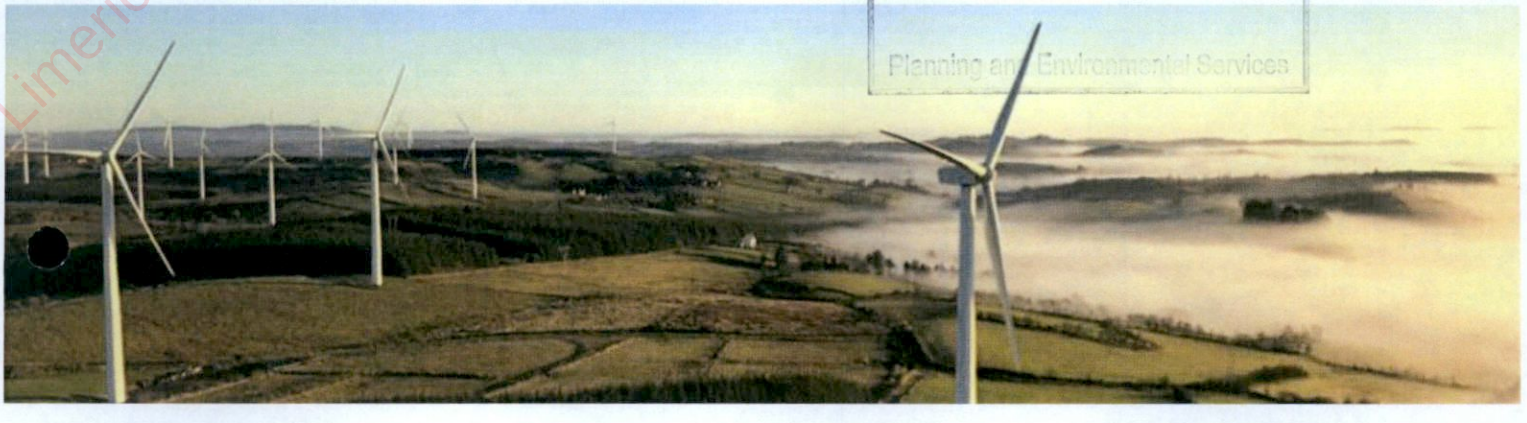

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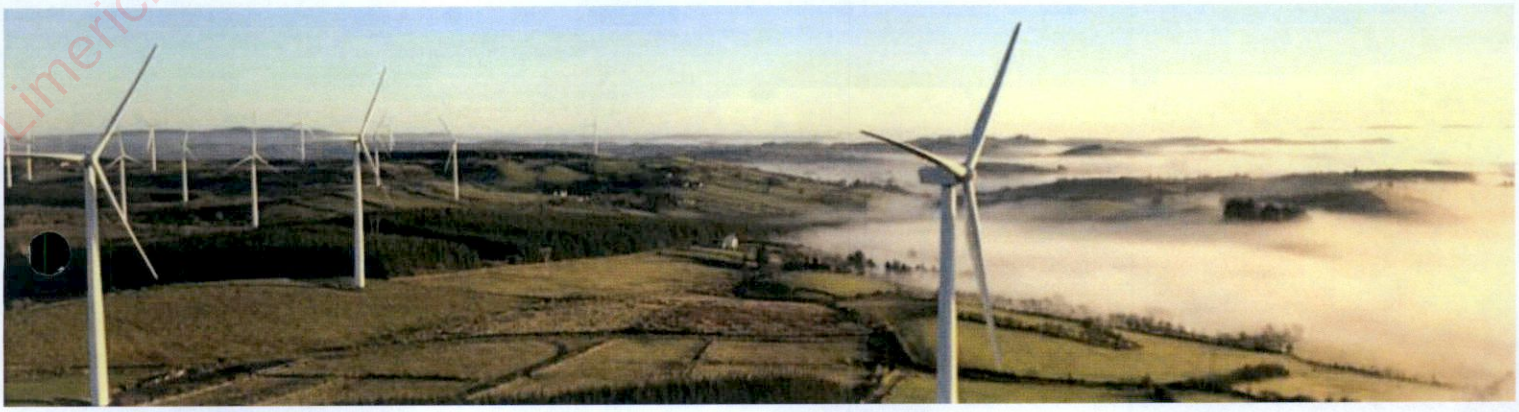

Knockastanna Wind Farm Extension of Operational Life

Chapter 6: Land and Soil

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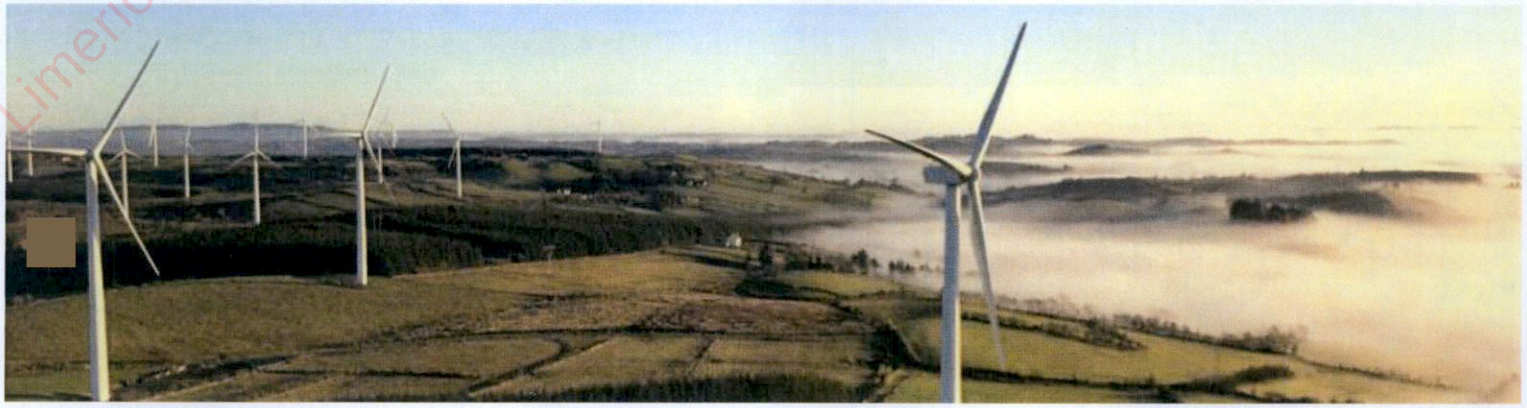

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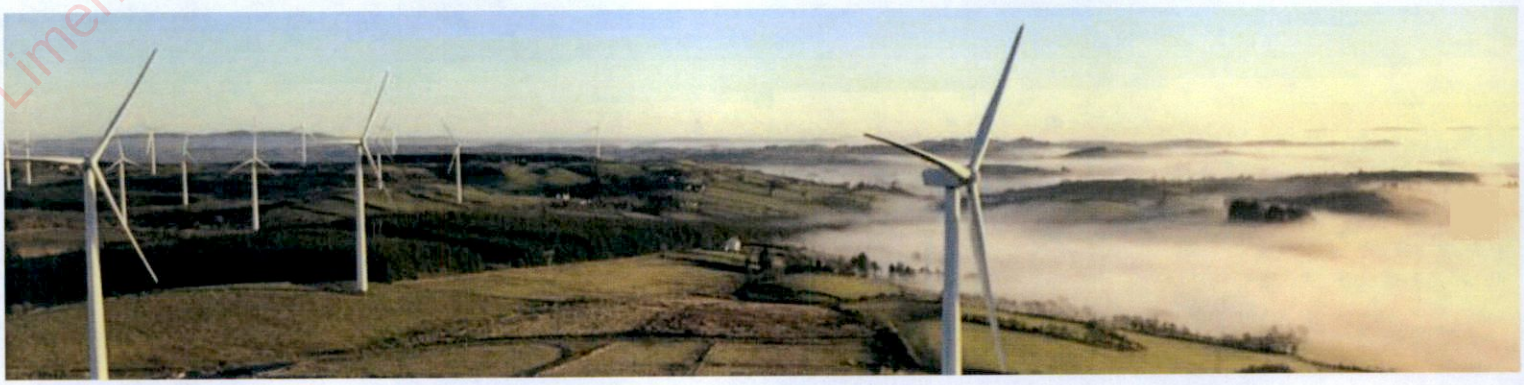

6.1 Introduction

This chapter provides a description of the existing geological setting of the proposed development site at the regional and local scale and assesses the likely significant effects on the geological features arising as a consequence of the proposed development. The specific objectives of the chapter are to:-

- describe the assessment methodology and significance criteria used in completing the impact assessment;
- describe the baseline geological conditions;
- describe the likely significant effects, including direct, indirect and cumulative effects;
- describe the mitigation measures proposed to address likely significant effects; and
- assess the residual effects remaining following implementation of mitigation.

Given the close association of the geological, hydrological, and hydrogeological environments; this assessment also draws on information and findings presented in **Chapter 7** (Water).

6.1.1 Statement of Authority

This chapter has been prepared by SLR Consulting Ltd and has been overseen by a **Technical Director with more than 20 years' experience assessing similar** developments.

Katy Rainford **is a hydrologist with SLR with over 3 years' experience in the sector,** specialising in environmental assessments for planning applications. She has undertaken and prepared geology chapters of EIARs for a wide range of projects across Ireland and the UK, including numerous wind farm and electricity transmission projects.

Peter Glanville is a Technical Director (Hydrology) with **SLR and has over 20 years'** experience in the area of Quaternary Geology. Peter has undertaken and prepared geological assessments for a wide range of projects requiring Environmental Baseline Studies, exploration operations, quarry site operations and infrastructure projects.

6.1.2 Summary of the Proposed Development

In summary, the proposed development comprises the continued operations of the existing wind farm for a further period of 15-years. The existing development, including secondary ancillary developments, consists of the following main components:

- 4 no. wind turbines;
- Associated turbine foundations and crane hard standings;
- 1 no. electrical control building with a total footprint of 66 square metres (m^2), including welfare facilities and associated electrical equipment enclosure;
- Underground electrical cabling between each of the existing wind turbines and the electrical control building;
- 1 no. site entrance and 2km of site access tracks; and
- Site drainage infrastructure.

A full description of the proposed development is presented in **Chapter 3**.

6.2 Methodology

6.2.1 Scope of the Assessment

6.2.1.1 Spatial Scope

The geological study area includes the entire development site and a buffer of a 2km radius around the site boundary as per Institute of Geologists Ireland (IGI) *Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements* (2013). The study area encompasses geological features which could potentially be affected by the continued operation and decommissioning of the existing development.

6.2.2 Legislation Policy and Guidance

The assessment has been undertaken with regard to relevant environmental legislation, planning policy and general guidance, including:-

- Environmental Impact Assessment Directive (2011/92/EU);
- Directive of the European Parliament and the Council amending Directive 2011/92/EU on assessment of effects of certain public and private projects on the environment (2014/52/EU);
- Environmental Protection Agency (2022): *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*;
- Environmental Protection Agency (2017): *Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*;
- Environmental Protection Agency (September 2015): *Draft - Advice Notes on Current Practice (in the preparation on Environmental Impact Statements)* where relevant;
- Environmental Protection Agency (2003): *Advice Notes on Current Practice (in the preparation on Environmental Impact Statements)* where relevant;
- *Geology in Environmental Impact Statements, a guide* (Institute of Geologist of Ireland, 2002);
- *Guidelines for the Preparation of Soils, Geology and Hydrology Chapters of Environmental Impact Statements, Institute of Geologist of Ireland*, April 2013; and
- *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes* National Roads Authority (2008).

The assessment also takes note of policies and development controls outlined in the Limerick County Development Plan 2010-2016 and *Draft Limerick Development Plan 2022–2028* relating to soils, geology and geomorphological and geological heritage.

6.2.3 Baseline Determination

6.2.3.1 Desk Study

An initial desk study has been undertaken to determine and confirm the baseline characteristics of the study area by reviewing available information on land, soils, subsoils and bedrock geology.

The following sources of information have been consulted in order to characterise and assess the geology of the area within and surrounding the proposed development site:-

- Geological Survey Ireland website (www.gsi.ie);
- Irish Soils Information Systems (www.teagasc.ie);
- Teagasc soil and subsoil mapping for Irish Forestry Soils Project (www.epa.ie);

- Irish Geological Heritage Programme (www.gsi.ie); and
- Ordnance Survey of Ireland (www.osi.ie).

6.2.3.2 Field Study

A detailed site walkover survey was undertaken by SLR Consulting Limited in May 2021. The field work was undertaken in order to:-

- verify the information collected during desk and baseline study;
- allow appreciation of the development site, determine ground conditions and to assess the relative location of all the components of the existing development to soils and geology; and
- assess peat extent and depths and site geomorphology.

The data obtained as part of the desk study and collected as part of the field work has been processed and interpreted to complete the impact assessment and recommended mitigation measures, where appropriate.

6.2.3.3 Cumulative Baseline

A likely significant cumulative effect is considered to be an effect on geological features arising in combination with other developments. Cumulative developments within a distance of 2km of the development have been considered.

Cumulative effects are assessed using the same methodology as for effects of the development in isolation.

6.2.4 Assessment of Likely Significant Effects

6.2.4.1 Assessing Significance

The likely significance effects of the development have been assessed by considering two factors: the sensitivity of the receiving environment and the potential magnitude of impact, should that effect occur. The assessment methodology has also been informed by the assessor's experience of carrying out such assessments for renewable energy developments, knowledge of the geology environment in Ireland and cognisance of good practice.

This approach provides a mechanism for identifying the areas where mitigation measures are required and for identifying mitigation measures appropriate to the significance of the likely significant effects presented by the development.

Criteria for determining the significance of effect are presented in **Table 6.1**, **Table 6.2**, and **Table 6.3**.

6.2.4.2 Sensitivity of Receptor

The sensitivity of the receiving environment (i.e. baseline quality of the receiving environment) is defined as its ability to absorb an effect without a detectable change and can be considered through a combination of professional judgement and a set of pre-defined criteria which are set out in **Table 6.1**. Receptors in the receiving environment only need to meet one of the defined criteria to be categorised at the associated level of sensitivity.

Sensitivity	Definition
High	• receptor is of high ecological importance or national or international value (e.g. Special Area of Conservation (SAC) or habitat for protected species) which may be dependent upon the land, soil or geology of the development area; and

	• land, soil and geology is considered to be of high importance at the local and regional scale.
Medium	• land, soil and geology is considered to be of medium / moderate importance at the local and regional scale.
Low	• land, soil and geology is considered to be of low importance at the local and regional scale.

Table 6.1: Criteria for Assessing Sensitivity of Receptor

6.2.4.3 Magnitude of Impact

The potential magnitude of impact would depend upon whether the likely effect would cause a fundamental, material or detectable impact. In addition, the timing, scale, size, and duration of the likely effect resulting from the development are also determining factors. The criteria that have been used to assess the magnitude of impact are defined in **Table 6.2**.

Magnitude	Criteria	Definition
Major	Results in a loss of attribute	Fundamental (long term or permanent) changes to the baseline geology.
Moderate	Results in impact or integrity of attribute or loss of part of attribute	Material but non-fundamental and short to medium term changes to baseline geology.
Minor	Results in minor impacts on attribute	Detectable but non-material and transitory changes to the baseline geology.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect the use/integrity	No perceptible changes to the baseline geology.

Table 6.2: Criteria for Assessing Magnitude of Impact

6.2.4.4 Significance of Effect

The sensitivity of the receptor together with the magnitude of impact determines the significance of effect, which can be categorised into level of significance as identified in **Table 6.3**.

The significance of effect provides a guide to assist in decision making. However, it should not be considered as a substitute for professional judgement and interpretation. In some cases, the potential sensitivity of the receiving environment or the magnitude of impact cannot be quantified with certainty and therefore professional judgement remains the most robust method for identifying the predicted significance of a likely effect.

	Magnitude of Impact			
Sensitivity	**Major**	**Moderate**	**Minor**	**Negligible**
High	Major	Major	Moderate	Minor
Medium	Moderate	Moderate	Minor	Minor
Low	Moderate	Moderate	Minor	Negligible

Table 6.3: Significance of Effect

Effects of major significance are considered significant in terms of the EIA Regulations.

6.3 Description of Existing Environment

6.3.1 Site Setting

The development site is located c. 29km east of Limerick City, Co. Limerick, 26km west of Thurles, Co. Tipperary, and c. 6km north of the village of Doon, Co. Limerick. It is centred at ITM E585767 N656649 and the overall landholding encompasses a land area of approximately c. 43.3ha.

It is situated in a rural area on the northern flanks of Knockastanna Hill which has a peak elevation of 444 mOD.

Ground elevations within the development site range from approximately 444 mOD along the southern boundary to 230 mOD in the north-eastern corner of the development site.

6.3.2 Designated Sites

There are no designated County Geological sites or Irish Geological Heritage (IGH) sites within the study area.

6.3.3 Land Baseline

Land refers to the 'land take' required for the development. Land can be considered to be a resource with beneficial use to society, for example agricultural land use, extractive industry land us or urban residential land use.

The land use at the development site, excluding the existing development, comprises agricultural land of mixed grazing land to the north and areas of blanket peat across the southern part of the development area.

In terms of land take, it is not proposed to remove any further land resource at the development site and therefore is not considered further.

6.3.4 Soils Baseline

Soil is the top layer of the earth's crust and is formed by mineral particles, organic matter, water, air and living organisms. Soil is an extremely complex, variable and living medium and its characteristics are a function of parent subsoil or bedrock materials, climate, relief, and the actions of living organisms over time.

Soil formation is an extremely slow process and can take thousands of years to evolve; soil can be considered essentially as a non-renewable resource.

As the interface between the earth, the air and the water, soil performs many vital functions; it supports food and other biomass production (forestry, biofuels etc.) by providing anchorage for vegetation and storing water and nutrients long enough for plants to absorb them. Soil also stores, filters and transforms other substances including carbon and nitrogen, and has a role supporting habitats serving as a platform for human activity.

The Irish Soil Information Systems (ISIS) project was undertaken by the EPA and Teagasc and has gathered existing information and data from soil survey work in Ireland, which has been augmented with new field data, leading to the production of a new national soil map at a scale of 1:250,000.

The ISIS soil mapping project has identified a number of Soil Associations across Ireland, each of which comprise a range of similar soil types, or **'Series'**.

The Soil Association at the proposed development site is classified as the Ballylanders Soil Association Group (1100e) within the northern extent of the development site and the Knockastanna Soil Association Group (0843b) with areas of blanket peat within the southern extent of the development site (see **Annex 6.1**).

Peat is found in extensive areas in the upland and lowland regions of Ireland and is defined as the partly decomposed plant remains that have accumulated in-situ, rather than being deposited by sedimentation. When peat forming plants die, they do not decay completely as their remains become waterlogged due to regular rainfall. The effect of water logging is to exclude air and hence limit the degree of decomposition. Consequently, instead of decaying to carbon dioxide and water, the partially decomposed material is incorporated into the underlying material and the **peat 'grows' in**-situ. Peat is an important and efficient carbon sink for the planet.

Peat is characterised by low density, high moisture content, high compressibility, and low shear strength, all of which are related to the degree of decomposition and hence residual plant fabric and structure. To some extent, it is this structure that affects the retention or expulsion of water in the system and differentiates one peat from another.

Lindsay[1] defined two main types of peat bog, raised bog and blanket bog, which are prevalent on the west coast of Europe along the Atlantic seaboard. In Ireland, the dominant peatland is blanket bog which occurs on the gentle slopes of upland plateaux, ridges and benches and is predominantly supplied with water and nutrients in the form of precipitation. Blanket peat is usually considered to be hydrologically disconnected from the underlying mineral layer.

Peat probing was undertaken at the site as part of the baseline assessment for the original site development and the results area shown in **Annex 6.4**. The peat probing has confirmed that the majority of the site is underlain by peaty soils (i.e. peat with a thickness of 0.5m or less), and therefore peat stability would not normally be considered to be an issue for such soils. The only part of the site where peat depths greater than 1m thickness were recorded was around turbine T04. It is noted that the proposed development does not include the construction of any new infrastructure and therefore it is assessed that the development will not have an adverse impact on the existing peat deposits. There is no evidence of any peat disturbance/peat slides or extensive erosion as a consequence of the existing wind farm, so any degradation of the peat is not anticipated in the future.

Turbine T05 will be reinstated at its existing location in due course; therefore, the necessary works will not require any additional land take or footprint above what is already exists at the site in terms of working areas, lay down areas and the turbine footprint. It is not therefore anticipated that the reinstatement of the turbine will have a significant impact on the peaty soils at this location.

The Ballylanders Soil Associated Group is characterised by '*fine loamy soils over shale and slate bedrock*' and is described as comprising '*brown earths on lower slopes, podzols on steeper slopes, luvisols and surface water gleys in depressions, related to fine soil textures on shale bedrock and on drift with siliceous stones*'[2].

[1] **Lindsay, R.A., (1995),** '*Bogs: The ecology, classification and conservation of Ombrotrophic Mires.*' **Scottish Natural** Heritage, Perth

[2] EPA Report No. 130 (2014), Irish Soil Information System: Synthesis Report Appendix 3 - Soil Association List

The Knockastanna Soil Association Group is characterised by '*loamy soils over shale bedrock*' and is described as comprising '*podzols and brown podzolics over shale and slate bedrock and peat, with inclusions of humic rendzinas and brown earths on bedrock*'[2].

6.3.5 Subsoils Baseline

The Quaternary (subsoil) deposits were deposited during the last 2 million years, and essentially comprise the unconsolidated materials overlying the bedrock. The two main types of quaternary subsoils in Ireland are glacial till, deposited at the base of ice sheets, and sand and gravel deposits associated with the melting of the ice sheets which are generally termed glaciofluvial outwash sands and gravels. Other extensive quaternary subsoils in Ireland include peat, river alluvium and coastal process deposits. Most Quaternary subsoils in Ireland were deposited since the maximum of the last glaciation, the Midlandian, which occurred approximately 17,000 years ago.

The subsoils at the proposed development site have been mapped as blanket peat within the southern extent of the development site whilst the northern areas are shown to be absent of any subsoils with bedrock at or close to the surface (see **Annex 6.2**).

6.3.6 Bedrock Geology Baseline

The Geological Survey of Ireland (GSI) digital bedrock geology map of Ireland shows that the proposed development site is underlain by greywacke, siltstone and grit of the Hollyford Formation (see **Annex 6.3**). The bedrock is of Silurian age and has been described by GSI as thick-bedded greywackes and greenish-grey mudstones inter-bedded with thin siltstones and/or blackish-grey laminated siltstones, occasional grits, a few ash beds.

The proposed development does not involve the extraction of any bedrock.

6.3.7 Geological Heritage Baseline

A review of the GSI digital bedrock geology map indicates that the development site is not located within an area designated as a Geological Heritage site.

6.4 Land, Soils and Geology Environmental Sensitivity

The sensitivity of the identified land, soil and geology environmental receptors is assessed here.

Land use at the site comprises mixed grazing land to the north and areas of blanket peat across the southern part of the development area. The land at the site is considered to have a Low sensitivity as it is only important at the local scale or level.

The soils at the site are poorly drained gleys and luvisols with more extensive areas of areas of peaty soils and blanket peat. The poorly drained gleys and luvisols are considered to be of Low sensitivity and are only important at the local scale or level.

Peat and peaty soils are important carbon sinks; however, due to the thin nature of the peaty soils, generally <0.5m in thickness at the site, they ae considered to have a Moderate sensitivity at the local scale only.

There are no designated geological receptors at or in the vicinity of the site. The bedrock geology at the site is considered to be of Low sensitivity.

6.5 Description of Likely Effects

6.5.1 Construction Phase

The proposed development does not include any construction activities. Therefore, no construction effects are considered for the development.

6.5.2 Operational Phase

Routine maintenance of the existing infrastructure (turbines, switch room, access tracks, etc.) will be required at the site on an ongoing basis during the lifetime of the proposed development. These activities are likely to include maintaining the existing access tracks, drainage and carrying out wind turbine maintenance.

Turbine T05 will be reinstated at its existing location in due course; however, the necessary works will not require any additional land take or footprint above what is already exists at the site in terms of working areas, lay down areas and the turbine footprint. Therefore, it is not anticipated that the reinstatement of T05 will have a significant effect on land, soils or geology.

Activities which have the potential to give rise to impacts include road and drainage maintenance and the handling and management of hydrocarbons (oils and lubricants) at the site.

During the continued operational phase, it is assessed that the magnitude of any impacts form activities on the land, soil or geology at the site would be to Minor to Negligible only as the impacts and would be localised only to a specific and limited part of the site.

Based on the Low to Moderate sensitivity of the identified receptors and the Minor to Negligible nature of any impacts then the significance of the effects are classified as being Minor to Negligible only (see **Table 6.3** above).

As there are no likely significant effects, no specific mitigation measures are required, other than good practice measures (**Section 6.6** below).

6.5.3 Decommissioning Phase

In general, as described at **Annex 3.3**, all structures above ground level shall be dismantled and removed from the site for reuse or recycling where possible; however, access tracks may be retained depending on the proposed future use of the site. It is likely that, in order to minimise environmental disturbance, the majority of sub-surface elements of the wind farm shall remain in situ. For example, electrical cabling shall be removed and recycled but the ducting within which it is located would remain to avoid unnecessary excavations and ground disturbance.

During the decommissioning phase, there is a risk of soil contamination due to the presence of plant and machinery (leaks/spillages) while the undertaking of works may result in some wind or surface water erosion. However, given the relatively small scale of the necessary works and the methodologies to be implemented (see **Chapter 3**), effects are assessed to be Minor to Negligible, and not significant.

6.5.4 Cumulative Effect

Developments are listed in **Chapter 1** and includes a number of wind farms, quarries and also agricultural and residential developments.

There are no wind farm developments or quarries located within 2km of the site and therefore it is considered that there are no cumulative impacts on the land, soil or

bedrock geology associated with the proposed development and any existing developments.

6.6 Mitigation & Monitoring Measures

Current industry standard good practice measures and monitoring/inspection will continue to be implemented during the proposed additional period of operations. Best practice measures are stated below.

6.6.1 Construction Phase

As the construction phase of the development is complete, no mitigation measures are required.

6.6.2 Operational Phase

As a principle, preventing an adverse impact on the land, soil or geology at the site is preferable to dealing with the consequences impacts.

Current good practice measures implemented at the site include:

- Site management measures to prevent the erosion of soils;
- No hydrocarbons will be stored on the site;
- A spill kits and drip trays will be kept at the site to be used in the event of an accidental leak or spill;
- Stockpile soils and material on level ground away from drains; and
- Undertake any earthworks during drier weather only;

Good practice measures will be applied in relation to pollution risk and management of surface runoff at the site which could impact land, soils and geology.

Full details of the existing preventative measures which exist at the existing development are included in the SSE's Environmental Management System (EMS) for the operation of their sites. SSE's EMS has ISO 14001 accreditation, and a copy of the cert is included in **Chapter 7**.

As a principle, preventing the erosion of any soils or sediment is preferable to dealing with the consequences of any release. Measures which cover the prevention of soil erosion and sediment are assessed within **Chapter 7** of this EIAR.

6.6.3 Decommissioning Phase

Prior to decommissioning, a comprehensive Decommissioning Management Plan, further developed from **Annex 3.3**, will be prepared to detail the control of any activities which could have an adverse impact on the land, soil and geology for the duration of the decommissioning works.

The management plan will detail the precise implementation of controls and is likely to include may include silt fences, silt traps and silt bags, check dams and buffered outfalls to prevent the surface water erosion of soils in any works areas; and will detail the appropriate management of hydrocarbons to prevent soil contamination.

6.7 Residual Effects

Given the controls above the following residual effects are assessed:

6.7.1 Construction Phase

As all construction activities associated with the Knockastanna Wind Farm have been completed, no residual effects will occur.

6.7.2 Operational Phase

There are no predicted significant residual effects under the terms of EIA regulations associated with the operational phase, and other than the good practice measures, no specific mitigation measures are required. No significant residual effects on land, soil or geology receptors are predicted as a result of the development.

6.7.3 Decommissioning Phase

There are no predicted significant residual effects under the terms of EIA regulations associated with the operational phase, and other than the good practice measures, no specific mitigation measures are required. No significant residual effects on land, soil or geology receptors are predicted as a result of the development.

6.8 Summary

This chapter presents a detailed overview of the geological characteristics of the proposed development site and the 2km study area.

It has been shown that the geology underlying the site, including land, soils and subsoils, are not of regional or local importance.

The assessment has concluded, subject to the continuation of best practice site maintenance techniques, that the proposed development will not result in a significant effect on land and soils.

A site specific Decommissioning Management Plan will be agreed with the Planning Authority prior to decommissioning works. The plan will include measures to ensure that the works do not have any Significant adverse impact on Land, Soil or Geology receptors.